Editors'notes

In this edition of the journal, we have paid attention to a range of current, sometimes threatening, regional topics and highlighted research work and initiatives underway to address them. Hopefully, the recency (and 'work in progress' status) of the articles will assist with addressing similar issues in other regions. Both the critical nature and the diversity of these topics reflect the size of the challenges ahead – at regional, national, and global levels.

Given the Australasian focus of the journal, we are pleased to include a New Zealand paper and, as is our practice, we also publish an international paper, emanating from the Maldives – certainly a 'front line' geographic region threatened by climate change.

On wider issues, Wilkinson's paper considers over a long timeframe, population change across regional areas and the dynamic relationship between Australia's regions and major urban areas. Taking a more specific, regionally-based focus, the paper by Ward *et al.* considers the public policy and the role of Government in enabling significant change and adaptation. It considers the case study of Gippsland in south-eastern Victoria and reviews the role of 'Smart Specialisation' as a methodology to address such dramatic change.

The paper by Wallace *et al.* considers another critical and current Australian regional issue, this being our approach to rural fires and the coordination of responses to what are obviously increasing threats. This paper particularly investigates the structure and operations of the New South Wales rural fire service with lessons for all Australian regions facing existential threats to lives, occupations, development, use and sustainability in our regional environments.

Dyson's paper draws on research in Canterbury, New Zealand and considers labour market responses to the limitations on movement required under Covid-19 restrictions. It tracks, as much as possible given the currency of these issues, the impact on labour markets and likely effects on labour movement and population growth into the future. It is also interesting to observe the similarities and difference in impacts and the future scenarios between the New Zealand experience and the diverse impacts on various regions elsewhere in Australasia.

Paralleling those observations is the contemporary and controversial matter of border closures within Australia, specifically a case study of the Queensland/NSW border and commuting flows between those areas. Often border regulations and controls invoke the idea of discreet borders and

various specific controls points. An interesting point here of course that, despite State political boundaries, these border communities are, to all intent and purposes, the same places in the minds of residents and visitors. This work uses mathematical modelling to explore such relationships.

Our paper sourced from outside of Australasia relates to a case study from the Maldives. Author, Afshin Abolhasani, considers the climate change policy initiatives now underway in response to what are increasingly seen as survival issues for that region. Perhaps this provides scenarios for the future as these issues develop for other countries.

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GROWTH DYNAMICS AND MUNICIPAL POPULATION CHANGE IN AUSTRALIA, 1911-2016

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ABSTRACT: In Australia, empirical analyses of municipal populations are uncommon given its cities are usually conceived of as metropolitan areas. Widespread usage of metropolitan statistics is practical; however, municipal perspectives engage with the machinery of government and can reveal complementary insights about cities as institutions. To develop such insights, this study utilised a statistical model of Australian municipal populations to examine the drivers of growth from 1911 to 2016. Statistically significant long-term positive relationships were identified between population and location specific features such as being coastal, eastern, and near to a seaport or state parliament. The constant and strong involvement of political factors is noteworthy given they are less recognised drivers of settlement. The findings of this paper, which partly elucidate drivers of population growth in Australia, have major implications for the federal government's plan to steer anticipated high population growth into regional centres.

KEYWORDS: Local government; municipality; Australia; urban primacy.

1. INTRODUCTION

What is Australia's most populous city? Since Federation (1901), there have usually been two correct answers. At the 2016 census, Sydney Greater Capital City Statistical Area's population measured 4.64 million, signifying Australia's most populous city, a title Sydney has held since the

first national census (1911). This first correct answer refers to the urban area, a delineation of 'city' that is widely used and key to how Australian cities are understood. The second answer utilises administrative boundaries to define 'city,' officially Local Government Areas (LGA). From this vantage, Brisbane has been Australia's largest city since 1924, whilst Sydney and Melbourne ranked 16th and 53rd respectively in 2016.

The second answer may be somewhat obscure because a lot of what is known about Australian city populations does not engage with cities officially, as government arenas where development manifests. Whilst the prevalence of urban statistics has practicalities, Florida's (2019) research of American municipalities demonstrates how the administrative perspective can stand on its own, providing valuable insights about cities as formal institutions. In the interest of learning more about these institutions, this study conducted empirical analyses of Australian municipal populations to examine drivers of growth.

Time-series analyses of Australian municipal populations are rare for two practical reasons. First, the diversity of LGA size and composition poses limitations to studies purporting to examine cities. LGAs range from geographically small fractions of large metropolitan regions to country-sized, sparsely inhabited geographies. In this study, the term *city* identifies a municipal government and its domain. Comparable implicit usage of the term can be found in studies of municipalities from the Americas and studies of Chinese cities deriving from census data (Forstall *et al.*, 2009). The United Nations (2018) has indicated that 35% of cities with populations over 300,000 are administratively delineated.

The second reason Australian municipal populations are overlooked is because Australia's urban and municipal geographies misalign, rendering urban statistics the rational default in studies of urbanisation and population. As Florida (2019) explains, 'the reality is that most studies that purport to talk about cities are really talking about the performance of broader metropolitan areas.' Indeed, the fact that many urban regions extend beyond their namesake municipalities has led some to question the utility of municipal populations and whether or not such definitions are obsolete (Verhetsel *et al.*, 2018).

Table 1 illustrates the challenge of urban and municipal alignment by juxtaposing the top five urban and municipal populations for Australia, Canada, and the USA, the latter two being similarly wealthy, large federations of British colonial origin sometimes subject to comparative analysis with Australia (Brunet-Jailly and Martin, 2010). In Australia, only Brisbane appears in both rankings, the only capital to do so despite the

dominance of state capitals (in the urban sense) over their states, a phenomenon known as urban primacy (Short and Pinet - Peralta, 2009). In featuring a largely unfamiliar list, Australia's municipal ranking illustrates why it is little examined empirically because many of the most populous are incomplete urban areas. Meanwhile four Canadian and four American cities appear in both rankings. Furthermore, all Canadian and American municipalities constitute large, central, namesake municipalities of large urban regions. Thus, in Canada and the USA, either ranking serves as a proxy of the city-size hierarchy, whereas Australian rankings tell different stories.

Table 1. Top 5 Population Ranking for Urban and Municipal Definitions of Cities in Australia, Canada, and the USA.

	Aus	stralia	Cana	da	USA		
Rank	Urban	Municipal	Urban	Municipal	Urban	Municipal	
1	Sydney, NSW 4,637,436	Brisbane, QLD 1,184,752	Toronto, ON 5,429,524	Toronto, ON 2,731,571	New York, NY 19,232,494	New York, NY 8,336,817	
2	Melbourne, VIC 4,546,593	Gold Coast, QLD 575,303	Montreal, QC 3,519,595	Montreal, QC 1,704,694	Los Angeles, CA 13,182,453	Los Angeles, CA 3,979,576	
3	Brisbane, QLD 2,282,759	Moreton Bay, QLD 439,292	Vancouver, BC 2,264,823	Calgary, AB 1,239,220	Chicago, IL 9.454,282	Chicago, IL 2,693,976	
4	Perth, WA 1,982,270	Canterbury, NSW 361,862	Calgary, AB 1,237,656	Ottawa, ON 934,243	Dallas, TX 7.574,390	Houston, TX 2,320,268	
5	Adelaide, SA 1,305,526	Blacktown, NSW 348,030	Edmonton, AB 1,062,643	Edmonton, AB 932,546	Houston, TX 7,063,400	Phoenix, AZ 1,680,992	
Sources	Significant Urban Area, Australian Census 2016	Local Government Area (LGA), Australian Census 2016	Census Metropolitan Areas, Canadian Census 2016	Incorporated Cities, Canadian Census 2016	Metropolitan Statistical Area, 2019 estimates (Brinkoff, 2021)	Municipalities, 2019 estimates (Brinkoff, 2021)	

The two dynamics outlined above drive the preference for urban statistics. However, the peculiarities of Australian municipalities should not be taken to suggest they are unworthy research subjects. This study's aim is to provide a complimentary empirical view of Australian cities that speaks to the drivers of population in local governments. Given such modelling is uncommon in Australia, the paper contributes novel statistical insights about Australian local governments.

The research questions guiding this study are, *Since Federation how have Australian municipal populations changed? Can statistical relationships between population and location-specific factors be identified?* This research is important and timely because the Commonwealth government has recently launched initiatives aiming to decentralise projected high twenty-first century population growth out of state capital city regions through infrastructure investment in regions with 'the potential to support economic and population growth,' thereby alleviating congestion (Australian Government, 2015; 2019), what Hugo (2002: p. 1) described as 'one of the most dynamic and policy-relevant dimensions of the contemporary demographic situation.' However, in purporting to advance a settlement strategy (e.g. decentralisation), government initiatives imply known drivers of the current state, which we suggest is not an empirically based/tested understanding.

2. AUSTRALIAN LOCAL GOVERNMENT SINCE FEDERATION

Local government is a fundamental sphere of Australia's public sector. LGAs are creatures of their states and subservient to state legislation. Still, the role of local government is important and complex. Australia's national population (25 million) is dispersed across over 500 LGAs commonly referred to as councils, cities, municipalities, shires or towns (Ryan and Lawrie, 2020). Spatially, in the most populous states municipal geography is reminiscent of a fractal centred on state parliament, each LGA growing geographically larger as the distance from parliament increases. Queensland differs in that its capital city LGA is much larger following the agglomeration of Brisbane with nearby LGAs in 1924. The average size of state capital LGAs is 250km² whilst Brisbane's size is 1,338km² (Australian Government, 2020).

Given the diversity of municipal size and composition, as well as an absence of a formal tier of regional government in Australia, LGAs might be likened to hybrids of the Canadian and American local and county tiers. The Australian Productivity Commission (2017) discussed the complexities deriving from a system lacking an intermediary tier between states and local, with states doubling as metropolitan authorities and many local governments as counties.

Historically, LGAs were established to service local needs such as public works, community services, emergency services, recreation, cultural facilities, low-level public order, etc. As noted by Wild River (2003), Australian local government functions are internationally distinctive in what they do not cover, such as police, school, and hospital services which are provided by states. Until the implementation of reforms in the 1990s, local government tended to be managed by prescriptive state government

Acts and were service-directed rather than strategic (Aulich, 1999). The prevailing landscape nationally is now one of general competence. LGA's venture into a range of non-traditional activities, counter-balanced by a framework of fiscal constraint, transparency, accountability, and community engagement.

LGAs are varied in their constituent base, geographic and demographic features, their funding sources, and range of functions. They are also relatively weak, a dynamic attributed to being creatures of their states, and lacking federal Constitutional recognition (Grant and Drew, 2017). LGA weakness also derives from state administrative practice and choices. McNeil (1997, p. 21) compares Australian municipalities with American, noting both lack federal Constitutional status, however, American political culture 'favours local political action and participation... giving to local authorities a greater degree of responsibility and autonomy.'

In recent decades a growing local-federal relationship is apparent. Chronic resource shortages facing LGAs are exacerbated by growing concern that the federal government is using the local sector to bypass recalcitrant state governments. In part, this reflects both the problems of vertical fiscal inequality and the peculiar policy and program ambiguities generated by Australian federalism. The Commonwealth has sufficient resources to address the problems of uneven development between regions but as noted by Beer (2000), on occasion federal governments have found it convenient to argue that they lack a clear constitutional mandate for involvement in this arena.

Descriptive Statistics

To contextualise Australian municipalities, Table 2 features descriptive statistics for LGAs with populations over 2,500 from 1911 to 2016. As data were assembled it became apparent that local government has been subject to continuous change relative to quantity, size, boundaries, and hierarchy, the result of three primary forces. First, in 1911 formal local government was in its nascency and absent across swathes of the country. The first half of the twentieth century was a period of formalisation, with many LGAs established on unincorporated land.

Also apparent in Table 2 is the second driver, state reorganisations of LGAs in the second half of the twentieth century. These reforms, their

Wilkinson

NEW SOUTH WALES	1911	1933	1954	1976	1996	2016
LGA Count	197	236	206	192	164	125
Average LGA Population	7,244	10,324	16,217	24,613	37,671	61,807
Median LGA Population	4,638	5,733	5,912	8,105	15,405	26,356
Maximum LGA Population	112,921	88,308	193,145	169,939	239,818	361,862
Most Populous LGA	Sydney	Sydney	Sydney	Warringah	Blacktown	Canterbury-Bankstown
Most Populous LGA as Percent of State Urban Population	10.74%	4.90%	6.83%	4.01%	4.37%	5.16%
Average LGA Area (km2)	NA	1,672	1,983	NA	3,644	4,894
VICTORIA	1911	1933	1954	1976	1996	2016
LGA Count	142	160	161	176	78	79
Average LGA Population	8,496	10,958	14,833	20,343	58,462	78,130
Median LGA Population	4,769	5,385	6,963	8,299	36,901	45,600
Maximum LGA Population	103,593	92,112	93,192	117,144	183,728	312,789
Most Populous LGA	Melbourne	Melbourne	Melbourne	Waverley	Greater Geelong	Casey
Most Populous LGA as Percent of State Urban Population	13.47%	7.74%	4.67%	3.66%	4.59%	5.54%
Average LGA Area (km2)	NA	1,260	1,168	NA	2,891	2,876
QUEENSLAND	1911	1933	1954	1976	1996	2016
LGA Count	82	91	92	95	93	49
Average LGA Population	5,930	9,463	13,611	20,885	35,521	98,262
Median LGA Population	4,286	4,412	5,412	6,240	9,698	29,287
Maximum LGA Population	39,917	299,748	502,353	696,740	819,592	1,184,752
Most Populous LGA	Brisbane	Brisbane	Brisbane	Brisbane	Brisbane	Brisbane
Most Populous LGA as Percent of Urban Population	15.03%	60.08%	52.19%	42.64%	30.39%	27.81%
Average LGA Area (km2)	NA	7,395	6,700	NA	8,908	19,038
WESTERN AUSTRALIA	1911	1933	1954	1976	1996	2016
LGA Count	24	41	47	61	72	70
Average LGA Population	6,507	7,496	10,965	17,171	23,465	35,595
Median LGA Population	3,705	4,138	7,152	8,181	9,997	16,286
Maximum LGA Population	35,767	82,290	97,305	162,313	213,368	220,073
Most Populous LGA	Perth	Perth	Perth	Stirling	Wanneroo	Stirling
Most Populous LGA as Percent of State Urban Population	22.57%	32.62%	21.43%	16.98%	13.88%	9.49%
Average LGA Area (km2)	NA	6,851	5,273	NA	17,370	17,747
SOUTH AUSTRALIA	1911	1933	1954	1976	1996	2016
LGA Count	27	42	58	71	74	54
Average LGA Population	8,431	9,397	11,326	16,121	18,946	31,199
Median LGA Population	5,035	4,807	5,040	6,846	7,953	14,767
Maximum LGA Population	42,294	40,999	57,539	77,477	111,778	169,372
Most Populous LGA	Adelaide	Unley	Woodville	Salisbury	Salisbury	Onkaparinga
Most Populous LGA as Percent of State Urban Population	18.70%	11.26%	9.69%	7.33%	8.81%	11.20%
Average LGA Area (km2)	NA 1011	553	609	NA 107(864	1,862
I ASMANIA L CA Count	1911	1933	1954	19/0	1996	2016
LGA Count	<u> </u>	28	33	31	20	25
Average LGA Population	3,4/1	7,081	8,//9	12,235	18,053	20,417
Menimum LCA Permittion	3,975	4,237	4,383	5,438	12,298	14,482
Mast Depulsus LCA	27,520	47,054	54,896	50,384 Hobort	03,890	00,318
Most Populous LGA as Paraant of Linhan Population	20.710/	40.15%		16 600/	19 550/	
wost ropulous LGA as reicent of Urban Population	50.71%	40.15%	20.99%	10.09%	10.33%	17.24%
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Table 2. Descriptive Statistics for Australian Municipalities with Populations Over 2,500, 1911-2016. Source: Australian Bureau of Statistics (1921, 1947, 1966, 2014, 2019) and Australian Government (2009).

290

justification and impacts, have been documented and examined by various scholars (Aulich *et al.*, 2014; Dollery *et al.*, 2008). Reorganisations usually entailed two state actions. First, the abolition and forced amalgamation of LGAs by states. Second, the creation of micro-capitals, referring to states breaking apart large state capital municipalities. With amalgamations, nationally the quantity of LGAs declined from its peak of 626 in 1976 to 402 in 2016. This was particularly transformative to municipal geography in New South Wales, Victoria, and Queensland. Relative to micro-capitals, their creation disrupted the capital city dominance that characterised Australia's early municipal hierarchy. A proclivity for smallness and evenness is conveyed in Table 2 where the most populous LGA is represented as a percent of the state urban population, a common measure of urban primacy (Henderson, 2003).

The third driver of LGA volatility was population growth in municipalities near capitals. Whilst capital city LGAs retained their initial limited size or were split into micro-capitals, surrounding LGAs grew larger. Only Queensland deviated from these trends, evinced by its apparent tolerance of more populous LGAs, comparable in scale to those found in Canada and the USA. Unlike the flat municipal hierarchies engineered by other states, Queensland's municipal hierarchy is reminiscent of rank-size or Zipf's law (Jiang *et al.*, 2015), a power law predicting a city's relative size to be the inverse of rank.

3. A MODEL OF AUSTRALIAN MUNICIPAL POPULATIONS: METHODS

To potentially identify attributes populous LGAs have in common, an empirical model of population was used to test for correlations between location-specific features and municipal populations. The model's design was guided by Galiani and Kim (2011), who tested for correlations between municipal populations and natural, economic, and political factors in the Americas, the aim being to examine the impact of natural endowment, infrastructure, and institutions on population. Similarly, this study adopted a deductive correlational modelling strategy, theoretically grounded in institutional economics, to regress municipal populations with factors that might constitute competitive advantages. Methodologically, the model reflects the entrenched American custom of municipal population data interrogation (Frey, 2020).

Study Sites

The model utilised state LGA population data from Australia's quinquennial census. The dataset included only LGAs with populations over 2,500 in eleven census periods (1911, 1921, 1933, 1947, 1954, 1966, 1976, 1986, 1996, 2006, 2016). A low population threshold and the regional scale of LGAs enabled the model to examine the relationship between population and the natural environment for 40% (3.17 million km^2) of Australia's landmass in 2016. LGA quantity, geographic size, and boundaries changed during the century of analysis. To manage these changes we examined each period separately. The definition of a municipality focused upon political existence, regardless of how the LGA physically morphed through time.

Regression Factors

Table 3 outlines eleven variables identified from the literature utilised in a model of LGA populations and how they were measured. The selection follows institutional studies focused upon foundational, location-specific attributes that condition development (Galiani and Kim, 2011; Kim and Law, 2016). They are grouped into three categories: Natural, economic, and political.

Natural factors: A theory/hypothesis of environmental determinism informed the selection of natural factors. Each LGA was defined as either coastal or non coastal - coastal being within 100 horizontal kilometres of the coast, less than 100 vertical metres above sea level (Small and Nicholls, 2003, p. 585). Kim and Law (2016) examined the presence of major rivers in Canada and the USA, representing a means of aquatic navigation and trade. Due to Australia having few major rivers, a broader tack was taken and the model examined perennial rivers, signifying a source of freshwater, not necessarily a means of navigation. For granularity, the river variable utilised proximate measures (e.g. distance between the LGA administrative seat and its nearest river) due to the fractured municipal geography of some metropolitan areas, whereby an LGA may be near a river however the attribute is not within its boundaries.

Relative to climate, average annual high temperature and average annual rainfall were included given Australia's heat and aridity. Larger municipal populations are hypothesized to occur in more moderate, wetter climates. Finally, positional factors were examined, latitude and longitude, to control for unmeasured natural and historic circumstances that might account for concentrations of population in particular regions of the continent such as the southeast.

Table 3. Independent Variables Utilized in Model of Australian Municipal

 Populations. Source: the Authors.

Factor	Туре	Measured As	Description						
Coastal Natural		Yes (1); No (0)	Coastal is defined as within 100 horizontal kilometers of coast, less than 100 vertical meters above sea level.						
Perennial river	Natural	Kilometres	Distance between LGA administrative seat and nearest perennial river						
Temperature	Natural	Degrees Celsius	Climate statistic (30 years mean annual maximum temperature) pertaining to respective regression period retrieved Australia Bureau of Meteorology						
Rainfall	Natural	Millimetres	Climate statistic (30 year mean annual rainfall) pertaining to respective regression period retrieved Australia Bureau of Meteorology						
Longitude	Natural	Decimal	East-west coordinate retrieved from Australian Bureau of Meteorology						
Latitude	Natural	Decimal	North-south coordinate retrieved from Australian Bureau of Meteorology						
Major Seaport	Economic	Kilometres	Distance between the administrative seat and a major seaport. 1911-1986: 'Major' as identified in respective Australian Yearbook. 1996 onwards: 'Major' signifies greater than 500,000 tonnes handled annually as per Australian trade statistics.						
Major Airport	Economic	Kilometres	Distance between administrative seat and a major airport. 1966-1996: 'Major' as identified in Australian Yearbook. 2006 onwards: 'Major' signifies greater than 500,000 passenger movements annually as per Australian trade statistics.						
Area	Political	Kilometres squared	Geographic area of LGA retrieved from Australian census records, regional reports and Local Government National Reports. 1911 and 1976 omitted due to incomplete data.						
State capital status	Political	Yes (1); No (0)	State capitol located in LGA determined from public record						
State capitol proximity	Political	Kilometres	LGA administrative seat distance from state capitol calculated using National Map Australia						

Economic factors: Two economic factors, major seaport and airport, were examined. Major ports were included given they are critical components of transportation and trade infrastructure. For ports, proximate data were utilised in lieu of binary data to account for numerous LGAs being near to major ports. 'Major 'was ascertained from trade statistics contemporaneous with the census period. In terms of other economic data, municipality-specific, industry-level productivity data were unavailable for the period of analysis. Still, the model holds central as the dependent variable one such economic actors/units. Their concentrations speak volumes about variable productivity. Further, the qualification of ports as

293

'major 'considers productivity. Conceptually, the focus upon foundational attributes of economic development as opposed to current state productivity outcomes aligns with an institutional focus.

Political factors: Three political factors were measured; geographic area, state capital city status, and proximity to the municipality's respective state capitol. Land area was regressed on the basis that large areas are associated with large populations (Kim and Law, 2016). Land area data were accessed from the national census, state yearbooks, and local government national reports. Relative to capital city status, there are numerous reasons to anticipate high populations in capitals. Whether a capital makes the city, or a city makes the capital, empirical evidence suggests capital city status itself constitutes a competitive advantage (Anthony, 2014). This is explained by capitals' agglomeration of government jobs, lobbying activities, and businesses, which foster growth (Ades and Glaeser, 1995). Given most state capitols are located in geographically small LGAs nestled centrally within metropolitan regions, distance to the capital was included on the basis that the benefits of capital city status may extend to proximate regions. Proximity was measured as the distance between state Parliament and council chambers contemporaneous with the census period. Council chambers and municipal seats were identified following consultation with public records.

Statistical Analysis

Univariate analyses were run for every period, regressing each factor individually with LGA populations. Multivariate models were then run for each year with all factors. Multivariate models were then built by progressively adding additional factors. For each decade the final statistical model regressed the log of LGA populations with all factor data (as per Table 3) corresponding to that year. The following regression equation was estimated;

 $log(pop)i = \beta 0 + \beta 1NATi + \beta 2ECOi + \beta 3POLi$

In the equation log(pop)i is the natural logarithm of the LGA *i* population, NAT*i* corresponds with natural factors (6), ECO*i* corresponds with economic factors (2). and POL*i* corresponds with political factors (3).

4. RESULTS

Table 4 presents the results of eleven multivariate linear regressions, one representing each decade from the 1910s to 2010s. It is important to note

that some factors that appear insignificant in multivariate analyses, often had statistical relationships with population in univariate analyses (results not shown). Specifically, in univariate analyses precipitation positively correlated with population whilst distance to rivers negatively correlated with population in all periods. Meanwhile, temperature negatively correlated with LGA populations in eight of eleven periods. The multifactor model does not indicate that these factors are unimportant but identifies the strongest relationships.

The correlation coefficient is presented for each factor above the standard error and significance code, or p-value. To contextualise this, if x is the coefficient, its impact on city population equals $\exp(x) - 1$ for every unit change in the independent variable. For example, in 2016 coastal locations had a correlation coefficient of 0.32 with a p value less than 0.001, signifying the strongest measurable statistical relationship. The impact of coastal location on municipal population equalled exp (0.32) - 1 = 0.3771 - the coefficient is associated with a 37.71% increase in population.

Natural Factors

Similar to coastal location, in all periods longitude correlated with population positively, indicating that cities east of the sample's centre point tended to be larger, reflecting the eastern weighting of Australian settlement. Meanwhile, latitude was largely insignificant, with the exception of 1996 and 2006, when cities south of the sample's centre point tended to be larger. Other natural factors had inconsistent, less significant relationships. In 1911 and 1921 distance from rivers positively correlated with municipal populations, an unexpected result that, controlling for other factors, reflects the fact that some of Australia's earliest, large municipalities were mining centres in the interior. For example, in 1911 Broken Hill was New South Wales's fourth municipality and fourteenth nationally with a population over 30,000. Furthermore, there were many lowly populated municipalities proximate to rivers, rendering the variable not predictive of large populations. From 1933 remote mining settlements faded as capital city regions developed. Distance from a river did not explain population variation again until 2006 and 2016, when it negatively

	1911	1921	1933	1947	1954	1966	1976	1986	1996	2006	2016
Coastal	0.09	0.17	0.18	0.22	0.26	0.33	0.34	0.34	0.33	0.38	0.32
	(0.03)**	(0.03)***	(0.03)***	(0.03)***	(0.03)***	(0.03)***	(0.04)***	(0.04)***	(0.05)***	(0.05)***	(0.05)***
Distance from	0.00	0.00	0.00	0.00	0.00	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00
River	(0.00)**	(0.00)**	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)**	(0.00)***
Max Temp	-0.01	0.00	0.01	0.01	0.02	0.02	0.03	0.04	0.03	0.02	0.02
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)*	(0.01).	(0.01)***	(0.01)***	(0.01)*	(0.01).	(0.02)
Precipitation	-0.00	-0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)*	(0.00)	(0.00).	(0.00).	(0.00)**	(0.00)*	(0.00)
Longitude	0.00	0.01	0.01	0.01	0.01	0.00	0.00	0.01	0.01	0.01	0.01
	(0.00)*	(0.00)**	(0.00)***	(0.00)**	(0.00)**	(0.00)*	(0.00).	(0.00)**	(0.00)***	(0.00)***	(0.00)***
Latitude	0.00	-0.00	-0.00	-0.01	-0.01	-0.01	-0.01	-0.01	-0.02	-0.02	0.01
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)*	(0.01).	(0.01)
Distance from	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00
Major Seaport	(0.00)**	(0.00)***	(0.00)***	(0.00)**	(0.00)***	(0.00).	(0.00).	(0.00)*	(0.00)**	(0.00)*	(0.00)**
Distance from Major Airport	NA	NA	NA	NA	NA	-0.00 (0.00)**	-0.00 (0.00)***	-0.00 (0.00)***	-0.00 (0.00)*	-0.00 (0.00)	-0.00 (0.00)
Land Area	NA	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00).	NA	0.00 (0.00)**	0.00 (0.00)**	0.00 (0.00)**	0.00 (0.00)***
Distance from	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00
State Capitol	(0.00).	(0.00).	(0.00)*	(0.00).	(0.00)***	(0.00)**	(0.00)**	(0.00)**	(0.00)*	(0.00)**	(0.00)***
Capital City	0.89	0.88	0.95	0.96	0.87	0.70	0.50	0.42	-0.05	0.13	0.19
Status	(0.10)***	(0.11)***	(0.12)***	(0.13)***	(0.13)***	(0.15)***	(0.15)**	(0.16)**	(0.17)	(0.17)	(0.17)
R-squared	0.28	0.32	0.31	0.31	0.37	0.38	0.38	0.39	0.39	0.42	0.48
Adjusted R- squared	0.26	0.30	0.30	0.30	0.36	0.37	0.37	0.38	0.38	0.41	0.47
N	501	546	598	581	597	623	626	619	507	467	402

Table 4. Log of Australian Municipal Populations Regressed on Location Specific Natural, Economic, and Political Factors. Source: Author's Calculations.

Notes: Each column represents a separate regression. Standard errors are displayed in parentheses. N = LGAs with populations greater than 2,500

Significant codes: 0 (***) 0.001 (**) 0.01 (*) 0.05 (.) 0.10

correlated with population. In 2016 a one kilometre increase in distance from a river was associated with a 0.13% decline in population.

Temperature positively correlated with population from 1954 to 2006, with a one degree Celsius increase in average annual maximum temperature associated with a 1.98% increase in population in 2006. Mirroring this relationship, rainfall correlated positively with population in five periods. Collectively, these trends indicate disproportionate population growth in warmer, wetter municipalities before 2016, aligning with a late twentieth century migration into tropical Queensland and Western Australia, sometimes referred to as Australia's sunbelt (O'Connor *et al.*, 2001).

Economic Factors

In all time periods, distance from a major seaport had a strong, negative impact on population. Specifically, a one kilometre increase in distance between a municipality and major port was concomitant with a 0.07% decrease in population. Similarly, distance from a major airport had a strong, negative relationship with population from 1966 to 2006, in 1996 associated with a 0.04% decrease in population (0.0004, p<0.05) for every one kilometre increase in distance from a major airport.

Political Factors

From 1911 to 1986 capital city status strongly, positively correlated with municipal populations. In 1947 capital city status peaked in significance and impact, associated with municipal populations 160% larger than non capital municipalities. Comparable orders of impact were apparent in all periods from 1911 to 1966 and remained large until 1976 when it sharply declined following the emergence of large capital proximate municipalities and microcapitals. As capital city status declined in importance, the distance between a municipality and its state capital grew in importance. In all periods distance to state capitol significantly, negatively correlated with population, signifying that large municipalities are usually proximate to their capitals. By 2016, a one kilometre decrease in distance from the state capitol was associated with a 0.07% increase in population, a sevenfold increase from the early 20th century. Finally, in 1966, and from 1986, geographic area positively correlated with population, albeit the magnitude was weak, with a 1km² increase in size being associated with a

0.0004% population increase. Not surprisingly, the relationship between municipal area and population aligns with the timing of amalgamations.

5. DISCUSSION

At the time of Australia's first census in 1911, typical large municipalities were state capitals, inland mining settlements, or coastal, eastern locations near to their capitals or a major seaport. A century later, with the exception of Brisbane, the capitals and remote mining settlements disappeared from the top of the municipal hierarchy. Today, the largest municipalities are geographically large, capital proximate, coastal, eastern locations near major seaports or rivers. They are also relatively obscure. However, we see evidence in recent periods that this may be changing.

According to the 2016 census, three Australian cities (Gold Coast, Sunshine Coast, Qld; Central Coast, NSW) ranked among the top ten most populous cities for both urban and municipal definitions. The emergence of large-scale LGAs in capital proximate regions follows the 1980s when many Australians embarked upon sea-change, e-change, and more recent flee-change lifestyle migrations into regional Australia as a result of retirement, remote work, and COVID 19 (Burnley and Murphy, 2004). Counter urbanisation trends present all tiers of government with opportunities to meet the consumptive demands of lifestyle migration (Benson and O'Reilly, 2016), and it appears the municipalities of Gold Coast and Sunshine Coast have already seized upon them. Generally, capital proximate regions have boomed across Australia in recent decades.

Part of the (population) success of regional municipalities can be attributed to their large geographic catchment of population, whereas urban municipalities are usually fractions of large metropolitan areas. Another competitive advantage is the ease of engagement large, regional municipalities provide to states. Unlike most of Australia's large urban areas, which depend upon state-led metropolitan coordination across many LGAs, regional municipalities present states with a single point of contact, simplifying developmental coordination across a large area. This was the strategy adopted by Queensland when it amalgamated the Greater Brisbane region in the 1920s, creating a microcosm of strong localism, evinced by Brisbane's adoption of unusual administrative responsibilities including public transport. In summary, absent of further municipalities is rising.

Institutional Factors

The evolution and consistent involvement of political factors at the state level in all periods is noteworthy given institutions are less recognised sculptors of Australian settlement. The statistical results suggest state capital regions are significant magnets of population and that whatever powers Australian municipalities have to attract population they are secondary. For example, in 2016 seven of Australia's top ten most populous municipalities were part of capital city urban areas and the administrative seats of the remaining three were within seventy five kilometres of their respective state parliaments.

The importance of state capitals differentiates Australia from its institutional siblings, Canada and the USA, where the role of state/provincial capital cities is less pronounced (Kim and Law, 2012; 2016). As per Table 1, in Canada three of the top five most populous municipalities in 2016 were capitals. However, two (Montreal, Calgary) are not capitals nor capital proximate. The USA provides a stronger contrast, wherein 2019 the top five most populous municipalities included only one state capital, Phoenix, and no municipalities that could be described as capital proximate.

In institutional economics, the gravity of capital cities is indicative of political centralisation. As Kim and Law (2016, p. 134) explain,' In the decentralised scenario... locations are allowed to independently set taxes and local public goods [so] the geographic distribution of population between the capital city and hinterland will be determined by differences in economic productivity. In the politically centralised scenario... population distribution between capital city and hinterland depends on the relative weight the central government places on the welfare of capital city versus hinterland residents.' Put another way, strong local governments possess the autonomy to develop whilst weak localism renders development beholden to and bottlenecked in higher tiers. The statistical results suggest this logic is applicable in Australia, that its settlement pattern is influenced by the centralisation and weak localism that characterise Australian federalism (Grant and Drew, 2017). Granted, the results do not refute the importance of natural and economic factors, however, the presumption that these alone explain the gravity of state capitals was not supported.

Municipal Hierarchy 1911-2016

In 1911 Australia's municipal population ranking resembled its current urban centre ranking. By 2016 it was transformed. Whilst Australia's ranking of metropolitan regions has been mostly stable, its municipalities are volatile, fractured, and arguably nascent. One outcome of volatility is a tendency toward small populations and evenness. The latter characteristic is reminiscent of a study of Chinese cities by Au and Henderson (2006), where an even municipal hierarchy was associated with political interventions and federal ideology. Au and Henderson (2006) concluded China's urban hierarchy was artificially flat and suggested political interventions undermined productivity. Previously, Henderson (2003) had modelled 'optimal' city-size distributions, based upon a geography's size, wealth, and population and found deviations above or below the optimal undermined growth. Considering this logic in Australia, while an even municipal hierarchy may give the appearance of a 'fair go' and equity, arguably aligning with ideology, given the critical role municipalities play in development, it is worth considering the economic impact of holding local governments down.

Also noteworthy is the way in which many small evenly sized municipalities came to exist, via sweeping, forced restructures. These actions suggest states consider an even population distribution desirable perhaps for the purposes of expedient financial management, or as Sansom (2009, p. 18) pointedly suggests, 'to ensure the state's political and administrative dominance.' Supporting this hypothesis is the fact that regional municipalities are spatially configured to encapsulate larger regions (e.g. Greater Geelong, Greater Geraldton, Newcastle, Albany). That is, the centre-and-surrounds spatial model of local government is not foreign to states, they apply it everywhere *except* capitals. This reality speaks to a renowned cultural trait (egalitarianism) and suggests successive state governments have taken steps to curb the dominance of any one municipality.

Municipal Analyses in Australia

Given the peculiarities of Australian municipalities, three considerations should be emphasesed relative to the interpretation of results. First, municipal volatility directly impacted and steered the statistical results, as evinced by the declining significance of capital city status through time. That populations have been subject to numerous, significant political shifts is part of the story, not grounds for discarding these data altogether. Each regression stands on its own as a point in time reflection of statistical relationships between populations and location-specific factors. Second, likening LGAs to municipalities or cities-proper, admittedly North American terms, whilst politically true, should be done with the explicit understanding that Australian municipalities cover a wider spectrum of forms, from micro-capitals to Germany-sized shires; this however does not negate their relevance as municipal units. Third, Australian municipalities exist at the state level and this might seem to disqualify an analysis of a national municipal hierarchy. However, national municipal analysis is commonplace in other countries and complementary to urban perspectives. To conclude that the challenges of municipal analysis in Australia render such efforts meaningless is dismissive and speaks volumes about weak localism in Australia.

Finally, whilst the model used in this study provided novel statistical insights about relationships between population and location specific factors, discussion of its weaknesses may support future research. Specifically, amongst the independent variables there was some multicollinearity, signifying a linear relationship between explanatory variables. For example, this was apparent between the 1954 and 1966 when the introduction of major airport data significantly reduced the explanatory power of the seaport variable, indicating that the two factors have a linear relationship to some degree. Every effort was made to minimise multicollinearity, such as a rigorous process of independent variable development and selection. Future studies might address this challenge by considering a different range of more broadly constructed variables and/or analyses designed for highly correlated variables, such as principal components analysis or partial least squares regression.

6. CONCLUSION

This paper presents time-series, quantitative analyses of population change in Australian municipalities from 1911 to 2016. Australia's municipal hierarchy has an interesting history, particularly the dismantling of capital city municipalities and the creation of microcapitals. Such deliberate actions spark conversation about, and perspective of, Australian federalism and its impact on economic geography. This history also brings into focus Brisbane and Queensland as relatively innovative institutional geographies, perhaps Australia's strongest version of local empowerment. Numerous statistical relationships between population and locationspecific features were identified, such as being coastal, eastern, near to seaports and rivers. Particularly important was the influence of state capitals on municipal populations, suggesting state-led drivers of settlement patterns, and less involvement of local governments in the cultivation of population growth. The results provide a quantitative link between weak localism and Australian settlement, an interpretation of the drivers of settlement, and implications relative to planning for growth (Australian Government, 2019). That is, the federal government has selected target growth centres while advancing a means of redressing primacy via upgraded regional transportation. However, the results of this study suggests effective decentralisation will need to address institutional factors, such as weak municipalities, and therefore require political reform; a consideration absent from current plans.

REFERRENCES

- Ades, A. F. and Glaeser, E. L. (1995). Trade and circuses: explaining urban giants. *The Quarterly Journal of Economics*, 110, pp. 195-227.
- Anthony, R. M. (2014). Bringing up the past: political experience and the distribution of urban populations. *Cities*, 37, pp. 33-46.
- Au, C. C. and Henderson, J. V. (2006). How migration restrictions limit agglomeration and productivity in China. *Journal of Development Economics*, 80, pp. 350-388.
- Aulich, C. (1999). From convergence to divergence: reforming Australian local government. *Australian Journal of Public Administration*, 58, pp. 12-23.
- Aulich, C., Sansom, G. and McKinlay, P. (2014). A fresh look at municipal consolidation in Australia. *Local Government Studies*, 40, pp. 1-20.
- Australian Bureau of Statistics (1921). 2111.0 Census of the Commonwealth of Australia, 1921. Australian Bureau of Statistics, Canberra. Online version accessed July 2021, https://www.abs.gov.au/AUSSTATS/abs@.nsf/mf/2111.0.
- Australian Bureau of Statistics (1947). 2109.0 Census of the Commonwealth of Australia, 1947. Australian Bureau of Statistics, Canberra. Online version accessed July 2021, https://www.abs.gov.au/AUSSTATS/abs@.nsf/mf/2109.0.

Australian Bureau of Statistics (1966). 2106.0 - Census of Population and Housing, 1966. Australian Bureau of Statistics, Canberra. Online version accessed July 2021, https://www.cha.gov.go/AUSSTATS/cha@.psf/DatailePage/2106

https://www.abs.gov.au/AUSSTATS/abs@.nsf/DetailsPage/2106 .01966.

Australian Bureau of Statistics (2014). 3105.0.65.001 Australian Historical Population Statistics. Australian Bureau of Statistics, Canberra. Online version accessed July 2021, https://www.abs.gov.au/AUSSTATS/abs@.nsf/DetailsPage/3105 .0.65.0012014.

Australian Bureau of Statistics (2019). 3105.0.65.001 Australian Historical Population Statistics. Australian Bureau of Statistics, Canberra. Online version accessed July 2021, https://www.abs.gov.au/ausstats/abs@.nsf/81d2945d3269ee5cca2

5709a00138ffb/632cdc28637cf57eca256f1f0080ebcc!OpenDocu ment.

- Australian Government. (2015). Our North, Our Future: White Paper on Developing Northern Australia. Online version accessed July 2021, https://www.infrastructure.gov.au/sites/default/files/documents/nawp-whitepapersummary.pdf.
- Australian Government. (2019). Planning for Australia's Future Population. Online version accessed July 2021, https://www.pmc.gov.au/resource-centre/domestic-policy/plan-

ning-australias-future-population.

- Australian Government (2020). Local Government National Reports. Online version accessed July 2021, www.regional.gov.au/local/publications/reports/index.
- Australian Productivity Commission (2017). Transitioning Regional Economies, Study Report. Online version accessed July 2021, https://www.pc.gov.au/inquiries/completed/transitioning-regions#report.
- Beer, A. P. (2000). Regional Policy and Development in Australia: Running out of Solutions? UNSW Press, Annandale.
- Benson, M. and O'Reilly, K. (2016). From lifestyle migration to lifestyle in migration: Categories, concepts and ways of thinking. *Migration Studies*, 4, pp. 20-37.
- Brunet-Jailly, E. and Martin, J. F. (2010). *Local Government in a Global World: Australia and Canada in Comparative Perspective*. Toronto: University of Toronto Press.

- Burnley, I. H. and Murphy, P. (2004). Sea change: movement from metropolitan to arcadian Australia. UNSW Press, Sydney.
- Dollery, B., Byrnes, J. and Crase, L. (2008). Australian local government amalgamation: A conceptual analysis population size and scale economies in municipal service provision. *Australasian Journal* of Regional Studies, 14.
- Florida, R. (2019, August 22). The Fastest-Growing U.S. Cities Aren't What You Think. Bloomberg City Lab.
- Forstall, R. L., Greene, R. P. and Pick, J. B. (2009). Which are the largest? Why lists of major urban areas vary so greatly. *Tijdschrift voor economische en sociale geografie*, 100, pp. 277-297.
- Frey, W. H. (2020). American cities saw uneven growth last decade, new census data show. Brookings Institute.
- Galiani, S. and Kim, S. (2011). Political Centralization and Urban Primacy: Evidence from National and Provincial Capitals in the Americas. In D. Costa & N. Lamoreaux (Eds.), Understanding Long-Run Economic Growth: Geography, Institutions, and the Knowledge Economy (pp. 121-153), Chicago, University of Chicago.
- Grant, B. and Drew, J. (2017). Local Government in Australia. History, Theory and Public Policy, Springer, Singapore.
- Henderson, J. V. (2003). The urbanization process and economic growth: The so-what question. *Journal of Economic growth*, 8, pp. 47-71.
- Hugo, G. (2002). Changing patterns of population distribution in Australia. *Journal of Population Research* (Special ed. 2002), pp. 1-21.
- Jiang, B., Yin, J. and Liu, Q. (2015). Zipf's law for all the natural cities around the world. *International Journal of Geographical Information Science*, 29, pp. 498-522.
- Kim, S. and Law, M. (2016). Political centralization, federalism, and urban development: evidence from US and Canadian capital cities. *Social Science History*, 40, pp. 121-146.
- McNeill, J. (1997). Local government in the Australian federal system. In B. Dollery & N. Marshall (Eds.), *Australian local government: Reform and renewal* (pp. 17-39). South Melbourne: MacMillan Education Australia.
- O'Connor, K., Stimson, R. J. and Daly, M. (2001). *Australia's changing economic geography: a society dividing*, Oxford University Press, Oxford.

- Ryan, B. and Lawrie, A. (2019). Local Government. In P. J. Chen, N.
 Barry, J. R. Butcher, D. Clune, I. Cook, A. Garnier, Y. Haigh, S.
 C. Motta, & M. Tafalga (Eds.), *Australian Politics and Policy*, Sydney University Press, Sydney.
- Sansom, G. (2009). Commonwealth of Australia. In N. Steytler (Ed.), *A Global Dialogue on Federalism* (Vol. 6, pp. 7-36), McGill-Queen's University Press, Quebec.
- Short, J. R. and Pinet Peralta, L. M. (2009). Urban primacy: Reopening the debate. *Geography Compass*, 3, pp. 1245-1266.
- Small, C. and Nicholls, R. J. (2003). A global analysis of human settlement in coastal zones. *Journal of Coastal Research*, pp. 584-599.
- United Nations (2018). World Urbanization Prospects: the 2018 Revision, Online Edition. Online version accessed July 2021, https://population.un.org/wup/Publications/Files/WUP2018-Report.pdf.
- Verhetsel, A., Beckers, J. and De Meyere, M. (2018). Assessing daily urban systems: A heterogeneous commuting network approach. *Networks and Spatial Economics*, 18, pp. 633-656.
- Wild River, S. (2003). Local Government. In S. Dovers & S. Wild River (Eds.), *Managing Australia's Environment* (pp. 338-362), Federation Press, Leichhardt.

REGIONAL POLICY IN AUSTRALIA: CAN SMART SPECIALISATION DELIVER VIBRANT AND PROSPEROUS REGIONAL AUSTRALIAN COMMUNITIES?

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306

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ABSTRACT: Regional policy in Australia is fragmented, incoherent, and reactive. With responsibility sitting uneasily across Federal, State, and local governments, there is evidence of both duplication in responsibilities and significant gaps in the policy frameworks affecting country Australia. Over the past forty years, this has been exacerbated by the public policy which has focused on reducing costs and introducing markets to various aspects of public service provision across Australia, with lasting, negative effects on country communities. This article reviews the multiple challenges facing public regional policy in Australia and considers those challenges in light of international experience and policy development - particularly that led by the Organisation for Economic Cooperation and Development (OECD) and the subsequent development of 'Smart Specialisation Strategies' (S3) policy in the European Union (EU). This analysis suggests that over the last ten years, policy initiatives in the EU in particular have demonstrated the value of taking a more deliberate approach to regional policy. This observation has been tested in Australia through policy experimentation with S3 in Gippsland in southeast Victoria. This case study suggests that the implementation of S3 might have a transformational effect in country Australia, but that S3 alone would not be enough to deliver vibrant and prosperous regional communities. In line with the gradual evolution of 'S3' in Europe to 'S4' – Smart Specialisation Strategies for Sustainability - there needs to be a more comprehensive framing of the relationship between city and country Australia, and a new social contract. In the context of the social and environmental challenges identified by country Australians themselves, socio-ecological innovation has emerged as a distinct imperative for this policy experimentation in the Australian context.

KEYWORDS: Regional policy; smart specialisation; socioecological innovation; collaboration; quadruple helix.

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1. INTRODUCTION

With responsibility sitting uneasily across Federal, State, and local governments, there is evidence of both duplication in responsibilities and significant gaps in the policy frameworks affecting country Australia. This has been exacerbated in the past 40 years by the public policy which has focused on reducing costs and introducing markets to various aspects of public service provision across Australia, with pointed effects on country communities. Alongside this, corporate decision-making has cut direct services in country areas. Interpersonal services have been replaced by automated call services, and the direct links between city and country people have become increasingly mediated and distant. For many urban Australians, country Australia has become a source of staples from the far end of supply chains, and a site for recreation and tourist expenditure.

In this context, contemporary regional policy is characterised by minimalist provision of essential services, belated infrastructure investment and reactive disaster spending, leavened by a solid dose of competitive grants programs. Little is said about the future of country Australians as part of the nation, apart from the small minority whose jobs depend on extractive industries, and the once valued social contract between city and country Australia appears to have evaporated.

The aim of this article is to prompt debate about a more strategic approach to public regional policy in Australia. It draws on a review of international regional policies undertaken by the Organisation for Economic Cooperation and Development (OECD, 2009), the conclusions from which led to the European Union (EU) adopting a new approach to its major investment in Regional Policy. The EU's 'Smart Specialisation Strategies' (S3) policy framework encourages a place-based focus on developing regional innovation systems, building on the endogenous economic strengths and assets of localities.

The EU's initiatives in the last decade have prompted considerable learning and have demonstrated the value that taking a more deliberate approach to regional policy can have. The article addresses the question of whether 'smart specialisation' could work in Australia? The implementation of this approach in the Gippsland region in south-east Victoria since 2017 suggests not only the economic and political benefit of deliberative, place-based approaches but also, more specifically, the potential for innovation to address critical socio-ecological challenges facing country Australia. Action research on this project has shown that Smart Specialisation in itself offers a strong foundation for regional development, but that country Australia also needs a more comprehensive reframing of the relationship between city and country Australia, and a new social contract.

The article begins with an outline of the current status of regional policy in Australia, before providing an overview of the OECD conclusions and an introduction to the EU's Smart Specialisation policy framework. It then draws on action research to provide an account of the key learning from the implementation of S3 in Gippsland, and the importance of embracing both economic and socio-ecological innovation opportunities. It concludes with a discussion of the broader implications for regional policy in Australia.

2. THE POLICY CONTEXT IN COUNTRY AUSTRALIA

Agriculture and mining (not least the gold rush) have underpinned economic life and prosperity in country Australia. Over time, country communities emerged in response to the local needs of increasing settlements, evidenced in the establishment of shops, courts, and even Regional Policy in Australia: Can Smart Specialisation deliver vibrant and prosperous regional Australian communities?

gaols in specific communities such as Dubbo in New South Wales (Bureau of Infrastructure, Transport and Regional Economics, 2014).

These developments were underpinned by a 'social contract' between country Australia and its national government. Country people undertook the privations of rural life in order to provide the nation with food, fibre, and ores; in return, the government would ensure their well-being through the provision of infrastructure and services and, when needed, specific forms of aid. Up until the 1970s, successive Australian governments supported this contract by underwriting the socio-economic sustainability of vast numbers of towns through protectionist policies that ensured the viability of their local industries. The collapse of Keynesian economics in the late 1970s and the subsequent shift to economic rationalism led to the development of new policies for country Australia. These policies, whose stated goal was to make country Australia more prosperous and vibrant (Smith and Pritchard, 2015), were focused primarily on improving the efficiency of Australian agricultural industries (including eggs, dairy, wheat) and the removal of tariff protections.

In consequence, these policies changed the economic fundamentals of agriculture in Australia (Lawrence and Gray, 2000), so that the sector became focused on productivity increases, achieved through better financial margins, the more efficient use of land and water and the minimization of labour (Smith and Pritchard, 2015). Under free-market policy settings, farmers could no longer be assured of government assistance in the face of environmental or external market threats. Farmers were now seen as independent economic units who carried and managed their own economic and climate risks, notwithstanding the economic and environmental factors that were beyond their control. Their viability was affected by rising input costs, falling commodity prices, greater competition from market deregulation (Lawrence and Gray, 2000), a compressing terms of trade (Barr, 2009), and climate change (Milne et al., 2008), manifested, not least, in more frequent and intense droughts (2002, 2009, 2015, 2017-2019; Bureau of Meteorology, 2021). To survive in such an environment, farmers had to achieve basic efficiencies of scale and access to land that was climatically suited to their productive needs (Hogan et al., 2008).

3. EMPLOYMENT IMPLICATIONS

The wealth generated by agriculture remains central to the social and economic viability of many local communities (Marsden Jacobs et al.,

309

2010), but the drive to secure scale and efficiency has worked against the goals of supporting local employment. The subsequent gradual loss of employment has had cascading impacts on the availability of services. Employment in the agricultural sector has fallen by 14 per cent over the past 20 years and presently constitutes less than 3 per cent of the national workforce (Department of Agriculture, Water and the Environment (DAWE), 2021a). At a national level, agriculture's share of the Australian workforce fell, proportionally, by 28 per cent between 2010 and 2020 (Trading Economics, 2021), down from 3.2 per cent to 2.5 per cent.

The profile of agricultural workers is of an ageing, predominately low paid, unskilled, casual or seasonal and often migrant workforce (DAWE, 2021a). The majority of young people working in the industry are not highly educated although almost one third do hold a Technical and Further Education (TAFE) certificate (29 per cent) of some kind (DAWE, 2021b). The decreasing need for unskilled labour and the increasingly mechanised nature of the industry have resulted in workers who identified as managers exceeding farmworkers themselves by a factor of 2:1 (DAWE, 2021b). Indigenous workers, including those living in more rural and remote areas such as northern and western Australia, were also under-represented in the agricultural workforce.

This data is not a surprise. In 2017, the Productivity Commission (2017) concluded that the long-term financial gains reported in agriculture have resulted from reducing labour inputs through technical innovations. The loss of the need for a continuing agricultural labour force led to the subsequent decline of smaller rural communities, as they, and once locally based services came to be absorbed into larger regional centres (Productivity Commission, 2017). These trends have been exacerbated by successive droughts on country towns. This has led to 'serious erosion of income for farms and small businesses (and) increasing rural poverty' (Alston and Kent, 2004: xiii) with increasing suggestions that 'regional towns and cities are sliding towards welfare-dependency' (Marsden Jacobs *et al.*, 2010, p. xii).

While market pressures were changing the way agriculture operated, the mining sector underwent a boom from the early 2000s onward. Coal and iron ore were in high demand, significantly improving the nation's terms of trade (Productivity Commission, 2017). While employment in agriculture was falling, employment rose in mining. The rise in mining employment, however, was based on fly-in, fly-out employment contracts, and the new jobs in mining were typically not rurally based (Carson, 2011).

Coastal communities around regional Australia have also faced increasing challenges, particularly from climate change. The 2019-20 bushfires and smoke storms had a significant impact on a vast number of coastal communities on the eastern seaboard. Inundation and coastal erosion also pose significant challenges with Australia being predicted to lose 40 per cent of beaches over 80 years (Australian Broadcasting Commission, 2020). Similarly, the sustained long-term economic impact of Covid-19 related business shut-downs has seen an estimated 10 per cent of regional businesses permanently close their doors (Wilson *et al.*, 2021), due to a loss of viability.

4. THE POLICY RESPONSES

The cumulative impact of these changes on the viability of farms and their communities became very evident by the end of the millennial drought, around 2008-2009. In response to a rising tide of concern about the socio-economic viability of country Australia, the Federal Government introduced a policy of localism. Localism was concerned with promoting self-sufficient, socio-economically viable regional communities. In announcing this policy, the then Minister for Regional Australia argued that to achieve regional sustainability, communities had to enact a placebased vision of effective partnerships with industry centred on scientific innovation (Crean, 2011). Yet this aspiration was not realised in any meaningful way. While the Australian Government of in 2011 invested in the development of broadband internet, and regional infrastructure projects, it did not make a distinct budget commitment to realise locally developed technologically innovative partnerships. The overall funding envelope did not support a specific strategy to underpin the socio-economic viability of country communities (Hogan and Young, 2015).

More recent regional policy and initiatives are still less coherent, focusing on the efficiency of some selected industries and supplementing state and local efforts to improve infrastructure and community cohesion. The Australian Government's 2020-21 budget statement for regional Australia asserted that 'with the right policy settings and under the right conditions, country, coastal, rural regional and remote Australia can only forge ahead' (Department of Infrastructure, Transport, Regional Development and Communications, 2020, p. 1). As can be seen in Figure 1 below, the policy settings prioritised by the Morrison Government were

focused on transport infrastructure, crisis recovery projects and localised small-scale grants and loans projects.¹



Figure 1. Regional Funding, Australian Government Budget 2020/21. Source: Department of Infrastructure, Transport, Regional Development and Communications (2021).

The budget statement identified regional industry growth of 12.6 per cent in the mining industry and of 1.6 per cent in agricultural revenues. However, each of these sectors is beset by considerable challenges, and there is no evidence of any consideration of strategic alternatives. It is a given that mining exports will have to reduce (coal to be reduced by half by 2050, if not more dramatically) if Australia is to meet the goals of

¹ The budget statement notes \$110 billion for transport infrastructure, but notes that this figure spans a ten year horizon. To this end 10% of that allocation is identified for the current budget year.

international climate policy (Sydney Morning Herald, 2020). At the same time, there is a significant lack of innovation investment in agriculture, and limited seeding of the development of alternate industries in country Australia. The Commonwealth Scientific Industry Research Organisation (CSIRO) has asserted that agriculture alone will require a 'tsunami' in technology development (Wu *et al.*, 2019), but current initiatives are very inconsistent.

More generally, policy coherence is undermined by the Australian multilevel version of regional governance. For example, in a report to the federal Department of Infrastructure, Transport, Regional Development and Communications, a Strategic Expert Panel recommended that the Department 'recognises the national importance of achieving good economic and social outcomes for regional Australia' (Department of Infrastructure, Transport, Regional Development and Communications, 2019, p. 9) and proposed closer collaboration with State and Territory governments and Regional Development authorities. Currently, much is left to local governments or regional development authorities even though they did not have the resources to act on goals or strategies. Local governments, for example, raise the majority of their own funds, with just 14 per cent of revenue coming from state and federal grants.

This is not to say that there is a shortage of funds for regional activities. Billions of dollars are spent each year on activities such as transport, water and power supplies, not to mention education and health. Rather, funding programs are reactive in nature, lacking strategy, poorly coordinated, and insufficient in the face of the task to be completed. Furthermore, the value of existing expenditure has been undermined by the reliance on competitive application and selection processes. Inevitably, these processes, even applied to programs offering much smaller amounts, have bred a culture of distrust and undermined collaboration, when organisational resources are already under pressure.

The long-standing crisis discourse of rural and regional Australia has intensified in recent decades as deregulation, globalisation, and climate change have taken effect, resulting in increasing evidence of rural decline. Tensions in social policy abound as policymakers seek to encourage communities to be economically self-sufficient while at the same time making billions of dollars available to support various change initiatives. It is evident though, that despite more than 40 years of policy that has been focused on securing increased efficiencies in agriculture, the policy changes did not deliver more vibrant and prosperous regional communities (Smith and Pritchard, 2015). As such, a primary focus on agricultural economic outcomes alone is insufficient to underpin the socio-economic viability of regions. A more coherent strategy is required to secure the much-promised vibrancy promised to regional Australia (Hogan and Young, 2015).

5. INTERNATIONAL EXPERIENCE: THE OECD PERSPECTIVE AND THE EUROPEAN UNION

In 2010, the OECD published a comparative review of regional development policies in all of its 36 member nations. The membership encompasses most advanced liberal economies, including Australia. The review observed that policies focused particularly on regional development could be traced to the 1950s and 1960s, although a paradigm shift had occurred in the years around the turn of the century. Up until the 1980s, policies had focused on infrastructure and investment aid, typically targeting designated poorer areas. These interventions were considered necessary as market mechanisms were failing to enable the convergence of living standards.

However, these policies were assessed as inadequate. The OECD outlined its view on a more constructive approach in *Regions Matter: Economic Recovery, Innovation and Sustainable Growth* (2009) which addressed the central question of how to generate growth in regions. The conclusion was that public policy needed to focus on maximising growth from the assets available in a region, rather than concentrating on the transfer of resources. National macroeconomic settings did not determine regional outcomes. Furthermore, they found that some regions had more in common with regions in other nations than they did with regional or national outcomes in their own nation. When aligning regional performance with regional policy, they were able to draw inferences about the effectiveness or otherwise of different approaches to regional policy.

The OECD concluded that:

Regional policy has evolved from a top-down subsidy-based group of interventions designed to reduce regional disparities, into much broader policies designed to improve "regional competitiveness". National governments are increasingly favouring regional growth over redistribution, in pursuit of national or regional competitiveness and balanced national development... Regional strategic programmes and programming have grown in prominence, reflecting a general policy shift towards support for endogenous development and the business environment, building on regional potential and capabilities, and aiming to foster innovation-oriented initiatives. (OECD, 2010, p. 12).

This conclusion signalled several themes which have become central in debates over the past decade: equity across regions: a focus on regional growth rather than redistribution; multilevel governance; strengths-based endogenous development; and innovation. The new paradigm was not entirely at the expense of the earlier emphasis but clearly marked a more dynamic, program-oriented approach which relied on more effective multilevel governance processes for stimulating growth, albeit still with some spatial targeting.

A key element in the approach advocated by the OECD was an emphasis on multilevel governance, in which each level of government contributed to 'policy design and, equally importantly, to the implementation of these policies' (OECD, 2009, p. 12). They proposed that regional policy was important, and should encompass such features as:

> clear roadmaps based on agreed priorities, needs assessment and stakeholder buy-in as a basis for accelerated public investment;

> human capital development and innovation support rather • than a narrow focus on infrastructure development;

> focusing investment on specific regions or communities that face specific economic, social or ecological pressures;

> arrangements for coordinating action across various ministries; and

> ensuring that local and regional knowledge, funds, and capacity are mobilized (OECD 2009, pp. 12-13).

Multiple OECD reports reinforced the value of the new paradigm, with regular updates (such as 'Regions at a Glance' and 'Regional Outlook') over the subsequent decade. One of the more influential was OECD Regional Outlook: Building Resilient Regions For Stronger Economies (2011), which examined the priority of place-based rather than 'spatiallyblind' policy. Their conclusion was that policies which are attuned to placed-based specific assets and provide for effective coordination of interventions are more likely to be successful than national economy-wide measures (OECD, 2011; OECD, 2015).

The OECD initiated a more direct policy orientation when it established a Working Party to review the EU's decision to invest extensively in 'Smart Specialisation'. The EU had drawn on work undertaken on how it could maximise commercial outcomes from science (Foray et al., 2009) on

the one hand, and on a review of the stronger for a stronger place-based emphasis in the expenditure of EU Cohesion Funds (Barca, 2011) on the other. It also reflected 20 years of academic work on the emergence of regional innovation systems, and the importance of proximity and the quadruple helix in innovation processes (Isaksen *et al.*, 2018).

The OECD Working Party concluded that S3 was an appropriate response to the structural trends in OECD economies, not least the increasing importance of information and communication technologies, a stronger emphasis on people and knowledge assets, and more intense global production processes. They concluded that the core policy characteristics of smart specialisation were:

> • the Entrepreneurial Discovery Process (EDP), which involves an interactive process in which the private sector is discovering and producing information about new activities and the government provides conditions for the search to happen, assesses potential and empowers those actors most capable of realising the potentials;

> • activities, not sectors *per se*, are the level for setting priority setting for knowledge investments;

• an emphasis on strategic and specialised diversification (ironically). Rather than encouraging specialisation along predetermined paths, the S3 approach recognises that new or unexpected discoveries of activities might emerge within a given parts of an innovation system leading to "specialised" diversification; and

• evidence-based monitoring and evaluation that feeds back into policy design (OECD, 2013).

The first of these is particularly important, as it highlights the importance of place-based 'quadruple helix' collaboration, in which business and researchers, government, and civil society contribute to innovation through the difficult process of bouncing different expertise and perspectives off each other. Bringing together these perspectives also offers much more grounded evidence about markets, regional assets, and expertise to inform investment processes.

The EU required each of its regions to complete an S3 Strategy as an *ex ante* conditionality to a significant proportion of the hundreds of billions of euros available through its Cohesion Funds in its 2014-2020 multiannual financial period. The achievements in these seven years led to the renewal of the S3 program for the 2021-27 period (EU, 2020). Nonetheless, the policy and academic evaluations of the first period led to a greater

appreciation of the difficulties of implementing S3 in 'Less Developed Regions' (LDRs), and of the importance of broadening the innovation agenda beyond a relatively narrow focus on science and technology to encompass socioecological innovation and the societal challenges associated with sustainability (Coenen and Morgan, 2020).

A decade on from the OECD's initial focus on regions, the EU has demonstrated the importance of a policy framework which provides a clear and consistent view of future possibilities and a clear methodology for engaging key stakeholders in how that future might be realised. As well, there has been considerable learning about the conditions and institutional capability that is crucial for successful implementation of S3 – the 'heroic assumptions' as they have been described by Marques and Morgan (2018; see also Rodriguez-Pose and Ganau, 2021). The emphasis in implementation has been on identifying specific regional assets, and on building cross-sectoral collaboration in order to realise the innovation potential of those assets (EU, 2020).

6. DEVELOPING AN AUSTRALIAN S3 APPROACH

Might this approach assist Australia in overcoming the inadequacies of its regional policy framework? The first regional authority to pay systematic attention to the EU's work on regional innovation and its possible benefits in Australia was the Regional Development Australia committee in the Hunter region (RDA Hunter). The Hunter region is Australia's largest, with a diversified economic base with coal mining as its principal source of revenue.

Interest in S3 developed over several years, beginning with the Hunter Central Coast Innovation Festival in 2009. This prompted a survey of businesses focused on 'Innovation in Business' that was conducted in 2012, with results feeding into the *Hunter 2013 Innovation Scorecard* (RDA Hunter, 2013, 10). This was followed by the subsequent publication in 2014 of the *Hunter 2014 Innovation Scorecard: Smart Happens Here*. This time, the RDA Hunter looked to benchmark Hunter businesses against global competitors, specifically those in Europe. Drawing on the EU's Regional Innovation Scorecard, businesses were surveyed using questions drawn directly from the EU's survey. As the 2014 *Scorecard* outlined:

> The EU recognises that innovation improves economic performance and employment opportunities - demonstrated by its ongoing multibillion Euro investment in innovation programs... RDA Hunter is applying the EU's lessons in the region by

producing the Hunter Innovation Scorecard. The 2014 Scorecard demonstrates the region's strong innovation performance and compares the Hunter to the EU which operates within a tested innovation system and framework. (RDA Hunter, 2014, p. 1).

With this experience, the RDA Hunter initiated an S3 process with the support of researchers at the University of Technology Sydney. Based on extensive quantitative and qualitative data and a forum attended by more than 150 stakeholders, this culminated in the publication of *Smart Specialisation Strategy (S3) for the Hunter Region: A strategy for innovation-driven growth* (RDA Hunter, 2016). The Strategy focused on innovation based on the region's assets, highlighting opportunities across seven sectors. It attracted strong political support, with endorsement from the Prime Minister, Malcolm Turnbull, and the EU Ambassador to Australia, HE Sem Fabrizi. However, the implementation of the Strategy depended on investment which was difficult to attract (see https://rdahunter.org.au).

The second commitment to implementing S3 in an Australian region came in another coal-transition region, the Latrobe Valley. Following the announcement of the closure of the Hazelwood coal mine and power generator in 2016, the State Government of Victoria established the Latrobe Valley Authority (LVA) to address the transition challenges which would arise, initially from the closure of such a large employer, and subsequently, of all coal-powered generators. It focused firstly on the redeployment of workers affected directly and indirectly by the plant closure, and then on large-scale projects that would bring public investment into the Valley.

The third stage was the reconstruction of the regional economy, which inevitably meant a focus on Gippsland, not only the Latrobe Valley (see Figure 2). Although there is considerable diversity within Gippsland, the interconnectedness of the regional economy has been a feature of its development since the beginning of European settlement (Australian Journal of Regional Studies, 2017). The LVA officers undertook a review of global best practice in regional transition and identified the OECD/EU engagement with S3 as an appropriate framework for Gippsland. They engaged support from researchers at the University of Melbourne and Royal Melbourne Institute of Technology University, who had expertise with respect to S3. This team initiated an action research project which has generated the data on which this section of the article is based.
Regional Policy in Australia: Can Smart Specialisation deliver 319 *vibrant and prosperous regional Australian communities?*



Figure 2. Map of Victoria with Gippsland Highlighted. Source: Regional Development Victoria (2021).

The S3 process (EU, 2012) commences with a Regional Context Analysis (RCA), which is a rigorous assessment of the evidence that aims to identify the assets and knowledge which can support innovation opportunities and potential challenges in a region. Such analysis is also difficult practically in the Australian context, where, unlike in Europe, there is no established architecture for the kind of place-based data collection that underpins European S3 processes. Further, in gathering evidence for the Gippsland RCA, the extensive geographical spread of the region and its population, its diversity and the limited presence of research and education facilities, demonstrated considerable variation from the pattern of most regions in Europe (Goedegeburre *et al.*, 2020, p. 24).

This learning made it apparent that implementing S3 in Gippsland ('GS3') would be an intense process of policy experimentation. Apart from

the inadequacy of regional data, there were other circumstances which indicated that it would differ greatly, not only from the European experience but also from typical regional development processes in Australia.

One important aspect of policy experimentation in the GS3 process was the decision to focus on particular industry sectors. The S3 methodology was designed to focus on activities within production processes, exploring the opportunities for innovation across sectors and developing regional innovation *systems*. However, in Gippsland, local political and policy constraints demanded the adaptation of the approach to take as its basis four significant sectors of the regional economy. These sectors – food and fibre, renewable energy, the visitor economy and health services – had emerged from the context analysis as being the foundation of the future regional economy (Goedegebuure *et al.*, 2020).

Steering Committees, representative of the industry, government, education/research, and civil society (the Quadruple Helix), were established for each sector. This kind of collaboration proved to be unfamiliar and challenging. Differences in language, priorities, reward systems, and resources required time to explore and understand and were contrary to established ways of working. Nevertheless, key themes and questions emerged and were informed by the RCA and Steering Committee discussions. From the outset, not least because of civil society participation, there was widespread recognition of social issues, such as food insecurity, which could not be dealt with simply through a focus on a single sector. It became evident that the initial sectoral focus would lead inevitably to the development of collaborative, cross-sectoral alliances and networks. Through extensive discussion focused on the RCA evidence, a series of specific assets and innovation opportunities were identified for careful examination through the Entrepreneurial Discovery Process (EDP) (EU. 2012).

In the 'New' Energy sector, for example, four opportunities were explored through the EDP: Bio-energy, Geothermal energy, Community energy, and Smart Grids. Subsequent Innovation Groups (an extension of the EDP that was unique to Gippsland) drew in more than a thousand individuals to address specific aspects of each type of new energy (Shortis *et al.*, 2020). Innovation, in this context, came very much to focus on meeting societal challenges as much as promoting new industries and employment. For example, emerging projects encompassed plans for a town-wide smart grid in Heyfield, aimed firstly at overcoming persistent breakdowns in the local grid, but also testing community-led and owned

Regional Policy in Australia: Can Smart Specialisation deliver vibrant and prosperous regional Australian communities?

power generation in ways that could be replicated in other locations. In the town of Yarram, work undertaken to pilot a 'Community Energy Park' has led to the State Government funding the installation of pyrolysis technology at a local sawmill, which would use the waste wood product as feedstock for energy production and a range of bio-fuels (see https://lva.vic.gov.au/media/download/GS3-eBulletin-3-August-2021.pdf).

A similar pattern became apparent in each of the four sectors. Alongside initiatives which did relate clearly to scientific and technological innovation, there was growing recognition of the significance of social innovation, drawing on the everyday economy of essential goods and services, not least education, health, and utilities (Coenen and Morgan, 2020; the Foundation Economy Collective, 2018). This developed from the challenges and priorities elucidated by participants, particularly community participants, in a region with a history of lagging social indicators. It also reflected the changing demographics of Gippsland, where, as in many regions in Australia, an increasing share of the workforce was engaged in 'foundational' activities such as healthcare, social services and education. In this sense, the agenda of GS3 has paralleled and even pre-empted the recent evolution of S3 into 'S4': Smart Specialisation for Sustainability (Coenen and Morgan, 2020; Miedzinksi et al., 2021).

7. A DISTINCTIVE APPROACH?

The implementation of an S3 process in Gippsland remains a form of policy experimentation unique in regional Australia. The project's focus on developing an integrated, innovative, and sustainable economy, based on efforts to systematically and empirically identify regional assets and opportunities is the first of its kind in Victoria (Goedegebuure et al., 2020). Gippsland was the first region outside of Europe – and the only in Australia - to be registered with the EU Joint Research Centre's Smart Specialisation Platform, making the region and the GS3 project a globally significant site of policy experimentation for an evolving methodology originally developed in and for a European context.

From an Australian perspective, the policy experimentation has had a number of features:

> a focus on strengths and assets rather than gaps and inadequacies in local resources;

• an exploration of the innovation potential associated with natural assets, as well as science and related knowledge assets;

- an emphasis on collaboration rather than competition;
- diverse models of place-based innovation; and
- exploration of appropriate governance arrangements.

Apart from the learning on each of these issues and the progress with specific projects, a culture of collaboration and learning can be seen to have developed in the region (see, for example, Food and Fibre Gippsland: https://www.foodandfibregippsland.com.au/smart-specialisation).

Furthermore, the achievements in New Energy, for example, demonstrate that empirically-driven economic innovation is possible, though progress has been limited and slow from a systemic point of view (Goedegebuure *et al.*, 2020). The process has contributed to an evidence-led discussion about the urgency of energy transition and climate action in the region, and the relevance of global transition as articulated by the UN Sustainable Development Goals (SDGs), to localised regional development. Across the Quadruple Helix, project champions and sector leaders increasingly recognised the value of co-design, co-investment, and burden-sharing (Wiseman *et al.*, 2020).

From the outset, the OECD/EU approach to regional innovation overwhelmingly focused on scientific and technological innovation as the pathway to establishing regional innovation systems. In Gippsland, like many lagging regions in the EU, such a focus is not necessarily conducive, or appropriate, to place-based innovation. In Europe, too, many lagging regions struggle with useful data collection, which is then reflected in the EDP and efforts to identify distinctive knowledge assets. The 'heroic assumptions' about how the S3 process is established in such regions had already been identified (Marques and Morgan, 2018). Such challenges were reflected in Gippsland, where a focus on natural assets and how those might act as a foundation for cross-sectoral innovation became important.

Other questions have emerged. The architecture for implementing S3 in Australia is undermined by ambiguities in regional governance, coherent management of resources and the limited capability of the tertiary sector in many parts of country Australia. As the final report of the GS3 team explained:

> ...[G]etting the space and resources to engage strategically with innovation depends on transformative interactions with educational and research institutions and the implementation of time and cost-saving technology. However, at this stage, the sector is largely segmented and inwardly focused, rather than engaged in

Regional Policy in Australia: Can Smart Specialisation deliver vibrant and prosperous regional Australian communities?

> strategic partnerships with regional government and industry (Goedegebuure et al., 2020, p. 17).

With respect to governance and resourcing, the establishment of the LVA, with its mandate not only for an immediate response but also for long-term economic planning, not to mention the capability of its key staff, has provided a rare space for experimentation. It has been able to sponsor different approaches while continuing to engage with local elites and entrenched interests. However, legitimating its approach has proved a persistent task, requiring it to 'continuously ... explain and convince its counterparts in government of the value of the approach and the value of the governance model adopted' (Goedegebuure et al., 2020, p. 34)

8. CONCLUSION

So, does smart specialisation offer deeper coherency and strategy in Australian regional policy? The methodology, certainly, lends itself to the development of coherent and strategic regional thinking. The place-based, detailed empirical work of documenting a region's assets overcomes the historic incoherence of data and information available for developing regional policy. The participatory, deliberative process of entrepreneurial discovery across sectors and across the quadruple helix, meanwhile, enables the development of strategic vision and tactics to achieve this. This can go some way towards remedying the perceived 'democratic deficit' in top-down policymaking, especially when seen through the vector of metropolitan-based governments making decisions for regions, rather than in partnership with them.

The insights into the benefits of S3 for regional policy in Gippsland indicate that it is part of a new approach. However, a more comprehensive rethinking of Australian regional policy depends on envisioning the work of government in the context of a new social contract between city and country. As signalled by the OECD a decade ago, governments at all levels need to see themselves as entrepreneurial partners in the sustained viability of the rural, regional and remote economy.

A revitalised social contract for country Australia calls for the government to focus on broadly-based partnerships with industry, research institutions, and community to achieve deliberate economic, social, and environmental ends through collaborative processes. Successive Australian governments have recognised their role in restructuring rural industries, but as yet have not taken the vital step to partner more actively with industry and community to enable the levels and kinds of investment

to occur that would bring about the longer-term restructuring of regional economies which are both desirable and achievable. European initiatives such as S3 provide a developed policy model for the kinds of partnership that would make a massive difference to how recovery processes could be imagined in Australia.

Furthermore, the policy requires sufficient flexibility to adapt to the circumstances of different kinds of regions and to pay attention to the institutional capacity that is required to nurture and support effective collaboration. However, the governance arrangements do not presently exist to enable such an approach to be implemented. From a government point of view, appropriate contracts and accountabilities need to be in place so that the public can be assured that government funds are spent appropriately. From a regional perspective, the necessary institutional processes do not exist that can properly receive, manage and distribute resources, in a manner responsive to local assets and needs.

If these broader issues can be addressed effectively, smart specialisation does indeed have a significant contribution to make to delivering vibrant and prosperous regional Australian communities. However, a critical element of its success will be recognition that there is still much to be learned about how diverse Australian regions can build regional collaboration and innovation systems that will strengthen their futures.

REFERENCES

Alston, M. and Kent, J. (2004). Social Impacts of Drought. A report to NSW Agriculture. Centre for Rural Social Research, Charles Sturt University, Wagga Wagga. Online version accessed March 2022,

https://www.csu.edu.au/__data/assets/pdf_file/0008/704483/Soci al-Impacts-of-Drought.pdf.

Australian Broadcasting Commission (2020). Sea level rise will see 40pc of Australia's beaches lost, predicts new study. Online version accessed September 2021,

https://www.abc.net.au/news/science/2020-03-03/beaches-sea-level-rise-australia/12006286?nw=0&r=HtmlFragment.

Australian Bureau of Statistics (2021). Twenty years of population change. Australian Bureau of Statistics, Canberra. Online version accessed October 2021, https://www.abs.gov.au/articles/twentyyears-population-change.

- Barca, F. (2011). An Agenda for a Reformed Cohesion Policy: a placebased approach to meeting European Union challenges and expectations. DG Regio, European Commission.
- Barr, N. (2009). *The house on the hill- the transformation of Australia's farming communities*. Canberra, Halstead Press.
- Brett, J. (2007). The country, the city and the state in the Australian settlement. *Australian Journal of Political Science*, 42, pp. 1-17.
- Brett, J. (2011). Fair share: Country and city in Australia. Quarterly Essay.
- Bureau of Infrastructure, Transport and Regional Economics (BITRE) (2014). The evolution of Australian towns. Report 136. Bureau of Infrastructure, Transport and Regional Economics, Canberra. Online version accessed October 2021, https://www.bitre.gov.au/publications/2014/report_136.
- Bureau of Meteorology (2022). Drought: Rainfall deficiencies and water availability. Bureau of Meteorology, Melbourne. Online version accessed October 2021, http://www.hom.gov.gov/alimete/drought/

http://www.bom.gov.au/climate/drought/.

- Carson, D. (2011). Political economy, demography and development in Australia's Northern Territory. *The Canadian Geographer/Le Géographe Canadien*, 55, pp. 226-242.
- Cockfield, G. (2015). From state direction to community self-efficacy: the devolution of responsibility for regional development in Australia. In A. Hogan; M. Young (Eds) *Rural and regional futures*, Routledge, London, pp. 38-57.
- Coenen, L. and Morgan, K. (2020). Evolving geographies of innovation: existing paradigms, critiques and possible alternatives. *Norwegian Journal of Geography*, 74, pp. 13-24.
- Crean, S. (2011). Investing in regional Australia. Online version accessed September 2021, https://archive.budget.gov.au/2011-12/ministerial statements/ms rural and regional.pdf.
- Danniell, K. A., Hogan, A. and Cleary, J. (2017). Breaking Down the 'One-Size-Fits-All' Approach to Rural and Regional Policy: Enhancing Policy Initiatives through Multi-level Governance. In K. A. Daniell and A. Kay (Eds) *Multi-level governance. Conceptual challenges and case studies from Australia*, Australian National University E Press, Canberra, pp. 403-428. Online version accessed September 2021, http://pressfiles.anu.edu.au/downloads/press/n3935/pdf/prelims.pdf.

Department of Agriculture, Water and the Environment (a) (2021). Snapshot of Australian Agriculture 2021. Department of Agriculture, Water and the Environment, Canberra. Online version accessed October 2021, https://www.agriculture.gov.au/abares/products/insights/snapshot -of-australian-agriculture-2021.

Department of Agriculture, Water and the Environment (b) (2021). Snapshot of Australian Agriculture 2021. Labour use in Australian Agriculture. Department of Agriculture, Water and the Environment, Canberra. Online version accessed October 2021, https://www.agriculture.gov.au/abares/research-topics/labour.

Department of Agriculture and Water Resources (2019). Agricultural Innovation - A National Approach to Grow Australia's Future: Full report. Ernst & Young, Canberra. Online version accessed September 2021,

> https://www.awe.gov.au/sites/default/files/sitecollectiondocumen ts/agriculture-food/innovation/full-report-agriculturalinnovation.PDF.

Department of Infrastructure, Transport, Regional Development and Communications (2019). Australia's regions – investing in their future. The recommendations of the Strategic Regional Growth Expert Panel for investing in the future of regional Australia. Online version accessed October 2021,

https://www.infrastructure.gov.au/sites/default/files/migrated/regi onal/publications/files/australias-regions-investing-their-future-expert-panel-report.pdf.

- Department of Infrastructure, Transport, Regional Development and Communications (2021). Regional Ministerial Budget Statement 2020-21. Department of Infrastructure, Transport, Regional Development and Communications, Canberra.
- European Union (2010). Europe 2020 Strategy. Online version accessed September 2021, http://ec.europa.eu/europe2020/tools/flagshipinitiatives/index_en.html.
- European Union (2012). Guide to Research and Innovation Strategies for Smart Specialisation. Sevilla, Smart Specialisation Platform. Online version accessed September 2021,

https://ec.europa.eu/regional_policy/sources/docgener/presenta/s mart_specialisation/smart_ris3_2012.pdf.

European Union (2020). Place-based innovation for sustainability. Report prepared by P. McCann and L. Soete, for the Joint Research

Centre, European Commission. Online version accessed September 2021,

https://publications.jrc.ec.europa.eu/repository/handle/JRC12127 1.

Foray, D., David, P. and Hall, B. (2009). Smart Specialisation – the Concept. EU Knowledge Economists Policy Brief n° 9, Brussels.

Goedegeburre, L., Wilson, B., Coenen, L., Schoen, M., Fastenrath, S., Ward, C. and Shortis, E. (2020). Developing and Implementing a Smart Specialisation Approach for Gippsland 2018-2020.
Melbourne Sustainable Society Institute (MSSI), Melbourne.
Online version accessed September 2021, https://sustainable.unimelb.edu.au/__data/assets/pdf_file/0003/35 18319/FINAL-GS3-Report-2018-2020.pdf.

Gross, C. (2015). Perspectives on population policy in Australia. In A. Hogan, M. Young (Eds) *Rural and regional futures*, Routledge, London, pp. 101-114.

- Hogan, A., Hanslip M., Kancans, R., Russell, J. and Stakelum, P. (2008).
 Climate risk and adaptation among primary producers. In *It's about people changing perspectives on dryness. A report to Government by an expert social panel.* Bureau of Rural Sciences, Canberra.
- Hogan, A. and Young, M. (2015). *Rural and regional futures*, Routledge, London.
- Isaksen, A., Martin R. and Trippl, M. (2018). New Avenues for Regional Innovation Systems – Theoretical Advances, Empirical Cases and Policy Lessons, Springer, Cham.

Joint Research Centre (2021). Miedzinski, M., Ciampi Stancova K, Matusiak M and Coenen, L. (2021). Addressing sustainability challenges and Sustainable Development Goals via Smart Specialisation: towards a theoretical and conceptual framework, Publications Office of the European Union. Online version accessed September 2021, https://s3platform.jrc.ec.europa.eu/en/w/addressingsustainability-challenges-and-sustainable-development-goals-via-

smart-specialisation.-towards-a-theoretical-and-conceptual-framework.

Kenny, P. (2008). Drought Policy Review Expert Social Panel 2008. It's About People: Changing Perspective. A Report to Government by an Expert Social Panel on Dryness, Report to the Minister for Agriculture, Fisheries and Forestry. Department of Agriculture,

Fisheries and Forestry, Canberra. Online version accessed September 2021,

https://www.awe.gov.au/sites/default/files/sitecollectiondocumen ts/ag-food/drought/publications/dryness_report.pdf.

- Lawrence, G. and Gray. I. (2000). The myth of modern Australian agriculture: Australian rural production in the 21st century. In B. Pritchard, and P. McManus (Eds) *Land of discontent the dynamics of change in rural and regional Australia*, University of NSW Press, Sydney, pp. 33-51.
- Marsden Jacobs & Associates, RMCG, EBC Consultants, DBM Consultants, Australian National University, Geoff McLeod and Tim Cummins (2010). Synthesis report. Economic and social profiles and impact assessments in the Murray Darling Basin. Murray-Darling Basin Authority, Canberra.

Marques, P. and Morgan, K. (2018). The Heroic Assumptions of Smart Specialisation: A Sympathetic Critique of Regional Innovation Policy. In A. Isaksen, R. Martin and Trippl, M. (Eds) *New Avenues for Regional Innovation Systems – Theoretical Advances, Empirical Cases and Policy Lessons*, Springer, Cham.

Miedzinski, M., Stancova, K. C., Matusiak, M. and Coenen, L. (2021). Addressing sustainability challenges and Sustainable Development Goals via Smart Specialisation. Joint Research Centre. Science for Policy Report, European Union.

Milne, M., Stenekes, N. and Russell, J. (2008). Climate Risk and Adaptation. In *It's about people – changing perspectives on dryness*. A report to Government by an expert social panel. Bureau of Rural Sciences, Canberra. Online version accessed September 2021,

https://www.awe.gov.au/sites/default/files/abares/documents/clim ateriskadapt.pdf.

- Organisation for Economic Cooperation and Development (OECD) (2009). Regions Matter: Economic Recovery, Innovation and Sustainable Growth. Organisation for Economic Cooperation and Development, Paris.
- OECD (2010). Regional Development Policies in OECD Countries. OECD, Paris.
- OECD (2011). Regions at a Glance 2011. OECD, Paris.
- OECD (2013). Innovation Driven-Growth in Regions: The Role of Smart Specialisation. OECD, Paris.
- OECD (2015). Promoting Growth in All Regions. OECD, Paris.

Regional Policy in Australia: Can Smart Specialisation deliver vibrant and prosperous regional Australian communities?

- Productivity Commission (2005). Trends in Australian Agriculture. Research Paper. Productivity Commission, Canberra. Online version accessed September 2021, https://www.pc.gov.au/research/completed/agriculture.
- Productivity Commission (2017). Transitioning Regional Economies. Study Report. Productivity Commission, Canberra. Online version accessed September 2021,
- https://www.pc.gov.au/inquiries/completed/transitioning-regions. RDA Hunter (2013). Hunter 2013 Innovation Scorecard: Australia's Most
- Innovative Region. RDA Hunter, Newcastle. Online version accessed September 2021, https://www.rdahunter.org.au/wpcontent/uploads/2019/03/2580_RDA_Hunter_Innovation_Scorec ard_DRAFT06b.pdf.
- RDA Hunter (2014). Hunter 2014 Innovation Scorecard: Smart Happens Here. RDA Hunter, Newcastle. Online version accessed September 2021, https://www.rdahunter.org.au/wpcontent/uploads/2019/03/Offsets_RDAHunter_submission_April _2014.pdf.
- RDA Hunter (2016). Smart Specialisation Strategy [S3] for the Hunter Region: A strategy for innovation-driven growth. RDA Hunter, Newcastle. Online version accessed September 2021, https://www.rdahunter.org.au/wpcontent/uploads/2019/03/SmartSpecialisationStrategyfortheHunte rRegion.pdf.
- Reserve Bank of Australia (2011). The Resources Boom. Reserve Bank of Australia, Sydney. Online version accessed October 2021, https://www.rba.gov.au/publications/bulletin/2011/mar/pdf/bu-0311-10.pdf.
- Rodriguez-Pose, A. and Ganau, R. (2021). Institutions and the productivity challenge for European regions. *Journal of Economic Geography*, 22, pp. 1-25. DOI:10.1093/jeg/lbab003.
- Shortis, E., Ward, C. and Wilson, B. (2020). Working hard to get energytransition policy right: learning from Gippsland's Latrobe Valley's efforts. *The Mandarin*, July.
- Smith, E. and Pritchard (2015). Australian agricultural policy: the pursuit of agricultural efficiency. In A. Hogan, and M. Young (Eds) *Rural and regional futures*, Routledge, London, pp 58-70.
- Sydney Morning Herald (2021). Australia's coal exports to 'halve by 2050' if climate goals are met. Online version accessed October 2021, https://www.smh.com.au/business/the-economy/australia-

s-coal-exports-to-halve-by-2050-if-climate-goals-are-met-20211006-p58xuc.html.

- The Australian Small Business and Family Enterprise Ombudsman (2019). The workforce challenges of rural and regional Australia. The Australian Small Business and Family Enterprise Ombudsman, Canberra. Online version accessed October 2021, https://www.asbfeo.gov.au/news/news-articles/workforcechallenges-rural-and-regional-australia.
- Trading Economics (2021). Australia employment in agriculture. Online version accessed October 2021, https://tradingeconomics.com/australia/employment-inagriculture-percent-of-total-employment-wb-data.html.
- Wu, W., Dawson., D, Fleming-Muñoz, D., Schleiger, E. and Horton J. (2019). *The future of Australia's agricultural workforce*. Commonwealth Scientific Industry Research Organisation Data61: Canberra, Australia. Online version accessed October 2021, https://www.qff.org.au/wp-content/uploads/2019/12/19-00351_DATA61_REPORT_AgricultureWorkforce_WEB_19103 1.pdf.
- Wilson, B., Ward, C. and Hogan, A (2021). Major Disruptive Events in Selected Australian Regional Communities: Policy Issues for Business Recovery, and for Decision-Making Structures. Report prepared for Regional Australia Institute, Melbourne.
- Windsor, T. (2011). Sustaining rural communities how can we achieve it? Keynote paper. Sustaining Rural Communities Conference, Cotton Communities CRC. Narrabri. Online version accessed October 2021,

http://www.cottoncrc.org.au/content/SRC/2011_Conference/2011 _Conference_program.aspx.

Wiseman, J., Workman, A., Fastenrath, S. and Jotzo, F. (2020).
Addressing sustainability challenges and Sustainable
Development Goals via Smart Specialisation. Centre for Climate and Energy Policy Working Paper, Australian National
University, Canberra. Online version accessed October 2021, https://ccep.crawford.anu.edu.au/sites/default/files/publication/cc
ep_crawford_anu_edu_au/2020-11/ccep2010 wiseman workman fastenrath jotzo after hazelwood.pdf.

331

LOCAL EMERGENCY CO-PRODUCTION IN AUSTRALIA: THE CASE OF THE NEW SOUTH WALES RURAL FIRE SERVICE

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ABSTRACT: Given the vast spatial area and low population density involved, together with the prevalence, frequency, and severity of bushfires, firefighting services in non-metropolitan areas of Australia have always depended heavily on the contribution of volunteer firefighters. Australian volunteer firefighting services represent an unusually high degree of collaboration between local volunteers and state and local governments. In this paper, we examine the nature and operation of the New South Wales (NSW) Rural Fire Service (RFS) through the analytical lens of the local co-production paradigm, to date a dimension of Australian volunteer firefighting that has remained largely unexplored in the scholarly literature. In particular, we examine the comparative advantages that the NSW RFS garners from its unique combination of government funding, professional staff, and volunteer firefighters. The paper concludes by considering the public policy implications of the analysis.

KEYWORDS: Bush fires; firefighting; local co-production; Rural Fire Service; volunteers.

1. INTRODUCTION

The 2019/20 southern summer witnessed a prolonged and savage bushfire season that engulfed more than eighteen million hectares of the Australian continent (Chester, 2020). The resultant damage included extensive human and animal loss of life, as well as immense economic and environmental losses (West *et al.*, 2020). An important consequence of these horrific bushfires has been to focus public attention worldwide on the critical role played by volunteer firefighters in combating the Australian bushfires (O'Halloran and Davies, 2020; Vardoulakis *et al.*, 2020). As a consequence of its longstanding experience with severe seasonal bushfires, all Australian states and territories have developed formidable administrative and technical capacity in firefighting (Pyne, 1991; Clark, 2020; Dickson-Hoyle *et al.*, 2020). Given the immense spatial size of non-metropolitan Australia with its sparse human settlement, firefighting capacity outside of cities relies heavily on co-production involving state and local governments together with volunteer firefighting Service (RFS) is the largest of the eight Australian state and territory firefighting services with 1,994 fire brigades and more than 71,234 volunteers in 2018/19 financial year (Table 3).

In the present paper, we address the question, how the NSW RFS operates through the conceptual lens of co-production and we also consider how well this model of co-production functioned during the 2019/20 NSW bushfires. In particular, we attempt to identify the synergies that the NSW RFS has harnessed through a combination of public funding, professional staff, and volunteer firefighters that serves to capture the comparative advantages of these inputs. We then examine whether or not the co-production model was a suitable model for the extreme levels of firefighting experienced during the 2019/20 bushfires. The methodological approach used to answer these questions comprised a qualitative analysis of the primary documentary evidence and the extant grey literature, including government reports, annual reports, and parliamentary inquiries, augmented by scholarly research.

The paper is divided into six main parts. Section 2 provides a synoptic account of the scholarly literature on local co-production, co-production in emergency service provision, and volunteer firefighting in Australia. Section 3 briefly describes the nature of volunteer firefighting agencies in Australia by way of institutional background and then section 4 considers the NSW RFS in more detail. Section 5 illuminates the manner in which the NSW RFS operates by examining its performance during the catastrophic 2019/20 bushfires. Section 6 adopts the analytical prism offered by the literature on local co-production in an effort to shed light on the operation of the NSW RFS during the 2019/20 bushfire season. The paper ends in section 7 with a brief discussion of its chief public policy implications.

2. CONCEPTUAL PERSPECTIVES ON LOCAL CO-PRODUCTION

Elinor Ostrom (1972) introduced the concept of co-production into the public administration literature in order to illuminate the role local residents play in the provision of public services, including emergency services. While a voluminous literature has arisen around co-production in the public sector (see, for instance, recent reviews of the literature by Voorberg et al., (2015) and Brandsen and Honingh (2016)), much less attention has focused on co-production in the provision of emergency services, such as firefighting, possibly due to its additional institutional complexities (Musso et al., 2019). The past decade has witnessed a resurgence of interest in co-production in both real-world public service provision and the scholarly literature. Nabatchi et al., (2017, p. 766) contend that three main forces account for this trend. Firstly, the 'new governance' approach in public administration has emphasised the 'increasingly multi-sectoral nature of governance' and recognised the need for 'a pluralistic model of public service based on inter-organizational relationships, networks, collaborative partnerships, and other forms of multi-actor policy making and public action'. Secondly, the global financial crisis has ushered in an era of austerity in which co-production can act as an engine in reducing the cost of public service provision. Finally, the inexorable decline in social cohesion in many Western societies has 'prompted scholars and practitioners to look for new public service delivery mechanisms that will reinvigorate the role of citizens in their communities beyond simply voter and customer'.

Despite the renaissance of co-production in the public administration literature, widespread acknowledgement exists that there is ongoing confusion on the nature of co-production, derived in part from definitional ambiguities (Brandsen and Honingh, 2016). Together with its conceptual cousins, co-creation and co-design, co-production has been attacked on various grounds (Pollitt and Hupe, 2011; Voorberg *et al.*, 2015). For instance, in their editorial in a Special Issue of the *Public Management Review* devoted to co-creation, co-design, and co-production in public services, Dudau *et al.*, (2019, p.1577) argued that the concept of co-production suffered from three generic defects. Firstly, they contend that co-production is 'polysemic' in that 'it means different things to different people'. Secondly, in normative terms co-production is 'very appealing' since it is almost universally assumed that "co" necessarily leads to added value, hence it is superior to non "co" alternatives'. Finally, the

presentation of co-production as a 'consensual and marketable concept' implicitly denies that it can only be fully understood in a given and concrete real-world institutional setting. Notwithstanding these difficulties, in the present context we adopt Alford's (2009, p.23) definition that classifies co-production as 'any active behaviour by anyone outside the government agency' that is (a) 'conjoint with agency production, or is independent of it but prompted by some action of the agency'; (b) 'at least partly voluntary'; and (c) 'either intentionally or unintentionally creates private and/or public value, in the form of either outputs or outcomes'.

A substantial scholarly literature has focused on co-production that includes co-production involving volunteers in the provision of local emergency services (see, for instance, Verschuere et al., (2012) for a survey of the literature on local co-production). For example, scholars have considered the conditions required for this mode of co-production to be effective, such as Needham (2008), Scolobig et al., (2015) and McLennan (2020). Researchers have also examined the nature and extent of cost savings associated with emergency service provision that utilises community volunteers (Sharp, 2006; Clark et al., 2013; Garlatti et al., 2019). Some work has investigated the question of the degree to which unpaid involvement in community co-production is indeed voluntary (Jakobsen and Andersen, 2013; Tõnurist and Surva, 2017). Researchers have invested considerable effort into examining local community coproduction centred on partnerships between local government and community groups that deals with marginalised residents, such as elderly residents (Kinoshita et al., 2020). Moreover, numerous other dimensions of voluntary co-production emergency service provision have also been considered (Pestoff, 2006; Alford, 2009; 2014; Mees et al., 2018; Velotti and Murphy, 2020).

A sizeable literature exists on volunteer firefighting services in the Australian context. For instance, researchers have established the critical importance of volunteers in firefighting efforts in non-metropolitan regions of Australia (Birch and McLennan, 2007; Baxter-Tomkins and Wallace, 2006). Similarly, scholars have devoted considerable attention to various problems surrounding the shortage of volunteer firefighters in rural areas (McLennan and Birch, 2005; Baxter-Tomkins and Wallace, 2009; O'Halloran and Davies, 2020). The impact of demographic change on volunteer firefighting has also been examined (Keane and Beer, 2000; Davies, 2011). Furthermore, scholars have considered the adverse physical and psychological health effects of firefighting on volunteers (Bryant and Harvey, 1996; Reisen and Brown, 2009) as well as the impact of competing demands on volunteer firefighters (Meikle, 2001; Mitchell, 2006). Finally,

some effort has been invested in examining disaster management programs that operate through co-production (McLennan, 2020).

Rural fire-fighting is a critical activity for the wellbeing of Australian society on a remote, regional, national, and international level. As a public service centred on meeting the needs of non-metropolitan Australia, where infrastructure and service-provision are largely beyond the reach of centralised metropolitan governments, the NSW RFS operates most effectively when members of the public voluntarily participate in its production (Uzochukwu and Thomas, 2018). However, local coproduction consultation within the Australian milieu can be superficial (Wiewiora et al., 2018). Interdependency between service providers and service users creates a matrix of interaction and participation requiring effective mechanisms for place-based participation in the decision-making and production processes to ensure bespoke local solutions are informed by local knowledge. Bovaird (2007) found that in general, government is often reluctant to share authority with local communities or enact local place-based co-production, thereby creating significant barriers to local voice and local choice (Meijer, 2016). As we shall see, the NSW RFS endeavours to establish place-based co-production systems. However, it operates within a strict regulatory framework with various constraints.

In Australia, national natural disasters have been subject to a variety of official inquiries. For example, a Royal Commission into National Natural Disaster Arrangements (RCNNDA) was finalised in 2020 (RCNNDA, 2020), in addition to a Royal Commission investigating the tragic 'Black Saturday' fires in Victoria (Victorian Bushfires Royal Commission (VBRC), 2009). Both Royal Commissions offered detailed information on rural fire organisations, including the coordination and resourcing of rural fire brigades. Various documents produced by the Australian Bushfire and Natural Hazards CRC has prompted further scholarly debate on the question. For example, a recent report on attracting and supporting new volunteers through non-traditional methods has underlined the national importance of the co-production model in non-metropolitan Australia (Dunlop *et al.*, 2022). In this paper, we seek to add to this nascent literature by considering co-production in the RFS in NSW.

3. VOLUNTEER BUSH FIREFIGHTING IN AUSTRALIA

The vast distances between rural settlements in colonial Australia, together with the sparse population, necessitated the establishment of local firefighting brigades operated by local volunteers (McLennan and Birch, 2005). As a result, there are presently some 220,000 volunteers distributed amongst thousands of local fire brigades across Australia. Table 1 provides a summary of volunteer numbers as well as state and territory rural fire services and local fire groups across the seven Australian state and territory jurisdictions:

Table 1. Australian State and Territory Rural Fire Services, Brigades and Volunteers. Source: O'Halloran and Davies (2020).

State/Territory	Fire Agencies	Number of	Number of
		Volunteers	Rural Brigades
ACT	ACT Rural Fire Service	413	9
NSW	NSW Rural Fire Service	72,491	2,002
NT	Bushfires NT	500	22
Queensland	Queensland Rural Fire	33,000	1,400
	Service		
SA	SA Country Fire	13,500	425
	Service		
Tasmania	Tasmania Fire Service	4,800	230
Victoria	Country Fire Authority	54,621	1179
WA	Department of Fire and	25,000	750
	Emergency Services		
	(Rural Fire Division),		
	Local Government		
	Bush Fire Brigades		

4. NEW SOUTH WALES RURAL FIRE SERVICE

Genesis of the NSW RFS

The NSW RFS is the world's largest volunteer fire service. In its present form, the NSW RFS was established under the *1997 Rural Fires Act* which created rural fire districts based around existing local government boundaries (NSWRFS, 2020). The NSW RFS has its origins in the small town of Berrigan in southern NSW, where in 1896 the first volunteer fire brigade was established (NSWRFS, 2020). As we can see from Table 2, provision for fire-fighting services had already been firmly entrenched in various legislative acts that prescribed responsibility for preventing, containing, and extinguishing fire in NSW. Until 1997, fire-fighting in regional, rural, and remote NSW was primarily the responsibility of local government, which enjoyed the power to create fire brigades and enforce regulatory fire policies within each local council jurisdiction. However, in 2000 the NSW Parliament approved the transfer of fire control and district staff to the NSW Government to create a single state-wide fire service (NSWRFS, 2000, p. 2).

Table 2. New South	Wales Fire Fighting	Legislation.	Source: NSW Legislation
(nd).		-	

Date	Legislation	Purpose		
1852	Act for Establishing Municipal	Councils may enact bylaws for the regulation, prevention and		
	Institutions- Section 72	extinguishing of fires.		
1866	Preventing the Careless Use of Fire	Careless use of fire could be punished by a substantial fine, or by		
	Act	imprisonment with, or without hard labour.		
1884	Fire Brigades Act (No. 3)	Established the Fire Brigades Board in the Sydney Metropolitan Distri- and Municipalities. This Act established and maintained an efficient fi- brigade and took over from the Insurance Companies Fire Brigades.		
1901	Careless Use of Fires Act	Revised in 1906 and 1912		
1906	Local Government Act	Ensured that fire brigades could be formed through local councils in non-metropolitan areas.		
1919	Local Government Act	Enabled and facilitated the local management of firefighting in local areas.		
1930	Bush Fires Act	Enabled local councils to appoint an officer to control and manage bush fire brigades.		
1932	Local Government (Bush Fires) Amendment Act	Gave authority and powers to bush fire brigade captains and deputy captains.		
1942	Bush and Rural Fires Prevention Order	Represented part of the National Security Act that established a number of restrictions and requirements surrounding fire prevention.		
1946	Economic Stability and War Time Provisions Continuance Act	Provided the Minister with the ability to prohibit lighting of fires in open areas.		
1949	Bush Fires Act	Established a bush firefighting fund with the following entities contributing a stipulated proportion of its revenue: Colonial Treasurer (25%), local councils (25%) and insurance companies (50%). Funds were used to enable local government to purchase equipment for their volunteer fire brigades. The new Act also incorporated the Careless Use of Fires Act and the Bush Fires Act of 1930, and amendments to the 1919 Local Government Act.		
1997	The Rural Fires Act (No. 65)	Established rural fire districts based around existing local government boundaries and simplified the manner in which the NSW RFS was organised		

Funding the NSW RFS

The Rural Fires Act 1997 (No. 65) prescribed the core activities of the NSW RFS and detailed how it would be funded through the NSW Rural Fire Fighting Fund (NSW Government, 2020). Under the Act, the NSW Treasurer pays an annual contribution to the NSW Rural Fire Fighting Fund each financial year. In addition, affected local councils pay a contribution of no more than 11.7 percent of the funding target applicable to their district. Other contributors to the NSW Rural Fire Fighting Fund include the NSW Government at 14.6 percent and the insurance industry at 73.7 percent. The insurance industry contribution derives from its annual insurance premium revenue, which is imposed as a condition of doing business in NSW. This funding pays for core response activities of the RFS (NSW Government, 2020).

 Table 3. New South Wales Rural Fire Service. Source: NSWRFS, 2000/2001;

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 NSWRFS, 2005/2006; NSWRFS, 2006/2007; NSWRFS, 2007/2008; NSWRFS, 2008/2009;

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 NSWRFS, 2012/2014; NSWRFS, 2014/2015; NSWRFS, 2015/2016; NSWRFS, 2016/2017;

 NSWRFS, 2017/2018; NSWRFS, 2018/2019.

Financial	Total Funding	Salaried Staff	Number of Rural	Volunteers	Annual Number
Year		Numbers	Fire Brigades	Numbers	of Incidents
2000/2001	Over \$93, 000,000.00	161	2, 164	68, 350	*
2001/2002	\$113,070,000	490	2,259	65,395	10,056
2002/2003	\$120,731,000.00	570	2,099	67,058	20,381
2003/2004	*	619	2,094	69,375	18,812
2004/2005	\$134,176,000.00	649	2,069	70,964	17,342
2005/2006	\$140, 00,000.00	680	2,100	70,745	19,590
2006/2007	\$168,000,000.00	685	2,077	71,441	20,186
2007/2008	\$198,000,000.00	710	2,058	70,159	17,569
2008/2009	\$211,00,000.00	752	2,065	70,701	19,474
2009/2010	\$216,000,000.00	822	2,051	70,552	20,146
2010/2011	\$257,000,000.00	920	2,039	70,448	18,830
2011/2012	\$271,000,000.00	942	2,036	70,246	18,913
2012/2013	\$303,128,000.00	846	2,031	71,976	23,436
2013/2014	\$331,116,000.00	822	2,053	73,746	23,375
2014/2015	\$332,900,000.00	824	2,032	74,516	23,148
2015/16	\$361,600,000.00	855	2,029	73,162	23,520
2016/2017	\$372,400,000.00	878	2,021	73,223	24,582
2017/2018	\$385,775,000.00	911	2,002	72,491	26,903
2018/2019	\$444,492,000.00	936	1,994	71,234	30,102

*Data not available

Table 3 outlines NSW RFS annual income, the number of salaried staff, the number of non-metropolitan fire brigades in NSW, the number of volunteers, and the annual number of fire incidents. As the largest volunteer fire service in the world, the NSW RFS expends a great deal of time and effort in training volunteers. For example, it has developed a Public Safety Training Package, a national level qualification in which training ranges from basic firefighting to group leader training. Moreover, the NSW RFS provides training to the NSW Police, metropolitan NSW fire brigades, and fire services in other countries (NSW RFS, 2001/02, p. 15). Training volunteers and professional firefighters in fire management skills, together with the export of firefighting technology to other countries, represents a significant source of revenue. The NSW RFS has been successful in this respect since its training programs are highly regarded (NSW RFS, 2001/02, p. 19). Communication about fire safety also constitutes a core activity of the NSW RFS. In this respect, school and community education programs represent a vital component of its efforts to ameliorate some of the more catastrophic effects of fires in nonmetropolitan NSW, where outside help may not be readily available.

5. NEW SOUTH WALES RURAL FIRE SERVICE AND THE 2019/20 BUSHFIRE CONFLAGRATION

The NSW bush fire season began much earlier than expected in July 2019 (Davey and Sarre, 2020). 2019 was Australia's hottest and driest year on record, with the rainfall average about 40 percent lower for much of the country (Filkov et al., 2020, pp. 45-46). In particular, NSW experienced its most severe drought on record, with 98 percent of the state affected by drought conditions (NSW RFS, 2019/20, p. 6), which was exacerbated by high temperatures. This served to reduce soil moisture further and render landscape even drier. The Australian Forest Fire Danger Index (FFDI) reflected the prevailing climatic conditions; its combined measure of temperature, humidity, wind speed and dryness of available fuel was the highest ever recorded (NSW RFS, 2019/20, p. 6). The combination of drought, record high-temperatures, low soil-moisture, and windy conditions created the perfect conditions for a number of lethal bushfires (Filkov et al., 2020, p. 49). This paved the way for a summer colloquially known as the 'summer from hell' (Davey and Sarre, 2020, p. 47).

After the last fire was extinguished, the quantitative effects of NSW's bushfires were devastating: 5.5 million hectares of the state had burned; 26 people, including four NSW RFS volunteers and three international

firefighting personnel, had died; 2, 476 homes were destroyed; \$899 million of critical infrastructure was lost; \$43 million worth of essential telecommunication sites were destroyed, and 601, 858 hectares of agricultural pasture was damaged (NSW Government, 2020, p. XXI). Furthermore, the loss of wildlife was immense. Royal Commission (2020, pp. 5-6) estimated that almost 3 billion native animals perished during the fires and for the remaining native animals, like koalas, 25 percent of suitable habitat in NSW had been destroyed (NSW Government, 2020, p. 243). Other dimensions of the bush fires, such as their economic, social, and psychological impact upon volunteers, non-metropolitan communities and wildlife, are more difficult to measure.

Work on identifying the primary causes of the 2019/20 bush fires started almost as soon as the fires began in 2019 and concluded that the fires were caused by a 'constellation of factors' (Institute of Foresters of Australia and Australian Forest Growers, 2020; Morgan et al., 2020; NSW Government, 2020, p. 21). While climate change was cited as the most significant causal factor (Jalaludin and Morgan, 2021, pp. 4-6), other contributing influences played a significant role in the spread, ferocity, and severity of the fires. For instance, lightning strikes combined with a very dry landscape seem to have played a pivotal role in most of the fires across NSW (NSW Government, 2020, p. 28). Moreover, deliberate arson and human error were significant causes of many fires. Indeed, 63 offences of arson were recorded under the Crimes Act 1900, with 59 fires deliberately lit, 11 of which with intent to generate a bushfire (NSW Government, 2020, p. 29). Human error and sheer carelessness caused much devastation (Read, 2019), resulting in then NSW Premier Gladys Berejiklian declaring three state-wide State of Emergencies (NSW Government, 2020, p. 108). This served to alter the NSW RFS chain of command by placing the NSW Minister for Police and Emergency Services in charge of the coordination of agencies and the allocation of resources (NSW Government, 2020, pp. 107-8; NSW RFS, 2019/20, pp. 6-7).

The NSW RFS is controlled by a complex bureaucratic structure. The *Rural Fires Act 1997*, which is the overarching legislative foundation of the NSW RFS, provides *inter alia* for coordinated firefighting arrangements, particularly the prevention, mitigation, and suppression of bush fires in local government areas in non-metropolitan parts of NSW, which are constituted as rural fire districts (NSW Government, 2020, p. 107). In addition to establishing the NSW RFS, the Act established the Bush Fire Coordinating Committee (BFCC), whose chief responsibility is the coordination of firefighting outside of urban areas (NSW Government, 2020). At the local level, the Act creates Bush Fire Management

Committees (BFMC), which work alongside the BFCC to oversee bush fire preparedness, in addition to managing cross-agency problems. During the 2019/20 bush fires, cross-agency problems proved challenging due to competing interests and jurisdictional obligations (NSW Government, 2020, p. 110), given the fact that four NSW agencies are tasked with the responsibility for firefighting: the NSW RFS, the National Parks and Wildlife Service, Fire and Rescue NSW and the Forestry Corporation of NSW (NSW Government, 2020, p. 117).

Under Section 44 of the Rural Fires Act 1997, the NSW RFS Commissioner may assume control of firefighting operations if s/he considers the bush fire too severe for the capabilities of the local fire authorities. During the 2019/20 bushfires, 43 Section 44s were declared by the NSW RFS Commissioner (NSW Government, 2020, p. 108). The first Section 44 was declared by NSW RFS Commissioner Fitzsimmons on 10 August 2019 (NSW Government, 2020, p. 107), resulting in all resources in the area in question falling under the responsibility of the Section 44 Incident Controller (NSW Government, 2020, pp. 108, 274-5), who was appointed by the NSW RFS Commissioner. The Incident Controller reports directly to State Operations and it, in turn, determines the overall local firefighting strategy. The Incident Controller forms an Incident Management Team (IMT) comprised of interagency personnel. During the 2019/20 bushfire season, 18 IMTs were formed and they managed large geographic areas that possessed multiple fire fronts (NSW Government, 2020, p. 276). Responsible for firefighting in more than 1,200 towns and villages, in 2019/20 the NSW RFS was comprised of 2,002 rural fire brigades with 71, 234 NSW RFS volunteers. These volunteers had an average age of 51 years and 22 percent of them were women. Most were qualified, with nearly 70 percent of the volunteers holding firefighting qualifications (NSW Government, 2020, p. 118). Volunteer firefighters, including interstate and international personnel, completed over 277, 415 firefighting shifts, each 12 hours long (NSW Government, 2020, p. XXI), and NSW RFS volunteers completed more than 186, 000 shifts (NSW RFS, 2019/20, p. 27), often risking their own lives and livelihoods in the process (NSW Government, 2020, p. 249). The NSW RFS encountered a significant number of problems during the fire season. For example, logistical problems associated with feeding firefighters in remote locales resulted in many firefighters lacking adequate nutrition (NSW Government, 2020, pp. 272-274). Similarly, fatigue and mental stress were evident, with many RFS volunteers enduring extremely unpleasant conditions (NSW Government, 2020, p. 267-271), together with a lack of safety equipment. Safety equipment, including Personal Protective Clothing (PPC), Personal Protective Equipment (PPE), and vehicle safety devices were in short supply for many NSW RFS volunteers. For example, a submission from the NSW Rural Fire Service Association to the NSW Government Bush Fire Enquiry noted that many volunteers lacked adequate respiratory equipment. Moreover, many did not have more than one set of PPC and numerous brigades faced significant danger from older, unsuitable vehicles which did not possess modern protective systems, like fire curtains, electric hose reels or spray systems (NSW RFSA, 2020, pp. 9-12). The NSW Government acknowledged this and admitted that resources were stretched and insufficient PPE, PPC, and vehicle protection systems were provided (NSW Government, 2020, pp. 73, 259-274).

Australian reliance on volunteer firefighters is far from unique. For instance, Russia, the USA and many parts of Europe have large brigades of volunteer firefighters in addition to substantial professional brigades (NSW Government, 2020, p. 254). However, the heavy reliance in NSW on volunteers represented a significant weakness in its approach to fire mitigation. Prior to the 2019/20 bushfire season, NSW had experienced three years of severe drought that had reduced the availability of NSW RFS volunteers (NSW Government, 2020, p. 250). This placed a greater burden on interstate and international personnel who did not possess the requisite local knowledge of local areas (NSW Government, 2020, p. 251). Communication was problematic and it highlighted the weaknesses of many systems within the NSW RFS, as well as the disaster management agencies responsible for managing firefighting operations. For example, many NSW RFS crews were left in dangerous and vulnerable circumstances because IMTs could not accurately pinpoint where firefighters were situated because the majority of the fleet did not have automatic vehicle location capability, radio and mobile phone coverage in remote areas was not reliable, and not all NSW RFS vehicles were equipped with the necessary mapping capabilities (NSW RFSA, 2020, pp. 12-15). Despite being responsible for determining the overall firefighting strategy of an area, IMTs lacked integrated communication systems and necessary staff. Moreover, they were managed by the NSW RFS which was 'stretched beyond its capacity' and operating with 'too few resources available to adequately respond to such a large event' (NSW RFSA, 2020, pp. 16-17).

6. CO-PRODUCTION SYNERGIES IN THE NEW SOUTH WALES RURAL FIRE SERVICE

As we have seen, the NSW RFS represents an example of local coproduction that combines the comparative institutional advantages of formal public sector entities, notably the NSW government and NSW local councils, private sector companies, like the insurance industry, professional firefighting management and staff employed by the NSW RFS, and thousands of volunteer firefighters around NSW. Each of these participating partners possesses comparative institutional strengths and weaknesses. Thus public sector organisations in the form of the NSW government and NSW local authorities enjoy tax-based income that guarantees a steady income to the NSW RFS to adequately fund its operations. This serves to address the well-known problem of 'philanthropic insufficiency' (Salamon, 1987) or the chronic inability of most voluntary organisations to generate resources on a scale sufficiently adequate and reliable to fund a given voluntary program. In addition, these public sector partner organisations possess the power to enact legislation and pass municipal bylaws to thereby provide the official legislative foundations for the ongoing operations of the NSW RFS.

By contrast, the managerial professionalism of the NSW RFS salaried staff, who plan and control the day-to-day operations of the overall NSW RFS partnership, constitutes a comparative institutional strength frequently absent in voluntary organisations. In the absence of this kind of professional oversight, voluntary entities are often afflicted by what is sometimes termed 'philanthropic amateurism' (Salamon, 1987) exemplified by inadequate administration and management skills on the part of volunteers. Thirdly, the prescriptive legislative mandate enjoyed by the NSW RFS in its operations which is provided by the NSW government and participating local councils, as well as the administration and management delivered by the NSW RFS salaried staff, act to mitigate problems that sometimes affect purely voluntary organisations in the form of 'philanthropic particularism' and 'philanthropic paternalism' (Salamon, 1987). Philanthropic particularism describes the tendency of voluntary entities to concentrate on specific subgroups of the population rather than the population at large. This can distort the assistance provided by voluntary organisations. By contrast, philanthropic paternalism denotes excessive reliance on voluntary organisations to define the needs of those groups of persons they assist. It can also lead to a misrepresentation of the nature of the voluntary service that is required.

Finally, volunteers themselves possess a powerful comparative advantage in several respects. Scholars working in the government failure tradition, like Wolf (2003), have argued that notwithstanding the comparative institutional strengths of public entities and formal bureaucracies, they also typically manifest systematic weaknesses, especially bureaucratic rigidity and an absence of flexibility. In terms of comparative institutional advantage, Salamon (1987, p. 39) has proposed that 'the "transactions costs" involved in mobilizing a governmental response to shortages of collective goods tend to be much higher than the costs of mobilizing voluntary action'. For instance, prior to governmental intervention, 'substantial segments of the public must be aroused, public officials must be informed, laws must be written, majorities must be assembled, and programs must be put into operation'. This contrasts sharply with voluntary organisations. In the civic realm, 'to generate a voluntary sector response, a handful of individuals acting on their own or with outside contributed support can suffice'. Consequently, 'it is reasonable to expect, therefore, that the private, non-profit sector will typically be the first line of response to perceived "market failures" (Salamon, 1987, pp. 39-40), and that government will only be called on only as the voluntary response proves insufficient'. Thus 'government involvement is less a substitute for, than a supplement to, non-profit action'. In firefighting, local volunteers bring vital detailed local knowledge and high levels of enthusiasm typically absent in the public sector.

As we have seen from the analysis of the 2019/20 Bushfire Conflagration in section 5, despite the manner in which the operations of the NSW RFS synchronize the comparative institutional advantages of its constituent elements, the NSW RFS's performance was far from optimal. For instance, communication difficulties not only hampered the conduct of firefighting activities but also served to endanger the lives of volunteer firefighters. Similarly, shortages in safety equipment likewise threatened the wellbeing of firefighters.

7. CONCLUSION

In this paper, we have considered the NSW RFS as a case study of local co-production in the provision of firefighting services in non-metropolitan NSW. As we have seen, the NSW RFS represents a co-production partnership embracing the NSW RFS professional secretariat, the NSW government and local councils, the insurance industry, and a multitude of voluntary firefighters, who conduct firefighting activities on the ground.

We examined this collaborative partnership using the analytical lens offered by the local co-production literature. Our analysis has shown that the ongoing success enjoyed by the NSW RFS local co-production exercise is largely due to the manner in which it has harnessed the comparative institutional advantages of its constituent entities. The mutually reinforcing synergistic relationships between the participating groups involved in the NSW RFS local co-production arrangements have spawned at least two substantial external benefits to the NSW population at large. In the first place, given the voluntary involvement of local residents, the costs associated with firefighting and fire protection are much lower than if these services had been provided by public agencies or the private sector. Secondly, given the substantial number of local volunteers involved in firefighting in non-metropolitan NSW, collaborative local co-production through the NSW RFS generates considerable social capital amongst the NSW population. Much remains to be done.

Future research into the operation of the NSW RFS could fruitfully delve more deeply into the NSW RFS by interviewing participants drawn from all of its partner entities. Moreover, research on how the NSW RFS coproduction model compares with co-production models in other jurisdictions, both nationally and internationally, would prove insightful. In particular, it could seek to garner further information about operational and funding models, volunteer motivation, and co-production synergies. This could further illuminate the operational strengths and weaknesses of the NSW RFS and offer valuable insights to public policymakers. In addition, researchers could consult firefighting personnel who participated directly in the 2019/20 NSW bushfire conflagration and determine from them the operational difficulties and equipment shortages they encountered in order to develop effective remedial measures.

REFERENCES

- Alford, J. (2009). Engaging public sector clients: From service-delivery to co-production, Macmillan, Basingstoke.
- Alford, J. (2014). The Multiple Facets of Co-Production: Building on the Work of Elinor Ostrom. *Public Management Review*, 16, pp. 299–316.
- Baxter-Tomkins, T. and Wallace, M. (2006). Emergency Service Volunteers: What do we Really Know about Them?. *Australian Journal on Volunteering*, 11, pp. 7–15.

- Baxter-Tomkins, T. and Wallace, M. (2009). Recruitment and Retention of Volunteers in Emergency Services. *Australian Journal on Volunteering*, 14, pp. 39–49.
- Birch, A. and McLennan, J. (2007). Who's Interested? The NSW Grain Belt Community Survey about Volunteering with the Rural Fire Service. *Australian Journal on Volunteering*, 12, pp.14–25.
- Bovaird, T. (2007). Beyond engagement and participation: User and community coproduction of public services. *Public Administration Review*, 67(5), pp. 846–860, DOI:10.2307/4624639.
- Brandsen, T. and Honingh, M. (2016). Distinguishing Different Types of Coproduction: A Conceptual Analysis Based on the Classical Definitions. *Public Administration Review*, 76, pp. 427–435.
- Bryant, R. A. and Harvey, A. G. (1996), Posttraumatic stress reactions in volunteer firefighters. *Journal of Traumatic Stress*, 9, pp. 51-62.
- Chester, L. (2020). The 2019–2020 Australian bushfires: a potent mix of climate change, problematisation, indigenous disregard, a fractured federation, volunteerism, social media, and more. *Review of Evolutionary Political Economy*, 1, pp. 245-264.
- Clark, C. (2020). Causes of Big Bushfires in Australia: Higher Temperatures and Rainfall or More Fuel?. *Journal of Geoscience and Environment Protection*, 8, pp. 79.
- Clark, B. Y., Brudney, J. L. and Jang, S. (2013). Coproduction of Government Services and the New Information Technology: Investigating the Distributional Biases. *Public Administration Review*, 73, pp. 687–701.
- Davey, S. M. and Sarre, A. (2020). Editorial: the 2019/20 Black Summer bushfires. *Australian Forestry*, 82, pp. 47-51.
- Davies, A. (2011). On Constructing Ageing Rural Populations: "Capturing" the Grey Nomad. *Journal of Rural Studies*, 27, pp. 191–199.
- Dickson-Hoyle, S., Beilin, R. and Reid, K. (2020). A Culture of Burning: Social-Ecological Memory, Social Learning and Adaptation in Australian Volunteer Fire Brigades. *Society & Natural Resources*, 34 pp. 1-20.
- Dudau, A., Glennon, R. and Verschuere, B. (2019). Following the yellow brick road? (Dis)enchantment with co-design, co-production and value co-creation in public services. *Public Management Review*, 21, pp. 1577-1594.
- Dunlop, P., Farid, H. M., Gagné, M. and Kargt, D. (2022). Supporting New Volunteers: A resource kits for emergency service volunteer

leaders. Bushfire and Natural Hazards CRC. Online version accessed January 2022,

- https://www.bnhcrc.com.au/publications/biblio/bnh-7791. Filkov, A. I., Ngo, T., Matthews, S., Telfer, S. and Penman, T. D. (2020). Impact of Australia's catastrophic 2019/20 bushfire season on communities and environment. Retrospective analysis and current trends. *Journal of Safety Science and Resilience*, 1, pp. 44-56.
- Garlatti, A., Fedele, P., Iacuzzi, S. and Costa, G. G. (2019). Coproduction and cost efficiency: a structured literature review. *Journal of Public Budgeting, Accounting & Financial Management*, 32, pp. 114-135.

Institute of Foresters of Australia and Australian Forest Growers (2020). Submission to the Royal Commission into National Natural Disaster Arrangements. *Australian Forestry*, 83, pp. 107-135.

Jakobsen, M. and Andersen, S. C. (2013). Coproduction and Equity in Public Service Delivery. *Public Administration Review*, 73, pp. 704–713.

Jalaludin, B. and Morgan, G. (2021). What does climate change have to do with bushfires?. *Australian Health Review*, 45, pp. 4-6.

Keane, R. and Beer, A. (2000). Population Decline and Service Provision in Regional Australia: A South Australian Case Study. *People* and Place, 8, pp. 69–76.

Kinoshita, Y., Dollery, B. and Yamazaki, K. (2020). Creating institutional advantage: local government co-production with community groups. Asia Pacific Journal of Public Administration, 42, pp. 170-187.

McLennan, B. J. (2020). Conditions for effective coproduction in community-led disaster risk management. VOLUNTAS: International Journal of Voluntary and Nonprofit Organizations, 31, pp. 316-332.

McLennan, J., and Birch, A. (2005). A Potential Crisis in Wildfire Emergency Response Capability? Australia's Volunteer Firefighters. *Global Environmental Change Part B: Environmental Hazards*, 6, pp. 101–107.

McLennan, B., Whittaker, J. and Handmer, J. (2016). The changing landscape of disaster volunteering: opportunities, responses and gaps in Australia. *Natural Hazards*, 84, pp. 2031-2048.

- Mees, H., Alexander, M., Gralepois, M. and Matczak, P. (2018). Typologies of citizen co-production in flood risk governance. *Environmental Science & Policy*, 89, pp. 330-339.
- Meijer. (2016). Coproduction as a structural transformation of the public sector. *The International Journal of Public Sector Management*, 29, pp. 596–611, DOI:10.1108/IJPSM-01-2016-0001.
- Meikle, T. (2001). Burnout in the fire service: The work-life imbalance of volunteer firefighters. *Australian Journal on Volunteering*, 6, pp. 60-65.
- Mitchell, L. (2006). Volunteering and work/life balance. *Australian Journal on Volunteering*, 11, pp. 72-75.
- Morgan, G. W., Tolhurst, K. G., Poynter, M. W., Cooper, N., McGuffog, T., Ryan, R., Wouters, M. A., Stephens, N., Black, P., Sheehan, D., Leeson, P., Whight, S. and Davey, S. M. (2020). Prescribed burning in south-eastern Australia: history and future directions. *Australian Forestry*, 83, pp. 4-28.
- Musso, J. A., Young, M. W. and Thom, M. (2019). Volunteerism as coproduction in public service management: application to public safety in California. *Public Management Review*, 21, pp. 473-494,
- Nabatchi, T., Sancino, A. and Sicilia, M. (2017). Varieties of participation in public services: The who, when, and what of coproduction. *Public Administration Review*, 77, pp. 766–776.
- Needham, C. (2008). Realising the potential of co-production: Negotiating improvements in public services. *Social Policy and Society*, 7, pp. 221–231.
- New South Wales Government (2020). Rural Fires Act 1997 No 65. Online version accessed October 2020, https://legislation.nsw.gov.au/view/html/inforce/current/act-1997-.
- NSW Government (2020). Final Report of the NSW Bushfire Inquiry. NSW Government. Online version accessed January 2021, https://www.nsw.gov.au/nsw-government/projects-andinitiatives/nsw-bushfire-inquiry#toc-published-submissions.
- NSW Legislation (nd). Historical Information. Online version accessed October 2020.,

https://legislation.nsw.gov.au/historicalinformation.

New South Wales Rural Fire Service (2001). Annual Report 2000/2001. (2000/2001). New South Wales Rural Fire Service, Sydney. Online version accessed October 2020, https://www.rfs.nsw.gov.au/__data/assets/pdf_file/0015/4515/RF S-Annual-Report-2000-2001.pdf.

New South Wales Rural Fire Service (2002). Annual Report 2001/02. New South Wales Rural Fire Service, Sydney. Online version accessed October 2020, https://www.rfs.nsw.gov.au/__data/assets/pdf_file/0018/4509/RF

S-Annual-Report-2001-2002.pdf.

New South Wales Rural Fire Service (2003). Annual Report 2002/03. New South Wales Rural Fire Service, Sydney. Online version accessed: 8 October 2020, https://www.rfs.nsw.gov.au/__data/assets/pdf_file/0012/4503/RF S-Annual-Report-2002-2003.pdf.

New South Wales Rural Fire Service (2004). Annual Report 2003/04. New South Wales Rural Fire Service, Sydney. Online version accessed October 2020, https://www.rfs.nsw.gov.au/__data/assets/pdf_file/0006/4497/NS W-RFS-Annual-Report-2003-2004.pdf.

- New South Wales Rural Fire Service (2005). Annual Report 2004/05. (2004/2005). New South Wales Rural Fire Service, Sydney. Online version accessed October 2020, https://www.rfs.nsw.gov.au/__data/assets/pdf_file/0018/4491/RF S-Annual-Report-2004-2005.pdf.
- New South Wales Rural Fire Service (2006). Annual Report 2005/06. (2005/2006). New South Wales Rural Fire Service, Sydney. Online version accessed October 2020, https://www.rfs.nsw.gov.au/__data/assets/pdf_file/0003/4485/RF S-Annual-Report-2005-2006-Part-3-pages-54-104.pdf.

New South Wales Rural Fire Service (2007). Annual Report 2006/07. New South Wales Rural Fire Service, Sydney. Online version accessed October 2020,

https://www.rfs.nsw.gov.au/__data/assets/pdf_file/0018/4464/An nual-Report-2006-2007.pdf.

New South Wales Rural Fire Service (2008). Annual Report 2007/08. New South Wales Rural Fire Service, Sydney. Online version accessed October 2020. https://www.rfs.nsw.gov.au/__data/assets/pdf_file/0003/4458/RF

https://www.rfs.nsw.gov.au/__data/assets/pdf_file/0003/4458/R S-Annual-Report-2007-2008.pdf.

New South Wales Rural Fire Service (2009). Annual Report 2008/09. New South Wales Rural Fire Service, Sydney. Online version accessed October 2020, https://www.rfs.nsw.gov.au/__data/assets/pdf_file/0015/4452/NS W-RFS-2008-2009-Annual-Report.pdf.

New South Wales Rural Fire Service (2010). Annual Report 2009/10. New South Wales Rural Fire Service, Sydney. Online version accessed October 2020,

https://www.rfs.nsw.gov.au/__data/assets/pdf_file/0018/4446/NS W-RFS-2009-2010-Annual-Report.pdf.

New South Wales Rural Fire Service (2011). Annual Report 2010/11. New South Wales Rural Fire Service, Sydney. Online version accessed October 2020, https://www.rfs.nsw.gov.au/__data/assets/pdf_file/0012/4440/20 10-11-Annual-Report.pdf.

New South Wales Rural Fire Service (2012). Annual Report 2011/12. New South Wales Rural Fire Service, Sydney. Online version accessed October 2020, https://www.rfs.nsw.gov.au/__data/assets/pdf_file/0017/4427/Co mplete-2011-12-Annual-Report.pdf.

New South Wales Rural Fire Service (2013). Annual Report 2012/13. New South Wales Rural Fire Service, Sydney. Online version accessed October 2020. https://www.rfs.nsw.gov.au/__data/assets/pdf_file/0007/23299/C

omplete-2012-13-Annual-Report.pdf.

New South Wales Rural Fire Service (2014). Annual Report 2013/14. New South Wales Rural Fire Service, Sydney. Online version accessed October 2020, https://www.rfs.nsw.gov.au/__data/assets/pdf_file/0007/28285/N

SW-RFS-ANNUAL-REPORT-2013-14-Complete.pdf. New South Wales Rural Fire Service (2015). Annual Report 2014/15. New South Wales Rural Fire Service, Sydney. Online version accessed October 2020,

https://www.rfs.nsw.gov.au/__data/assets/pdf_file/0009/35856/C omplete-2014-15-NSW-RFS-Annual-Report.pdf.

- New South Wales Rural Fire Service (2016). Annual Report 2015/16. (2015/2016). New South Wales Rural Fire Service, Sydney. Online version accessed October 2020, https://www.rfs.nsw.gov.au/__data/assets/pdf_file/0004/47353/C omplete-NSW-RFS-Annual-Report-2015-16.pdf.
- New South Wales Rural Fire Service (2017). Annual Report 2016/17. New South Wales Rural Fire Service, Sydney. Online version accessed October 2020,

https://www.rfs.nsw.gov.au/__data/assets/pdf_file/0008/73673/N SW-RFS-Annual-Report-2016-17.pdf.

New South Wales Rural Fire Service (2018). Annual Report 2017/18. New South Wales Rural Fire Service, Sydney. Online version accessed October 2020, https://www.rfs.nsw.gov.au/__data/assets/pdf_file/0003/92262/N

SW-RFS-Annual-Report-2017-18-web.pdf.

New South Wales Rural Fire Service (2019). Annual Report 2018/19. New South Wales Rural Fire Service, Sydney. Online version accessed: 8 October 2020. https://www.rfs.nsw.gov.au/__data/assets/pdf_file/0004/129892/ NSW-RFS-Annual-Report-2018-19-web.pdf

New South Wales Rural Fire Service (2020). Annual Report 2019/20. New South Wales Rural Fire Service, Sydney. Online version accessed October 2020. https://www.rfs.nsw.gov.au/__data/assets/pdf_file/0008/186236/ NSW-RFS-Annual-Report-2019-20.pdf

- New South Wales Rural Fire Service (nd). About Us-History. New South Wales Rural Fire Service, Sydney Online version accessed October 2020, https://www.rfs.nsw.gov.au/about-us/history.
- O'Halloran, M. and Davies, A. (2020). A shared risk: Volunteer shortages in Australia's rural bushfire brigades. *Australian Geographer*, DOI:10.1080/00049182.2020.1813949

Ostrom, E. (1972). Metropolitan reform: propositions derived from two traditions. *Social Science Quarterly*, 53, pp. 474–493.

Pestoff, V. (2006). Citizens and Co-Production of Welfare Services. *Public Management Review*, 8, pp. 503–519.

Pollitt, C., and Hupe. P. (2011). Talking about Government: The Role of Magic Concepts. *Public Management Review*, 13, pp. 641–658.

Pyne, S. J. (1991). *Burning bush: A fire history of Australia*, University of Washington Press, Seattle.

Read, P. (2019). Arson, mischief and recklessness: 87 per cent of fires are man-made, *Sydney Morning Herald*, November 18, 2019.

Reisen, F. and Brown, S. K. (2009). Australian firefighters' exposure to air toxics during bushfire burns of autumn 2005 and 2006. *Environment International*, *35*(2), pp. 342-352.

Royal Commission into National Natural Disaster Arrangements (RCNNDA) (2020). Royal Commission into National Natural Disaster Arrangements. Royal Commission into National Natural

Disaster Arrangements. Online version accessed January 2022, https://naturaldisaster.royalcommission.gov.au/.

- Rural Fire Service Association (2020). Submission to the NSW Independent Bushfire Inquiry. Rural Fire Service Association (RFSA). Online version accessed January 2022, https://www.nsw.gov.au/nsw-government/projects-andinitiatives/nsw-bushfire-inquiry#toc-published-submissions.
- Salamon, L. (1987). Of market failure, voluntary failure, and third-party government: toward a theory of government-nonprofit relations in the modern welfare state, *Journal of Voluntary Action Research*, 16, pp. 29-49.
- Scolobig, A., Prior, T., Schroter, D., Jorin, J. and Patt, A. (2015).
 Towards people-centred approaches for effective disaster risk management: Balancing rhetoric with reality. *International Journal of Disaster Risk Reduction*, 12, pp. 202–212.
- Sharp, E. B. (2006). Policing Urban America: A New Look at The Politics Of Agency Size. *Social Science Quarterly*, 87, pp. 291-307.
- Tõnurist, P. and Surva, L. (2017). Is volunteering always voluntary? Between compulsion and coercion in co-production. *VOLUNTAS: International Journal of Voluntary and Nonprofit Organizations*, 28, pp. 223-247.
- Uzochukwu, K. and Thomas, J. C. (2018). Who Engages in the Coproduction of Local Public Services and Why? The Case of Atlanta, Georgia. *Public Administration Review*, 78, pp. 514– 526, DOI:10.1111/puar.12893.
- Vardoulakis, S., Marks, G. and Abramson, M. J. (2020). Lessons Learned from the Australian Bushfires: Climate Change, Air Pollution, and Public Health. *JAMA Internal Medicine*, 180, pp. 635-636.
- Velotti, L. and Murphy, P. (2020). Service and value co-production and co-creation in emergency services and emergency management. *International Journal of Emergency Services*, 9, pp. 1-7.
- Verschuere, B., Brandsen, T. and Pestoff, V. (2012). Co-production: The state of the art in research and the future agenda. *VOLUNTAS: International Journal of Voluntary and Nonprofit Organizations*, 23, pp. 1083–1101.
- Victorian Bushfires Royal Commission (VBRC) (2009). Victorian Bushfires Royal Commission Final Report. Victorian Bushfires Royal Commission (VBRC). Online version accessed January 2022,

http://royalcommission.vic.gov.au/finaldocuments/summary/PF/VBRC_Summary_PF.pdf.

- Voorberg, W. H., Bekkers, V. J. and L. G. Tummers. L. G. (2015). A Systematic Review of Co-creation and Co-production: Embarking on the Social Innovation Journey. *Public Management Review*, 17, pp. 1333–1357.
- West, S., Visentin, D.C., Neil, A., Kornhaber, R., Ingham, V. and Cleary, M. (2020). Forging, protecting, and repairing community resilience informed by the 2019–2020 Australian bushfires. *Journal of Advanced Nursing*, 76, pp. 1095-1097.
- Wiewiora, A., Keast, R., and Brown, K. (2016). Opportunities and Challenges in Engaging Citizens in the Co-Production of Infrastructure-Based Public Services in Australia. *Public Management Review*, 18, pp. 483–507, DOI:10.1080/14719037.2014.999820.
- Wolf, C. J. (2003). *Markets or Governments: Choosing between Imperfect Alternatives*, MIT Press, New York.

ASSESSING THE LABOUR MARKET RESPONSE DUE TO COVID-19 BORDER RESTRICTIONS: A CASE STUDY OF CANTERBURY, NEW ZEALAND

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ABSTRACT: Labour markets respond to supply and demand changes caused by external shocks, including pandemics. In 2020 and 2021, the Coronavirus disease-2019 (COVID-19) pandemic caused a sudden reduction in labour demand in certain industries globally. As economies emerge into the post COVID-19 reality, a return of patterns caused by ongoing structural pressures return. In Canterbury, a region centred on Christchurch in New Zealand, these include migration demand pressures. This paper uses data from the Canterbury region, which is no stranger to disasters, as a case study. Two models are developed to estimate the future workforce requirements during the recovery period. A population growth model is utilised to test the regional labour market's limits, while an economic model estimates the required jobs for the regional economy. The paper finds that the lower economic activity resulting from COVID-19 has reduced the near-term employment demand. At the same time, labour force transition coupled with strict border controls reveals the need for labour force participation to adjust during the extended recovery period. Although short-term demand for skilled migration remains lower, those leaving the workforce will require replacing.
KEYWORDS: Labour market; COVID-19; border restrictions; regional; labour force participation; economy; pandemic.

1. INTRODUCTION AND MOTIVATION

Labour market changes have local, regional, national and international elements. Local disasters or economic shocks have a direct and often significant effect on the regional labour market as the economy adjusts to changing consumer behaviour (Dyason *et al.*, 2021). These shocks can be in the form of natural disasters, such as earthquakes or floods, which tend to be local, or more widespread, such as the recent pandemic.

Improvements in the status of the global working class and globalisation projects as highlighted by Munck (2018) have been negatively affected by recent Coronavirus disease-2019 (COVID-19) related border restrictions that have hindered labour movement. Within this limitation, the ability of the resident regional labour market requires attention. New Zealand's COVID-19 elimination strategy, which was utilised through much of 2020 and 2021, has proved popular in limiting the number of lockdowns and enabling movement of people and the economy in a slightly different way than in previous years. However, with regards to the international movement of people (for work and/or migration), border controls and exclusions have substantially lowered New Zealand's labour intake.

Reacting to these restrictions, the extant regional labour force would be the main source of human capital until border restrictions change. The Canterbury region within New Zealand provides an example to other areas, both in New Zealand and elsewhere, of how successive disasters influence the workforce and how the policy response to the pandemic may affect short to medium-term labour requirements.

Several significant events in recent times have impacted the economy of the Canterbury region. Following the Global Financial Crisis of 2007-2009, three large magnitude earthquakes hit the Canterbury region in 2010, 2011 and 2016. These generated substantial economic shocks caused by social and economic destruction, with the subsequent rebuilding efforts eliciting further economic transformation.

In this study, we use Canterbury economic data to assess the impact of the COVID-19 shock to assess the labour needs in the regional economy given short-term restrictions on immigration and the role of population growth for the regional labour market.

Due in major part to regular disasters, the population within the Canterbury region has changed significantly over the past decade. The cataclysmic earthquakes had major impacts on the economy of the region and its workers. However, the rebuilding programme has waned as the Canterbury economy transitioned to 'business as usual' activity from around 2017. During this time migration has played a prominent role in population growth for the region. Canterbury is New Zealand's secondmost populous region with nearly 600,000 people in 2018 (Statistics New Zealand, 2021a).

The 2018 census reveals internal migration trends between 2013 and 2018 with a slight in-flow of people from other regions in New Zealand to Canterbury (Statistics New Zealand, 2021a). This inflow amounting to a net total of 3,288 between 2013 and 2018 represents only 5.5 percent of population change over five years. On the other hand, the number of people that have settled in the region, during the same period, from overseas amounted to 42,192. This represents a significant inflow from the international labour market into Canterbury. Sub-national population estimated for 2021 from Statistics New Zealand (2021b) reveals a continuation of this trend from 2018. The population growth for the region between 2018 and 2020 is primarily driven by net-international migration, accounting for 80 percent of population change (Statistics New Zealand, 2021b).

Nationally, New Zealand's immigration policy continues to emerge and adjust in support of national and regional growth imperatives as the economy evolves (Bedford and Spoonley, 2014; Liu, 2017; Immigration New Zealand, 2020).

As is the case in the rest of New Zealand, the baby-boom generation's transition into retirement significantly changed the Canterbury workforce from the turn of the century onward. Figure 1 shows the transition over time of the population per age group within the region. The results of the 2006, 2013 and 2018 censuses show this transition. In 2006, the population was dominated by the age groups of 30 to 49 (29 percent). This transitioned 5-years later to the groups between the ages of 40 and 59 (28.3 percent). From the 2018 census, the largest age group was between 45 and 64 years (at 26 percent).

The effect of migration is evident in the age group of 20 to 34 in the 2018 census with significant domestic and international in-migration of people in this age group into the region. This movement's primary driver was the construction-related rebuilding activity after the 2010/11 and 2016 earthquakes, which attracted a large contingent of workers to the region.



Figure 1. Age Composition in Canterbury - 2006, 2013 and 2018 Census. Source: Statistics New Zealand (2021c).

Following the emergence of COVID-19, New Zealand adopted some of the strictest policies related to movement controls during 2020, limiting international movements into the country and implementing a 7-week lockdown (Hall *et al.*, 2020; Hall *et al.*, 2021). This placed an effective end to immigration and other international travel during most of 2020 and some limitation is expected to remain in place from 2021 onwards. At the time of writing, these restrictions are enduring to a great extent. Indeed, New Zealand has been one of the most cautious jurisdictions in limiting people's movement during the pandemic event. Future changes with regards to COVID-19 international movement regulations are challenging to predict. However, the Director-General of Health in New Zealand, suggested in late 2021 that restrictions may continue for a further three to five years (Daalder, 2021).

2. PRIOR LITERATURE

Economists axiomatically agree that there is an association between GDP and population (Headey and Hodge, 2009). The neoclassical growth model introduces population growth exogenously, with an implication that if population growth outstrips per-capita output, the economy is worse off (Peterson, 2017). Some studies have found opposing results when empirically studying the relationship between population changes and

economic changes, especially when comparing between different geographies (Sethy and Sahoo, 2015; Huang and Xie, 2013; Becker, 1999). Recently, Piketty (2014) observed that economic growth consists of both a population and economic element, with both exhibiting mutual complementarities and dual effects.

As a result, the relationship between population and economic growth is a contested one. Peterson (2017) argued that there appears agreement in the literature that population growth and output (per capita) are codependent. Furthermore, this relationship seems to depend very much on the age structure of the population. Peterson (2017) highlights that an aging population implies that a smaller number of working-age people will have to support growing numbers of retirees and likely slow economic growth, unless productivity increases.

While there is often a stated one-directional relationship between population growth and economic growth (Kapuria-Foreman, 1995; Chang *et al.*, 2014), this is not always the case. Morley (2006) for instance, finds that immigration-based population growth is not exogenous to economic growth as growth runs from GDP to immigration, and not vice versa.

This study acknowledges the existence of this relationship through the models presented. In order to position this paper in the current literature, economic growth is built on the Keynesian assumption that aggregate demand influences output within the economy. For this reason, relationships between the various economic actors within the economy are assumed to stay relatively stable. The Input-Output model is an example of this approach where future demand in the economy is assumed to have similar relationships based on current endogenous input data. This approach is used extensively within the current literature to measure impacts within the economy and refers to the linear response theory (Klimek *et al.*, 2019).

In the analyses of population and economic growth, the international, national and regional economies are inexorably linked. When confronted with an unforeseeable and contractionary exogenous shock like COVID-19, economies and labour markets tend to react negatively before returning to some normality and later recovery (Bonaccorsi *et al.*, 2020). However, regional growth shocks driven primarily by local factors tend to create national and international economic responses such that the negative impacts are cushioned or moderated.

The ability of regional economies to bounce back after a disaster event has been studied in several contexts. Rose and Liao (2005) analysed regional economic resilience following the impact of earthquake-induced disruptions to water supply in Oregon. Their findings imply that economic

Assessing The Labour Market Response Due to COVID-19 Border Restrictions: A Case Study of Canterbury, New Zealand

resilience and the ability of regions to bounce back is a function of preevent mitigation and post-event inherent and adaptive resilience. In an empirical study of the resilience of the Buffalo-Niagra Falls region to weather-related disasters, Foster (2007) finds that the economic recovery prospects of a region are dependent on prevailing local and general economic trends at the time. The ability of regional Japanese labour markets to recover from earthquakes was analysed by Oliva and Lazzeretti (2018) who found that economic resilience and the ability to recover correlated with their respective degree of urbanisation although they stress that conclusions have to be seen in the context of economic conditions in individual regions. This should also be considered in the present study.

For example, when Canterbury suffered dual earthquakes in 2010/11 and 2016, the national and international economies quickly responded in the provision of labour and materials. However, when a global exogenous shock occurs (as was the case with COVID-19), a different response path may be anticipated by a regional economy and labour market. By mid-2020, international labour and migration movements effectively came to a halt. This had substantial flow-on effects on the supply of labour for regional and national economies. Border closures during the 2020 pandemic, and the prospect of greater labour mobility restrictions in future, will have long-term impacts on economic growth, potential labour demand and future labour availability globally.

In this paper, we anticipate a more 'coupled' economic, population and job growth trajectory post-COVID-19 than was observed after the 2010/11 and 2016 earthquakes. However, the ability to fill the new jobs will likely be affected by the openness of borders and the ability of labour to freely move while assuming no further exogenous and local shocks.

3. METHOD AND DATA

This study develops two separate but complementary models to determine the labour force requirements for the regional economy of Canterbury in New Zealand. This is done to exclude the interrelationship between economic output and population in identifying a growing economy's needs and requirements. These analyses aim to highlight the workforce requirements or workforce gap (if any) over time. It is not insinuated that the borders will continue to be closed for the next decade, and international labour movements will cease. The analysis goes beyond this and identifies to what extremes the local, regional labour market can support a growing economy, assuming that the human capital can be sourced locally. The analysis also identifies the limits within the regional labour force that has previously had to adapt to the outcomes of numerous natural disasters by identifying how the market will have to adapt to changing circumstances, which in this instance is restricted borders.

Population Model

The population model aims to quantify the future population in the region. Our study employs a cohort-component model that originated from the classic work by Cannan (1895). The baseline data is sourced from Statistics New Zealand (2021c) and weighted on the 2013 census results. The model includes fertility and deaths, with both sets of assumptions based on an assessment of historic and current trends. The fertility rate is assumed to be age-related and applied to new births for the area in each time period. The mortality rate is derived by the age-specific survival rate for each period and assumed to align with historical trends. This rate is applied for each period to give the number of people that survive each period. Migration is purposefully excluded from the analysis in order to identify the resident workforce for the region and the likely required migrant population to support the regional workforce.

The population forecast is on five-year intervals aligning with the New Zealand census. The approach is summarised by Wilson (2011) and measures the population at intervals for each age group, while the change in the cohort number is applied through a Cohort Change Ratio (CCR).

$$P_x(t) = P_{x-5}(t-5) CCR_{x-5,x}(t-5,t)$$

All cohorts except births during the interval are the population of the cohort age x-5 to x at time t-5 is the population of that cohort aged x to x+5 at time t multiplied by the CCR. The CCR in this study represents the cohort's survival rate based on historical mortality rates per age group sourced through Statistics New Zealand and the District Health Boards.

$$CCR_{x-5,x}(t-10,t-5) = \frac{P_x(t-5)}{P_{x-5}(t-10)}$$

Births are calculated using a fertility rate applied to the age group of 15 to 44 years, developing the child to adult ratio (CAR). Therefore, to project the population aged 0-4 requires:

$$P_0(t) = P_{15-44}(t) CAR(t)$$

where P_0 represents the new births during period t and P_{15-44} the adult population with CAR the ratio at time t.

This model is preferred over other widely-used models including a regression model, ARIMA model or a trends extrapolation method where

Assessing The Labour Market Response Due to COVID-19 Border Restrictions: A Case Study of Canterbury, New Zealand

mathematical functions are utilised. These models tend to extend the historical trend observed into the future and as a result, fail to account for population changes at age groups that affect the population (Wilson, 2011).

The age-group transition relationship from historical censuses reveals the strong relationship in age group movements over time (see Figure 2).



Figure 2. Age Group Transition Relationship. Source: Statistics New Zealand (2021c).

The 2013 to 2018 period corresponds to the Canterbury earthquake rebuild and as a result, the trend does take a different shape compared to the census data in previous years. The large-scale impact on the Canterbury economy from the earthquakes led to in-migration, particularly an increase in the number of people aged 20 to 39 years.

Economic Model

A second model is developed to estimate the relationship between the economy and the labour force. We use quarterly regional filled jobs data from the Linked Employer-Employee Data (LEED) (Statistics New Zealand, 2021d). The dataset is constructed from individual administrative data drawn from Inland Revenue's taxation system and business data from Statistics New Zealand's Business Frame and consists of 82 observations of quarterly data from March 2000 up to September 2020. Vector autoregressive (VAR) analysis is employed to estimate and forecast the

level of employment within the regional economy using employment main sector level and GDP data. The economic structure for Canterbury as well as the employment within the region is used in the model estimation. The interrelationship between employment and GDP is captured by the timeseries data and presented in the VAR model with quarterly input data for both employment and GDP. The VAR model enables us to regress a vector of time series variables on lagged vectors of the variables and represent a matric form like this:

$$\binom{Y1,t}{Y2,t} = \binom{A1,1\ A1,2}{A2,1\ A2,2} \binom{Y1,t-1}{Y2,t-1} + \binom{e1,t}{e2,t}$$

Where Y is total employment and A is a vector of time series variables applied in the analysis. The lag incorporated within the model is indicated through the lagged variables denoted as t-1. The model estimates total employment through employment in primary, goods-producing and services activity and the level of gross domestic product with quarterly data for the regional economy up to September 2020 (see Figure 3).



Figure 3. Jobs and Real GDP in Canterbury, 2000 – 2020, Quarterly. Source: Statistics New Zealand (2021d) and Infometrics (2021).

The lag order tests suggest an optimal lag of three. Given this proposed lag order the total employment model can be described as: *Total employment*

= [*Emp Primary* + *Emp Producing* + *Emp Service* + Region GDP + const]Where Primary = Primary.l1 + Producing.l1 + Service.l1 + GDP.l1+ Primary.l2 + Producing.l2 + Service.l2 + GDP.l2 + Primary.l3 + Producing.l3 + Service.l3 + GDP.l3 + + const + trendand Producing = Primary.l1 + Producing.l1 + Service.l1 + GDP.l1+ Primary.l2 + Producing.l2 + Service.l2 + GDP.l2 + Primary.l3 + Producing.l3 + Service.l3 + GDP.l3 + + const + trend and Service = Primary.l1 + Producing.l1 + Service.l1 + GDP.l1+ Primary.l2 + Producing.l2 + Service.l2 + GDP.l2 + Primary.l3 + Producing.l3 + Service.l3 + GDP.l3 + + const + trendand GDP = Primary.l1 + Producing.l1 + Service.l1 + GDP.l1+ Primary.l2 + Producing.l2 + Service.l2 + GDP.l2

+ Primary.l2 + Producing.l2 + Service.l2 + GDP.l2 + Primary.l3 + Producing.l3 + Service.l3 + GDP.l3 + + const + trend

To ensure the stability of the VAR model the time-series data is transformed into stationary data. Autocorrelation is tested through the Portmanteau test and with a p-value of 0.43 this reveals no autocorrelation. Testing for Heteroscedasticity reveals a p-value of 1 and therefore passes the test. Testing for the normal distribution of residuals, reveals p-values smaller than 0.05 and as a result, does not pass the normality test. However, this is not seen as a major problem for the VAR model and is explained by the COVID-19 effect of lockdown, during 2020, on the GDP and employment data used in the model.

Estimating the required workforce to support an economy from 2020 onwards is achieved by combining economic and population models' outcomes. This approach aligns with the current literature stated earlier in this paper that economic change is a driving force for demographic change (Beaumont, 1989; Headey and Hodge, 2009).

The population model, estimated through the cohort-component model, excludes international and national migration, to control for the existing population to identify the supply-effect of the local labour market due to

international labour movement restrictions. The results could also be used to extrapolate the effect of localised lockdowns, as recent COVID-19 events in New Zealand have led to regions being locked down at different alert levels with travel restrictions in place.

Finally, by overlapping the results from the two models, the labour requirements for the Canterbury region is provided for the medium term.

3. RESULTS

Forecasting the level of economic activity during a one in hundred-year pandemic presents complex forecasting challenges. The uncertainty regarding COVID-19 and its continued effects on economic activity, coupled with the stringent response from the New Zealand government, adds to the challenges of estimating the GDP impact on the regional economy. The major commercial banks in New Zealand expected an annual contraction for 2020 of between 2.5 percent and 3.5 percent followed by a sharp and quick rebound in mid-2021 to 2023 and low but stable growth from 2024 onwards (Westpac, 2021). Following these assumptions, we expect in our model a similar outcome.

Labour Needs

The economic model estimates the required employment for the regional economy from 2020 onwards. Thus, conservative estimates, aligning with current estimates by the Reserve Bank of New Zealand (RBNZ, 2021) and most commercial banks within New Zealand, are preferred. The RBNZ forecast acknowledges that border restrictions will continue to hamper international tourism and migration.

Our model reveals the initial impact of lockdowns due to COVID-19 as a negative short-term impact on employment levels and supports existing findings elsewhere for the Canterbury region (Dyason *et al.*, 2021). Additionally, there is a marked increase in fluctuations in the employment forecast from 2020 onwards as a result of the shock on the economy, with residual values increasing from the 2020 quarterly data. As more data becomes available in the future, these fluctuations might easy sightly. However, it does reflect the uncertainty of the current environment. The 12-month employment average reveals a continued strong demand for employment as the economy continues to expand at conservative growth of 1 percent annually as a midpoint forecast, with upside and downside growth possible. Figure 4 shows the employment forecast for Canterbury up to 2029.

Assessing The Labour Market Response Due to COVID-19 Border Restrictions: A Case Study of Canterbury, New Zealand



Figure 4. Canterbury Employment Forecast, up to 2029. Source: Statistics New Zealand (2021d) and Author's Calculations.

Population

The population model results are illustrated in Figure 5 and show the total resident population forecast up to 2048 at 5-year intervals. The peak in population is forecast to be near 648,000 people in 2038 for the region. Reiterating that the resident population excludes migration.

The working-age population, representing the people aged 15 and 64, is expected to peak earlier, around 2023. The model reveals the growing share of people above the age of 65, while the working-age population and people under 15 are predicted to decline gradually.

We are combining the results from both models to reveal the workforce requirements and the extent of regional and national regulatory intervention required to support or address any potential workforce gap for the regional economy. COVID-19 continues to emphasise the importance of a quick regulatory response to support regional economic activity.

Dyason



Figure 5. Population Composition Forecast, up to 2048. Source: Statistics New Zealand (2021a) and Author's Calculations.

Future Workforce Requirements

As New Zealand borders were closed for all but essential and specialised skills during the pandemic (Immigration New Zealand, 2020), the existing resident population remained the main source of labour. New Zealand has relied extensively on migration to support the economy through the provision of skilled- and seasonal visas. During the height of COVID-19, this source of labour supply came to an almost complete stop. This context is more relevant than before to understand the current population composition and workforce requirement within an economy where the international labour movement is limited.

The two models' combined results are represented in Figure 6, showing the historical and future level of employment and the workforce with the total population for the Canterbury region up to 2029.



Figure 6. Canterbury Workforce Projections, up to 2025. Source: Author's Calculations.

Figure 6 reveals a distinctive trend. The population is forecast to continue to increase, while the working-age population will peak near 2023. Secondly, the economy, assuming a modest rebound in 2021 and growth at 1 percent annually from 2022, will continue to require labour, with more jobs demanded over the long term. The limitation of the regional labour market becomes clear within the analysis and while the local labour force is likely to provide the required capacity for the foreseeable future in most industries, gaps are likely to start emerging in specialised or seasonal labour markets.

Recently, the labour market participation rate has been near 70 percent. Assuming that this represents the long-term full employment equilibrium within the Canterbury economy, deviation from this level is likely to result in increased demand for labour as participation breaches the mark or alternatively results in lower demand for labour participation is below.

Figure 7 reveals the historical and estimated future workforce required within the region with labour force participation at the average level (i.e. 70 percent participation). The graph reveals the estimated employment requirements that relate to the economy up to 2029 given the model

Dyason



Figure 7. Working-age Population Gap, up to 2029. Source: Author's Calculations.

specifications. The baseline (solid black line on the y-axis) represents labour force participation at 70 percent. Any deviation from this line represents over- and under-supply within the labour market and deviation from the baseline is expected to occur. The labour market takes time to respond to new employment opportunities. These may also create fluctuations in the labour market with periods of higher (above 70%) participation, but also lower (below 70%), as evident in the fluctuation on both sides of the baseline between 2006 and 2020. In the period between 2015 to 2019, labour force participation remained close to 70 percent with an increase throughout 2019 and 2020. This is a likely indication that the economy was gaining traction after the earthquake's significant investment.

However, we note that the economic shock from COVID-19 decreased participation rates, especially within the second and third quarters of 2020, but rebounded in the final quarter to reveal a slight decrease on an annual basis in Figure 7. The combined result from the modelling suggests that demand for labour is not expected to deteriorate soon. Labour force participation is expected to continue to be above 70 percent and increase. This result is further supported by recent household labour force survey findings for Canterbury, revealing labour force participation in 2021 has

Assessing The Labour Market Response Due to COVID-19 Border Restrictions: A Case Study of Canterbury, New Zealand

increased from around 69 percent in 2019 to 71 percent in 2021 (Statistics New Zealand, 2021e). The results suggest that labour force capacity is shrinking. The growing regional economy coupled with border restrictions is likely to result in increasing levels of participation as the local labour market pool stabilise and more importantly reduce due to population transitioning. This would suggest that other actions are required to increase the workforce. In-migration could be one possible response.

Therefore, much of the workforce for the next couple of years could be sourced locally, however, the long-term demand for jobs would require sourcing labour from outside the region.

5. DISCUSSION

The above analysis indicates a substantial emerging labour force gap in the coming decades in the Canterbury region. Assuming the absence of substantial productivity growth, current patterns in natural population growth will not be sufficient to satisfy the demand for labour over the medium term for Canterbury. Local and regional policymakers are thus limited to the following options regarding labour force development: devise policies that stimulate natural population growth, devise policies aimed at increasing domestic in-migration into Canterbury, devise policies aimed at reviving a larger share of international immigration into New Zealand, devise policies aimed at retention of potential outward migrants leaving Canterbury. The workforce model discussed above excludes migration and here we briefly discuss how suited the existing migration framework is to address the projected labour shortfall.

Current economic conditions and government policy both play a significant role in the migration to New Zealand. The current workforce is supported by migration from outside national borders and it is anticipated that this will continue to be an important source for skills within the economy once growth turns positive in the economy. COVID-19 has had a significant effect on migration throughout the world and New Zealand and Canterbury have been similarly affected. Recent migration has not only provided the required skills for the growth in the economy, but it has also replaced the retiring human capital within the workforce. Recent, prepandemic annual net migration for Canterbury increased from 3,500 in 2013 to 8,100 in 2018.

Uncertainty about international immigration will remain and is dependent on the longevity of COVID-19, border restrictions and economic growth within New Zealand and Canterbury.

Both national in-migration and international immigration have contributed to an estimated 9,800 people moving into the Canterbury region between 2017 and 2018. These have represented a significant contribution to population increases for the region. These flows are expected to remain one of the primary sources to fill the workforce expected in the regional economy.

The Canterbury labour market has previously shown resilience by adjusting to demands and difficulties associated with natural disasters. During that time, the ability to attract labour from outside the region has provided the required skill to support the economy. For a region that relied heavily on the international labour market, the border restrictions as a result of the COVID-19 pandemic could potentially be disastrous if restrictions remain in the long run. However, the results from the analysis reveal that the pre-pandemic labour inflow coupled with the lower near-term economic activity has created a labour buffer for the region, but this is quickly reducing.

The regional labour market pipeline remains strong in the short term and labour force participation rates are likely to edge higher as new employment opportunities emerge which could potentially mean people entering the labour force earlier (i.e. school leavers) or those that are nearing retirement would consider remaining in the labour force longer.

A further consequence of a growing economy is increasing internal migration into Canterbury from regions where the labour market pressure is low. Localised and regional lockdowns in response to COVID-19 are another possible restriction to labour market movements. Although the extent and duration of localised lockdowns are more flexible, it is expected that these will influence labour movement between regions.

Finally, as the labour force shrink and unemployment remain low, pressure on industry-specific labour supply pipelines is expected to emerge. Competition among industries to source students, both in high school and the university is expected to increase as the labour supply tightens. This has further implications on wage and salary increases which is again affecting inflation. The effect of tighter labour markets and their effect on the wider economy provide scope for further research on a regional level.

6. CONCLUSION

The effect of border restriction due to the pandemic is assessed for Canterbury, a region that has relied upon migration to support regional economic activity post-earthquake. In order to estimate the effect of restricted borders on a regional economy's labour market, this paper assessed both population change and economic change over time international labour movement restrictions are in place.

The results present both opportunities and challenges for policymakers as targeted support for the region post-earthquakes will reduce as the national post-COVID recovery gains traction.

Canterbury, a region familiar with disruption through disasters and recently with the COVID-19 pandemic, has over the past decade relied upon a significant inflow of labour through international migration but will have to rely on other sources in the near term as a result of policy.

The paper finds that the steady pre-pandemic inflow of international labour has provided a short-term buffer that is likely to keep labour force participation rates close to 70 percent in 2021 and 2022. This is further supported by the lower short-term economic activity resulting from COVID-19 with reduced demand pressure on the workforce. However, a rebound and consistent economic growth from 2021 is expected to increase labour demand, with a continued increase in labour force participation required to support economic activity. The current population structure should be able to support economic activity, but this could vary depending on actual growth and employment requirements. Recent labour market results already suggest that capacity within the labour market is shrinking and pressure on relaxing the strict border requirements is needed to support the economy. Migration is seen as an important source of population and workforce to replace retirements and support the growing economy. This migration is initially likely to be driven by internal migration within New Zealand and between regions, while international migration is seen as the long-term solution.

The workforce gap is expected to increase annually and the initial gap would require net inward migration of the working-age population to average at least 10,000 per year, from national or international sources. Migration is the likely primary source to support this workforce gap since the local labour market requirements would have to be sourced from outside the region to sustain continued economic growth. Without significant changes in productivity or natural population growth, regions and countries that historically relied on immigration to support the economy are likely to continue to rely on migration as a labour source.

This paper provides avenues for future research, especially with regards to the structure of the regional economy and how the tradeable and nontradeable industries of the regional economy rely on migration. In other words, some sectors within the economy are likely more reliant on labour that originate from outside the region than within. Due to the shock, the concept of coupling and decoupling between economic and population growth could be prevalent and potential future research to develop this further is suggested.

REFERENCES

- Beaumont, P. (1989). An Interregional Economic-Demographic Model of the United States, Garland Publishers, New York.
- Baker, M. G., Wilson, N. and Anglemyer, A. (2020). Successful elimination of Covid-19 transmission in New Zealand. *New England Journal of Medicine*, 383, pp. e56.
- Becker, G. S., Glaeser, E. L. and Murphy, K. M. (1999). Population and economic growth. *American Economic Review*, 89, pp. 145-149.
- Bedford, R. and Spoonley, P. (2014). Competing for talent: diffusion of an innovation in New Zealand's immigration policy. *International Migration Review*, 48, pp. 891-911, DOI:10.1111/imre.12123.
- Bonaccorsi, G., Pierri, F., Cinelli, M., Flori, A., Galeazzi, A., Porcelli, F. and Pammolli, F. (2020). Economic and social consequences of human mobility restrictions under COVID-19. *Proceedings of the National Academy of Sciences*, 117, pp. 15530-15535.
- Cannan, E. (1895). The probability of a cessation of the growth of population in England and Wales during the next century. *The Economic Journal*, 5, pp. 505-515.
- Chang, T., Chu, H. P., Deale, F. W. and Gupta, R. (2014). The relationship between population growth and economic growth over 1870-2013: Evidence from a bootstrapped panel-granger causality test. University of Pretoria, Department of Economics working paper 2014, 31.
- Daalder, M. (2021). Covid-19: Ashley Bloomfield sees some restrictions for three to five years. Online version accessed June 2021, https://www.stuff.co.nz/national/health/coronavirus/300319438/c ovid19-ashley-bloomfield-sees-some-restrictions-for-three-tofive-years.
- Dyason, D., Fieger, P. and Rossouw, R. (2021). Covid-19, the effect of lockdowns on retail expenditure and displacement effects on the regional economy. *Australasian Journal of Regional Studies*, 27, pp 66 - 87.

- Kapuria-Foreman, V. (1995). Population and growth causality in developing countries. *The Journal of Developing Areas*, 29, 531-540.
- Foster, K. A. (2007). A Case Study Approach to Understanding Regional Resilience. Working Paper 2007–08, Institute of Urban and Regional Development, University of California, Berkeley.
- Hall, M. C., Prayag, G., Fieger, P. and Dyason, D. (2020). Beyond panic buying: consumption displacement and COVID-19. *Journal of Service Management*, 32, pp. 113-128.
- Hall, C. M., Fieger, P., Prayag, G. and Dyason, D. (2021). Panic Buying and Consumption Displacement during COVID-19: Evidence from New Zealand. *Economies*, 9, pp. 46.
- Headey, D. D. and Hodge, A. (2009). The effect of population growth on economic growth: A meta-regression analysis of the macroeconomic literature. *Population and Development Review*, 35, pp. 221-248.
- Huang, T. H. and Xie, Z. (2013). Population and economic growth: a simultaneous equation perspective. *Applied Economics*, 45, pp. 3820-3826.
- Immigration New Zealand (2020). Border restrictions: who can enter New Zealand or request to travel. Online version accessed April 2021, https://www.immigration.govt.nz/about-us/covid-19/border-closures-and-exceptions.
- Infometrics (2021). Quarterly economic monitor. Online version accessed May 2021, https://www.infometrics.co.nz/.
- Klimek, P., Poledna. S. and Thurner, S. (2019). Quantifying economic resilience from input–output susceptibility to improve predictions of economic growth and recovery. *Nature communications*, 10(1), pp. 1-9.
- Liu, L. S. (2017). New Chinese Immigration to New Zealand: Policies, Immigration Patterns, Mobility and Perception. *In Contemporary Chinese Diasporas*, pp. 233-259, Palgrave, Singapore, DOI:10.1007/978-981-10-5595-9_11.
- Morley, B. (2006). Causality between economic growth and immigration: An ARDL bounds testing approach. *Economics Letters*, 90, pp. 72-76.
- Munck, R. (2018). *Rethinking Global Labour*. Newcastle upon Tyne, Agenda publishing, Newcastle.

- Oliva, S. and Lazzeretti, L. (2018). Measuring the economic resilience of natural disasters: An analysis of major earthquakes in Japan. City, *Culture and Society*, 15, pp. 53-59.
- Peterson, E. W. F. (2017). The role of population in economic growth. SAGE Open, 7, DOI:10.1177/2158244017736094
- Piketty, T. (2014). *Capital in the twenty-first century*, Belknap Press of Harvard University Press, Cambridge.
- Reserve Bank of New Zealand (2021). Monetary Policy Statement May 2021. Online version accessed May 2021, https://www.rbnz.govt.nz/monetary-policy/monetary-policy-statement.
- Rose, A. and Liao, S. Y. (2005). Modeling regional economic resilience to disasters: A computable general equilibrium analysis of water service disruptions. *Journal of Regional Science*, 45, pp. 75-112.
- Sethy, S. K. and Sahoo, H. (2015). Investigating the relationship between population and economic growth: An analytical study of India. *Indian Journal of Economics & Business*, 14, pp. 269-288.
- Statistics New Zealand (2021a). Usual residence five years ago indicator (2013) by age group and sex, for the census usually resident population count, 2018 Census. Online version accessed October 2021,

http://nzdotstat.stats.govt.nz/wbos/Index.aspx?DataSetCode=TA BLECODE8326

- Statistics New Zealand (2021b). Estimated resident population 2018: Data sources and methods. Online version accessed October 2021, https://www.stats.govt.nz/methods/estimated-residentpopulation-2018-data-sources-and-methods#
- Statistics New Zealand (2021c). Regional council area of usual residence one year ago (2017) by regional council area (2018), for the census usually resident population count, 2018 Census. Online version accessed March 2021,

http://nzdotstat.stats.govt.nz/wbos/Index.aspx.

Statistics New Zealand (2021b). Linked Employer-Employee Dataset -LEED. Online version accessed March 2021, http://archive.stats.govt.nz/infoshare/.

Statistics New Zealand (2021e). Labour market statistics: June 2021 quarter. Online version accessed October 2021, https://www.stats.govt.nz/information-releases/labour-marketstatistics-june-2021-quarter.

Statistics New Zealand (2020c). Estimated migration by direction and country of citizenship, 12/16-month rule (Qrtly-

Assessing The Labour Market Response Due to COVID-19 Border Restrictions: A Case Study of Canterbury, New Zealand

Mar/Jun/Sep/Dec). Online version accessed March 2021, http://archive.stats.govt.nz/infoshare/.

- Westpac (2021). Economic & financial forecasts. Online version accessed May 2021, https://www.westpac.co.nz/wib/economicupdates/economic-and-financial-forecasts/.
- Wilson, T. (2011). A review of sub-regional population projection methods. Report to the office of economic and statistical research. Queensland centre for population research, school of geography, planning and environmental management, The et University of Queensland, Brisbane.

DO STATE BORDERS EFFECT COMMUTING FLOWS – A CASE STUDY OF THE QUEENSLAND AND NEW SOUTH WALES BORDER ALONG THE TWEED RIVER

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ABSTRACT: This paper explores the impact of State borders on commuting flows. Barriers exist when the commuting frequency at a cross-border link is below the expected level given other characteristics, such as origin and destination size and distance. Work here applies spatial interaction modelling techniques to census 2016 Journey to Work data for the SA2s of the Richmond-Tweed region of New South Wales and the Gold Coast region of Queensland. The study is particularly relevant, with border closures the instrument of choice of State leaders hoping to restrict the spread of Corona Virus Disease-2019. The analysis uncovers evidence of barriers to cross border commutes using 2016 data. This finding is surprising, given that Australian States and Territories share the same language and culture, along with a constitution prohibiting trade barriers between the states.

KEYWORDS: Commutting; journey to work; spatial interaction modelling.

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1. INTRODUCTION

National borders, or borders created by language differences, have been found to create barriers to commuters, truncating labour market flows (Olson, 2002; Persyn and Torfs, 2016). Less is known about the effect of State borders within a nation with a homogeneous language and culture like Australia, Canada or the United States (US), though Agrawal and Hoyt (2014) identify large effects on commuting times for workers in US Metropolitan Statistical Areas (MSAs) in which taxes are based on the state of residence. However, overall border effects between states Do State Borders Effect Commuting Flows – A Case Study of the Queensland and New South Wales Border Along the Tweed River

seem unlikely, or certainly less likely than in the case of national borders. In the latter case, flows are likely to be affected by language barriers, or legislation restricting access of foreign workers to employment opportunities within a foreign labour market.

The effect of State or Territory borders on commuting patterns is of interest for a number of reasons. Firstly, in the Australian context, the constitution indicates that trade between the States shall be absolutely free¹. For this reason, a finding that State borders act as a barrier will be of some interest to national policymakers. In more recent times, the impact of State borders has likely been more pronounced, with several State and Territory Governments restricting access to their territories by closing borders in an attempt to control the spread of Corona Virus Disease-2019 (COVID-19).

The focus of this paper is the possible effects of State and Territory borders on labour market flows and labour market outcomes. Commuting is an important equilibrating mechanism in the regional labour market. In a standard closed-economy labour market model, commuting reduces differences in regional labour market outcomes, such as unemployment rates and wages and brings aggregate welfare gains (Borjas, 2001).

Commuting is, however, not without cost. These costs may be directly related to commuting distance and include travel expenses or the opportunity cost of lengthy daily commutes. Additionally, there may be substantial costs when a worker commutes to a different region. Persyn and Torfs (2016) note that these costs may include factors like informational deficiencies, linguistic barriers, or a regional cultural divide. Their existence may explain the difference between the expected commuting flows between regions based on purely economic and geographic factors and observed commuting flows. The same authors note that a finding of less than expected commutes also suggests an inefficient spatial allocation of labour, implying welfare gains from policies aimed at removing these barriers. Policies which may achieve

^{- &}lt;sup>1</sup> Section 92 of the Constitution of Australia, states, '... trade, commerce, and intercourse among the States, whether by means of internal carriage or ocean navigation, shall be absolutely free.'

this, include improving information exchange related to interregional job search or adjusting the regional skill structure.

Policymakers have the authority to make policies for their own jurisdictions and a finding that a State border acts as a barrier also implies that State policy may impact on local labour market conditions while their impacts, i.e., higher or lower unemployment rates, may not be diminished through the equalising impact of increased cross border commuting (Marston, 1985). This is potentially good news when policies have detrimental effects on local economic conditions, but means that sound economic management will be penalized if no border effects exist.

While there are a number of implications of border effects, if they exist, a brief search of the regional science literature indicates a paucity of research on this topic in Australia. Thus this paper addresses an important research gap of interest for a number of different reasons. This study uses census 2016 Journey to Work flows from Statistical Area Level 2 (SA2s) within the larger SA4s of the Richmond and Tweed of Northern New South Wales and the Gold Coast of South East Queensland (QLD) to explore the effect of the New South Wales - Queensland border on commuting flows. This data is outlined in the next section, while section 3 outlines the methodology adopted to measure the impact of the border on commuting flows. Section 4 briefly outlines the methodology adopted to analyse the data and also presents the modelling results. A brief conclusion is presented in section 5.

2. DATA

All data used in this study is drawn from the 2016 Australian Bureau of Statistics (ABS) Census of Population and Housing and has been extracted using ABS table builder. It relates to the 70 SA2s within the Gold Coast and Richmond-Tweed SA4s. While these SA4s lie adjacent to each other, they straddle the New South Wales - Queensland border, with the Gold Coast north of the Tweed river in Queensland, and the Richmond-Tweed SA4 within New South Wales (NSW).

The data extracted include Journey to Work, Origin-Destination flow matrices, showing work commutes on census day, in August 2016. These have been extracted by the 1st division Australianand New Zealand Standard Classification of Occupations (ANZSCO)occupational division as well as for total employment. Besides providing details of the flows between SA2s, this data has been used to derive estimates of the size of the origin and potential destination regions (in terms of the numbers of employed people), both of which are variables frequently incorporated in

Do State Borders Effect Commuting Flows – A Case Study of the Queensland and New South Wales Border Along the Tweed River

spatial interaction models. The distance between SA2s has been calculated as the Euclidian distance, derived using the X-Y coordinates of the centroids from each pair of SA2s.

Department of Infrastructure and Regional Development (2015) notes that average commutes for Gold Coast and Tweed Heads fall in the 15-20 km band. Table 1 below presents an aggregated flow matrix for the Tweed-Richmond and Gold Coast SA4s. Across the row of this table, we see the place of work or residents from the region in question, so that the first row shows the place of work of residents of the Tweed-Richmond SA4. For this region, 78,495 or 81.4% both live and work in the region, while another 8,597 or 8.9% commute to the Gold Coast for work. Census data indicates that there were 96,431 employed persons in the Tweed-Richmond SA4 at census time 2016 while 85,786 persons worked within this region. In contrast, there were 266,906 employed persons residing in the Gold Coast SA4. Of these, census data indicates that 207,865 or 77.9% worked on the Gold Coast, while a further 5,398 (2.0%) worked in the Richmond-Tweed SA4.

Source. All's Consus of Foundation and Housing (2010).											
	Tweed SA4	Other NSW Gold	l Coast SA4	Other QLD	Other Australia	Total					
Tweed SA4	78,495	6.667	8.597	1.979	693	96.431					

580

207,865

21,678

501

5,351

49,747

6,460

1,827,847

49,022

2,178

12,569

5,129,738

3,283,595

1,869,340 5,1<u>66,355</u>

266,906

3,227,510

1,718

6,592

29,549

Other NSW

Other OLD

Total

Gold Coast SA4

Other Australia

1,132

5,398

654

107

Table 1. Census 2016 Journey to Work Flows between the Richmond-Tweed and Gold Coast SA4s.
 Source: ABS Census of Population and Housing (2016).

239,221 1,891,384 85,786 3,272,036 5,194,200 10,682,627 The difference in incomes (Income_Diff), represents the wage premia for working in a specific SA2 and is derived by first calculating the average weekly income of persons working in each SA2 (by each of the eight 1st division occupational categories along with total employment). In contrast, the difference in occupational structure between origin and destination regions (Occ Diff), is derived as the mean absolute percentage difference in employment by occupation of workers residing in the origin region, compared to the occupational structure of persons employed in potential destination regions. This variable takes the value of 0 when origin employment and potential destination region's employment

Trendle

structure is identical and increases with increasing dissimilarity in regions. *Occ_Diff* is calculated using the 135 ANZSCO 3-digit, Minor groups occupational categories. In the tables of the appendix, model results for the 1st division ANZSCO categories are presented. In the models presented in these tables, the Minor groups which form the 1st digit category are used to derive the measure of *Occ_Diff*.



Figure 1a. Quintile Map of Outflows

Figure 1b. Quintile Map of Inflows

Figure 1. Regional Inflows and Outflows. Source: ABS Census of Population and Housing (2016).

Figure 1 provides quintile maps of in- and out-flows of commuters, with each quintile comprising 14 SA2s. The maps show large out-flows of workers from regions to the west of the Gold Coast in South-East Queensland and to a lesser extent around the hinterlands of Lismore and Ballina. In contrast, Lismore and Ballina are in the highest quintile of inflows as is the Tweed Heads SA2. North of the NSW Border, SA2s in the highest quintile for inflows of commuters include those around Nerang and Helensvale.

Do State Borders Effect Commuting Flows – A Case Study of the Queensland and New South Wales Border Along the Tweed River

Details of the regional distribution of average weekly wages at Place of Usual Residence (PUR) and Place of Work (POW) can be found in Figures 2a and 2b. Figure 2a shows the average weekly income by POW. SA2s in the highest quintile tend to be clustered in the Gold Coast region, with the only SA2 in this quintile in the Tweed SA4 being Ballina. In contrast, when looking at incomes by PUR, SA2s in the highest quintile again include Ballina and a cluster of areas at the northern end of the Gold Coast (around Hope Island), and further south at Burleigh Heads and Kingscliff and Fingal Head.



Figure 2a. Quintile Map -Wage at Place of Work Figure 2b. Quintile Map -Wage at Place of Residence

Figure 2. Wages and Place of Work and Place of Residence. Source: ABS Census of Population and Housing (2016).

In the study of regional labour markets, it is generally assumed that, all else being equal, high wages make a region attractive. There is likely to be more competition for jobs, thus high wages are likely to be associated with relatively high in-commutes, all else being equal (Nowotny, 2010).

Trendle

3. METHODOLOGY

In this section, the concept of barriers, along with the potential impacts of commuting barriers on the functioning of regional labour markets are discussed. The motivation for the modelling approach adopted is also outlined. Examples of work exploring the impact of barriers to spatial interaction include Batten and Törnqvist (1990) and Nijkamp *et al.*, (1990). Barrier theory has been applied to a variety of topics. For example, the barrier concept was used in an analysis of international trade by Bröcker and Rohweder (1990) and of communication by Rietveld and Janssen (1990) and Rossera (1990). Olsson (2002) and Persyn and Torfs (2016) provide examples of labour market applications. Generally, barriers are considered to exist where some form of interaction is unexpectedly low and, or where interaction costs increase sharply (Batten and Törnqvist, 1990).

A spatial barrier in a regional labour market is recognised by a lower than expected commuting flow between two regions (SA2s in the current study). Although some interaction may exist across the barrier, most of the labour force is geographically constrained. Olsson (2002) notes that in the presence of barriers, workers look for jobs and firm workers, in spatially constrained areas. The existence of a spatial barrier makes it less likely that a worker will find the job that suits them, while employers will be less likely to find the most suitable employee. For this reason, Olson (2002) and Persyn and Torfs (2016) note that the existence of barriers will reduce both labour productivity and total production.

A simple schema for the open gravity model estimated here is presented in equation (1). In the open gravity approach, interaction (in this study commutes) depends on origin, destination, and network attributes (Persyn and Torfs, 2016). The commuting flow from one region to another depends on many things, but the sizes of the regions, and the commuting time between them, are naturally important explanatory variables.

Following Olsson (2002), the commuting data consists of the number of workers that commute from region *i* to region *j*, i.e., C_{ij} . The data provide information about the number of workers that reside in a region, *i* i.e., O_i , as well as the number of persons working in a region (SA2), *j*, i.e., E_j . Olsson (2002) notes that O_i can be interpreted as the realised labour supply in the origin region *i* and E_j as the realised labour demand (Employment) in the destination region *j*. Additional data required for spatial interaction modelling include commuting time, or distance (*D*) Do State Borders Effect Commuting Flows – A Case Study of the Queensland and New South Wales Border Along the Tweed River

between region *i* and *j*, as used in this study. In this work, only interregional commutes are analysed, i.e. $j \neq i$.

$$C_{ij} = \alpha O_i^{\beta l} E_j^{\beta 2} + \varepsilon^{-\lambda D + \varepsilon i j}$$
(1)

The larger the region of residence (measured by the number of workers living there), the larger the number of expected out-commuters. Similarly, the number of workers that commute to a region is expected to increase with the number of jobs in that region. In contrast, commuting distance is expected to have a negative impact on the number of commuters, as it is expected that the farther apart two regions are located, the fewer workers are expected to commute between them. Long commuting time makes a workplace unattractive, at least if alternatives exist.

This relationship is illustrated as the smoothly declining expected level of commuting, C_{ij} in Figure 3. In this study, a barrier is said to exist if commuting between two SA2s is lower than the expected level, i.e. lower than the level predicted by the model (without a barrier specification). If a barrier is present, the curve will shift downward at the border. The size of the shift is a measure of the size of the barrier.



Figure 3. The Barrier Effect on Commuting. Source: Author's Calculations.

The second version of the open gravity model used in the analysis is introduced in equation (2). The barrier dummy B_{ij} is set to one if the commuter flow passes a border, and zero if not.

Trendle

$$C_{ii} = \alpha O_i^{\beta I} E_i^{\beta 2} + \varepsilon^{-\lambda (Dij + \gamma Bij) + \varepsilon ij}$$
(2)

In this specification, the estimated barrier parameter, γ , provides a way of representing and measuring the barrier effect. This formulation renders a barrier parameter expressed in the commuting distance dimension. Olsson (2002) notes that there are likely many causes for low interaction, such as the established choice and search behaviour, newspaper circulation resulting in information loss outside the circulation region and so on. The same author also notes that removal of the barrier (or barriers) is expected to generate a proportional increase in commuting, equal to $\varepsilon^{\lambda\gamma}$ -1, since:

$$(\overline{C}_{ij} \mid B_{ij} = 0) / (\overline{C}_{ij} \mid B_{ij} = 1) = e^{\lambda \gamma}$$
⁽³⁾

In other words, $\delta = \lambda \gamma$ is also an estimate of the effect of the barrier.

4. ESTIMATION

A number of alternative approaches have been developed to estimate gravity models. For example, a log-linearized version of the gravity equation (2) could be estimated by OLS. However, Silva and Tenreyro (2006) note that this approach has at least two limitations: first, in the presence of heteroskedasticity, log-linear transformations will result in the error term becoming correlated with the covariates. Second, by log-transforming equations 1 and 2, all observations with a commuter flow equal to zero are dropped from the analysis. This is the case for between 43% of our sample using total employment. Furthermore, this type of censoring may result in sample selection bias (Wölwer *et al.*, 2018).

To overcome these issues, this study treats commuter flows as count data. Count models explicitly allow for zero as a possible outcome and do not suffer from bias in the presence of heteroskedasticity (a situation where the residual of the estimated relationship displays unequal variability (scatter) across the dataset). Initial modelling indicated that overdispersion was a significant problem in models estimated using the Poisson distribution (variation was higher than expected). Test results for overdispersion from the Poisson versions of all models are included in all regression diagnostics. To address this issue, the study first used a negative binomial model that allowed the variation of the count variable to exceed its mean (overdispersion). However, additional diagnostics, specifically the Voung-test results (Voung, 1989), indicated that with the data used in this analysis, the zero-inflated version of the negative binomial model was the most appropriate approach to use and only results derived using this estimation technique are presented in the following tables. The authors note that this approach does not address the potential problems that may be caused by the existence of spatial autocorrelation (the presence of systematic spatial variation in the residuals of the estimated equations), however, it is also recognised that software to estimate count data models with both excessive zeros and spatial autocorrelation is not readily available.

Table 2 provides results from three models applied to Total employment. Model 1, in the first two columns is the base model. In this version of the model, there is no dummy variable included to capture the impact of cross-border flows. In contrast, columns 3 and 4 provide estimation results of Model 2, which includes a single dummy variable (*Cross_State_DV*), which takes the value of 0 when the flow is within the same state as the origin SA2 and 1 if the flow crosses a state border. The final two columns present the results of model 3. In this version of the model, two cross-border dummy variables are included, the first (*NSW_QLD_DV*) takes the value of 1 if the flow is from NSW to QLD and 0 otherwise, the second (*QLD_NSW_DV*) takes the value 1 if the flow is from QLD to NSW and 0 otherwise.

Details in the lower panel of Table 2 provide model diagnostics and summary information. Data here indicates that 4,830 observations were used in model estimation, with only the flows within each SA2 being dropped. The use of the count data approach to estimate the models means that an additional 2,075 zero flows are incorporated in the model for total employment. The overdispersion test statistics (which ranges from a high of 59.491 in model 1 to a low of 48.443 in model 2) is highly significant at normal levels in all models. This supports the use of the negative binomial version of the count data model applied here rather than the Poisson version. The Voung-statistic is also highly significant in all three models (as indicated by the extremely low p-values), suggesting that the data accessed here favours the application of the zero-inflated version of the model.

The middle panel of Table 2, with the title, *Zero-inflation model coefficients*, presents the models the probability of membership to each group, i.e. flows with a zero or non-zero value. In all three versions of the model, all three included coefficients are significant. Further, in all models the coefficients for Ln_Origin and Ln_Dest , the natural logs of the sizes of the origin and destination SA2 respectively, are negative, indicating that the larger are origin and destination size, the less likely the

Trendle

flow is to be a zero flow. In contrast, the coefficient estimates of Ln_Dist , the distance between origin and destination SA2s, is positive in all three versions of the model, indicating that the probability of a zero flow between origin and destination regions increases with the distance between SA2s.

Table 2. Model Estimation Results, Total Employment. Source: ABS Census of Population and Housing (2016) and Author's Calculations.

	Model 1		Mode	Model 2		Model 3						
Negative binomial model explaining flows from origin to destination SA2s												
(Intercept)	-6.869	0.000	-6.798	0.000	-6.911	0.000						
ln_Origin	0.804	0.000	0.803	0.000	0.800	0.000						
ln_Dest	0.765	0.000	0.755	0.000	0.770	0.000						
ln_Dist	-0.829	0.000	-0.785	0.000	-0.780	0.000						
Inc_diff	-0.396	0.002	-0.411	0.001	-0.499	0.000						
Occ_diff	1.748	0.000	1.600	0.000	1.558	0.000						
Cross_State_DV			-0.725	0.000								
NSW_QLD_DV					-0.880	0.000						
QLD_NSW_DV					-0.528	0.000						
Log(theta)	0.103	0.001	0.144	0.000	0.156	0.000						
Zero-inflation model coefficients (binomial with Logit link)												
(Intercept)	4.215	0.000	4.415	0.000	4.260	0.000						
ln_Origin	-1.112	0.000	-1.108	0.000	-1.096	0.000						
ln_Dest	-0.937	0.000	-0.954	0.000	-0.937	0.000						
ln_Dist	3.399	0.000	3.364	0.000	3.345	0.000						
No. Obs	4,830		4,830		4,830							
No. zeros	2,075		2,075		2,075							
% 0's	43%		43%		43%							
Function evaluations												
Number of iterations in BFGS optimization	1		1		1							
Log-likelihood (13 df)	-14,880		-14,780		-14,780							
Df	11		12		13							
Voung statistic (AIC)	24.866		20.608		20.473							
p-value	0.000		0.000		0.000							
Overdispersion test	59.491		48.443		48.467							
p-value	0.000		0.000		0.000							

Do State Borders Effect Commuting Flows – A Case Study of the Queensland and New South Wales Border Along the Tweed River

Turning to the coefficient estimates of the negative binomial model explaining commuting flows presented in the top panel of Table 2, the results are unsurprising in most instances. The coefficient of the natural log of the number of jobs in the Origin region (Ln_Origin) and the natural log of the number of jobs in the Destination region (Ln_Dest) are both positive in all three models presented in Table 2. This is a common finding in spatial interaction modelling. Flows from larger regions are larger, while flows to large employing regions are also larger. There are no surprises with this result.

In this type of analysis, distance is generally interpreted as a deterrent, suggesting that greater distances are associated with a lower volume of commutes. This is consistent with the parameter estimates from the three versions of the model presented here. In all cases, distance is highly significant (low p-value of the z-statistic) and the estimate is negative, indicating that as distance increases, the magnitude of flows declines. Interestingly, as we step from model 1 to model 2 to model 3, we see marginal declines in the absolute size of the parameter estimate for Ln_Dist , suggesting that excluding the effect of the border, via the dummy variables, results in an over-estimate of the deterrent effect of distance.

Further, the estimates of *Inc_diff* (the income difference) and the *Occ_diff*, (the difference in occupation structure between the origin and destination region) are as expected. For *Inc_diff*, which is derived as the income of the origin region, less the income of the destination region, a negative sign is expected, suggesting that workers are attracted to regions with incomes above that of their home region. This idea is supported by the coefficient estimates from all three versions of the model presented in Table 2, with all versions yielding a negative and statistically significant estimate of *Inc_diff*.

The value of *Occ_Diff* (the mean absolute percentage difference in occupational structures of workers residing in a region, compared to the occupational structure persons working in potential destination regions), runs from 0 for regions where the occupational structure of the workforce of an origin region is identical to that of a destination region, to 1 for regions with the most different occupation structure. The positive coefficient is a little surprising, flows are to SA2s that are more different in occupational structure. This outcome might be occurring because workers leaving a region are not representative of the region and for this reason, are less likely to find work in the place of residence and more likely to commute out of the SA2.

Trendle

The next three coefficient estimates refer to the dummy variables included to capture the effect of cross-border flows. Perhaps surprisingly, in all instances, these coefficient estimates are statistically significant and negative. This result indicates that the NSW-QLD border acts as a deterrent to commuting flows.

Following the discussion around equations (2) and (3) in section 3, the impact of the border can be calculated as $\delta = \lambda \gamma$, where $\gamma =$ estimated parameter of border dummy and $\lambda =$ the parameter estimate for distance. For the second model, the results indicate that the removal of the border effect will increase commuting flows by 56.9% for Total employment, while in model 3, the removal of the border effect will see flows form NSW to QLD increase by 68.6% and flows from QLD to NSW increase by 41.2%. These estimates seem unreasonably high and might be better interpreted as evidence of some significant impediments to cross-border commutes at the NSW-QLD border.

A possible approach to allow the derivation of more reasonable estimates of the impact of the border might be to disaggregate total employment and instead, estimate separate models for each first division ANZSCO occupational category. The results of adopting this strategy for models 2 and 3 are presented in Tables A1 and A2, respectively in the appendix. While there is some variability in the model results when comparing the models for the individual occupations to the models for total employment, it is noted that the state dummy variables are negative in all models, while the coefficient estimates for Ln Origin, the natural log of the number employed in the origin region, *Ln_Dest*, the natural log of the number employed in the destination region and Ln_Dist, the natural log of the distance between the origin and destination regions are also the same sign in all models. For the version of the model with only 1 state dummy variable (model 2) for the individual ANZSCO occupations, 68.7% of the signs of the estimated coefficients are the same as in the model for total employment. This increases to 78.6% for the model that has cross border flows disaggregated according to the direction of the flow (model 3).

Figure 4 presents the estimated effects of the removal of the cross-state border effects by individual occupation derived from the models in Table A1. This effect is estimated for all flows, i.e., they are not dependent on the direction of the flows (equivalent to model 2 of Table 2). While the estimate of the impact of removing the border on commutes is a 56.9% increase in cross-border commutes in the model for Total employment, the average estimate across the eight individual occupations is only

Do State Borders Effect Commuting Flows – A Case Study of the Queensland and New South Wales Border Along the Tweed River





Figure 4. Proportional Effect of Removal of Border - by Occupation. Source: ABS Census of Population and Housing (2016).



Figure 5. Proportional Effect of Removal of Border - Two Way Flows. Source: ABS Census of Population and Housing (2016).

Trendle

Figure 5 graphically presents estimates of the effect of the removal of the border for individual occupations from model 3 (presented in Table A2 of the appendix). The model results presented in this figure indicate that on average, flows from QLD to NSW would increase by an average of 34.9% with the removal of the impediment associated with the state border, while flows from NSW to QLD would increase by an average of 18.8%. For all occupations, the removal of the effect of the state border would be greater for QLD commuters.

5. CONCLUSION

In this study, three versions of a model explaining commutes between the SA2s within the SA4s of the Richmond-Tweed and Gold Coast SA4s have been estimated. These models move from a simple model that does not incorporate a border effect (Model 1 of Table 2). This is extended to a model having a single dummy variable to capture the effect of the state border on commutes (Model 2). Finally, a model with two dummy variables to determine if the state border has different effects on commutes from NSW to QLD and QLD to NSW (Model 3) is estimated.

The results are surprising on three counts. First, the model estimates yield many parameter estimates of the expected sign. These signs are consistent across all versions of the model and across the models of individual occupational categories. For example, Ln_Dist , the natural log of straight line distance between each pair of SA2s, is negative and significant in every version of the model. This is a common finding in spatial interaction models (Lourens *et al.*, 2020; Persyn and Torfs, 2016). A similar result holds for Ln_Origin and Ln_Dest , the natural log of employment size of the origin and destination regions respectively. These variables have positive and significant parameter estimates in all versions of the model.

The second surprising result is that the state border is found to have an effect on cross-border commutes. This is surprising because the homogeneity of language and culture throughout much of Australia naturally leads to the conclusion that state borders should have no effect. However, this does not seem to be the case for the NSW-QLD border at the Tweed. Finally, the effect of the border does not appear to vary systematically by occupation or skill level. There is no trend in the estimated impacts of removing the borders as we move from Managers through to the less skilled Labourers occupational category (see Figure 3). However, the border effect uncovered in this work is found to have
Do State Borders Effect Commuting Flows – A Case Study of the Queensland and New South Wales Border Along the Tweed River

more of an impact for QLD workers commuting into NSW than it does for NSW workers travelling north.

The reason for the results uncovered are unclear, particularly given that parts of the border run through an urban area in the Tweed-Coolangatta SA2s, where the state border runs down an urban thoroughfare. A number of factors may be at play. First, it may not so much be the border as geography that is producing the finding. In some situations, straight-line distances may be a poor proxy for the cost of commutes. In the current situation, the Tweed river, Border ranges, river valleys which are prone to flooding and the layout of the road network, all act to constrain commutes in the study area. However, the study area itself is a predominantly narrow north-south band compressed between the Pacific Ocean and the Great Dividing Range. This suggests that straight line distance should provide a reasonable approximation and it is difficult to see that the use of road network information will alter the findings by much. And if a decision is made to use road network information, then decisions must also be made about which point (settlement) in each SA2 the distances are measured between.

Further, the effect of the recent border closures remains to be seen. It is likely that interstate commutes in both directions have been reduced, with the introduction of border passes by the Queensland government along with the occasional closing of the border, acting to lengthen the duration of commutes and reduce the incentive to cross the border for employment. This extra 'cost' of commuting (longer durations) due to regulations introduced during a health crisis, may have effects that take some time to work through. Whether this has had a greater effect on NSW commuters travelling to QLD, or Queenslanders working in the Tweed is uncertain. However, there is likely to be some detrimental impact on commutes in both directions and in a recent study of the NSW-Victorian border closures, Spennemann (2021) noted short term impacts on workers from local communities, while Bernard *et al.*, (2020) noted that the impacts on internal migration of border closures are expected to be short-lived.

It might be thought that this result augers well for regional labour market policy in south-east QLD and northern NSW. With the border acting as an impediment to commuting flows, commuting may not have the equalizing effect expected in regional labour market theory (Marston, 1985). In this case, policies aimed at improving local labour market conditions in South-East QLD, for example, may not be washed away by in-commutes from northern NSW and vice-versa. In this situation, labour market programs may be effective in reducing unemployment in these two regional labour markets.

This finding needs to be tempered by the conclusion that missing interregional commuting suggests an inefficient spatial allocation of labour, implying that welfare gains can be obtained by removing these barriers (Borjas, 2001; Persyn and Torfs, 2016). These policies may comprise the improvement of information exchange related to assist in regional job search, adjustments to regional skill structure and improvements in the ease of commuting through infrastructure investments. Put simply, these impacts will occur on both sides of the border, with lower unemployment rates in one region attracting labour from the other, improving job matching, raising the productivity of firms, easing skill shortages and reducing inflationary pressures resulting from a constrained labour market with commutes supplementing the local labour supply.

REFERENCES

- Agrawal, D. and Hoyt W. (2014). State tax differentials, cross-border commuting, and commuting times in multi-state metropolitan areas. CESifo Working Paper Series 4852, CESifo. Online version accessed October 2021, https://aysps.gsu.edu/files/2016/11/AgrawalHoyt.pdf
- Batten, D. F. and Törnqvist, G. (1990). Multilevel network barriers: the methodological challenge. *The Annals of Regional Science*, 24, pp. 271-287.
- Bernard, A., Charles-Edwards E, Alvarez, M., Wohland, P., Loginova, J, and Kalemba S. (2002). Anticipating the impact of Covid-19 on Internal migration. Centre for Population Research Paper, The Australian Government, Canberra.
- Borjas, G. J. (2001). Does immigration grease the wheels of the labor market?. *Brookings Papers on Economic Activity*, 2001, pp. 69-133.
- Bröcker and Rohweder (1990). Barriers to International Trade, Methods of Measurement and Empirical Evidence. *Annals of Regional Science*, 24, pp. 289-305.
- Department of Infrastructure and Regional Development (2015). Australia's commuting distance: cities and regions. Department of Infrastructure and Regional Development. Online version accessed October 2021,

https://www.bitre.gov.au/sites/default/files/is_073.pdf.

Do State Borders Effect Commuting Flows – A Case Study of the Queensland and New South Wales Border Along the Tweed River

- Broersma L., Edzes A. and van Dijk J. (2020). Commuting Between Border Regions in The Netherlands, Germany and Belgium: An Explanatory Model. *Journal of Borderlands Studies*, DOI:10.1080/08865655.2020.1810590.
- Marston, S. T. (1985). Two views of the geographical distribution of unemployment. *Quarterly Journal of Economics*, 100, pp. 57-79.
- Nijkamp, P., Rietveld, P. and Salomon, I. (1990). Barriers in spatial interactions and communications A conceptual exploration. *The Annals of Regional Science*, 24, pp. 237-252.
- Nowotny, K. (2010). Commuting, Residence and Workplace Location Attractiveness and Local Public Goods. *Working paper no. 359, Austrian Institute of Economic Research* (WIFO), Vienna, DOI:http://hdl.handle.net/10419/128896.
- Olsson, M. (2002). Chapter 5, Spatial Barriers in Labour Market Commuting. In Olsson, M. *Studies of Commuting and Labour Market Integration*, Jönköping International Business School, Jönköping University.
- Persyn, D. and Torfs, W. (2016). A gravity equation for commuting with application to estimating regional border effects in Belgium. *Journal of Economic Geography*, 16, pp. 155-175.
- Rietveld, P. and Janssen, L. (1990). Telephone Calls and Communication Barriers, The Case of the Netherlands. *Annals of Regional Science*, 24, pp. 307-318.
- Rossera, F. (1990). Discontinuities and Barriers in Communications, The Case of Swiss Communities of Different Language. *Annals of Regional Science*, 24, pp. 319-336.
- Santos Silva, J. M. C. and Tenreyro, S. (2006). The Log of Gravity. *The Review of Economics and Statistics*, 88, pp. 641-658.
- Spennemann, D. (2021). "No Entry into New South Wales": COVID-19 and the Historic and Contemporary Trajectories of the Effects of Border Closures on an Australian Cross-Border Community. *Land*, 10, p. 610, DOI: 10.3390/land10060610.
- Vuong, Q. H. (1989). Likelihood ratio tests for model selection and nonnested hypotheses. *Econometrica*, 57, pp. 307-333.
- Wolwer, A., Burgard, J. and Breßlein, M. (2018). Gravity models in R. *Austrian Journal of Statistics*, 47, pp. 16-38.

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APPENDIX

Table A1. Parameter Estimates and Goodness of Fit Statistics ofNegative Binomial Version of Model with Cross-Border Dummy. Source:ABS Census of Population and Housing (2016) and Author's Calculations.

	Managers	Profession als	Tech & trade workers	Communit y service workers	Clerical workers	Sales workers	Mach op	Labourers
Count model coefficients								
Intercept	-4.253	-1.731	-4.507	-3.130	-3.580	-2.197	-2.163	0.052
	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.738
Ln_Dist	-0.506	-0.443	-0.460	-0.551	-0.462	-0.586	-0.351	-0.573
	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Ln_Origin	0.581	0.404	0.579	0.503	0.451	0.330	0.492	0.483
	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Ln_Des	0.726	0.516	0.764	0.653	0.732	0.685	0.540	0.302
	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Inc_Diff	0.314	-0.244	0.427	0.080	0.902	0.226	0.181	-0.132
	0.000	0.000	0.018	0.572	0.000	0.009	0.144	0.214
Occ_Diff	-0.430	2.558	-0.893	-0.257	-0.964	-1.078	-0.634	0.384
	0.164	0.000	0.001	0.362	0.000	0.009	0.179	0.313
Cross border_DV	-0.372	-0.618	-0.470	-0.556	-0.499	-0.523	-0.448	-0.453
	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Log (Theta)	1.154	0.138	1.093	0.859	0.921	0.715	1.241	0.632
	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000
Zero-inflation model coef	<u>ficients</u>							
Intercept	11.325	-0.854	9.779	5.218	8.794	6.644	5.448	0.503
	0.000	0.131	0.000	0.000	0.000	0.000	0.000	0.137
ln_Origin	-1.407	-0.685	-1.402	-1.078	-1.215	-0.916	-0.971	-1.037
	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Ln_Dest	-2.088	-0.479	-1.736	-1.300	-1.707	-1.540	-1.356	-0.862
	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
ln_Dest	3.032	2.308	2.793	2.922	2.861	2.702	2.184	2.803
	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

	Managers	Profession als	Tech & trade workers	Communit y service workers	Clerical workers	Sales workers	Mach op	Labourers
Theta	3.170	1.148	2.982	2.360	2.512	2.045	3.458	1.8805
No. Obs	4,830	4,830	4,830	4,830	4,830	4,830	4,830	4,830
No. zeros	3,078	2,739	2,925	3,068	3,100	3,280	3,853	3,304
% 0's	63.7%	56.7%	60.6%	63.5%	64.2%	67.9%	79.8%	68.4%
<i>Function evaluations</i> Number of iterations in								
BFGS optimization:	1	1	1	1	1	1	1	1
Log-likelihood (12 df)	-6,984	-9,577	-7,669	-7,403	-7,236	-6,713	-4,113	-6,555
Voung statistic (AIC)	25.281	26.784	25.213	23.414	24.152	22.764	20.553	21.940
p-value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Overdispersion test	54.879	63.219	47.224	48.628	27.121	43.4823	59.1445	60.2844

Do State Borders Effect Commuting Flows – A Case Study of the Queensland and New South Wales Border Along the Tweed River

	Managers	Professiona ls	Tech & trade workers	Community service workers	Clerical workers	Sales workers	Mach op	Labourers
Count model coefficients								
Intercept	-4.271	-1.687	-4.521	-3.092	-3.598	-2.185	-2.135	0.083
	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.589
Ln_Dist	-0.506	-0.450	-0.461	-0.553	-0.461	-0.584	-0.359	-0.581
	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Ln_Origin	0.582	0.396	0.574	0.498	0.451	0.327	0.485	0.471
	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Ln_Dest	0.729	0.522	0.772	0.654	0.735	0.686	0.545	0.313
	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Inc_Diff	0.289	-0.261	0.290	0.112	0.876	0.203	0.156	-0.124
	0.001	0.000	0.122	0.431	0.000	0.021	0.210	0.247
Occ_Diff	-0.472	2.361	-0.939	-0.316	-0.982	-1.124	-0.734	0.199
	0.127	0.000	0.001	0.261	0.000	0.007	0.121	0.600
NSW_QLD_DV	-0.308	-0.513	-0.371	-0.435	-0.458	-0.439	-0.307	-0.219
	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.020
QLD_NSW_DV	-0.466	-0.777	-0.660	-0.762	-0.555	-0.628	-0.749	-1.015
	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Log (Theta)	1.153	0.137	-0.371	-0.435	-0.458	-0.439	-0.307	-0.219
	0.000	0.001	0.000	0.000	0.000	0.000	0.002	0.020
Zero-inflation model coe	<u>fficients</u>							
Intercept	11.323	-0.808	9.792	5.248	8.799	6.660	5.452	0.558
	0.000	0.154	0.000	0.000	0.000	0.000	0.000	0.101
ln_Origin	-1.407	-0.692	-1.404	-1.081	-1.215	-0.919	-0.967	-1.037
	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Ln_Dest	-2.086	-0.476	-1.735	-1.300	-1.707	-1.539	-1.355	-0.865
	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
ln_Dest	3.029	2.301	2.789	2.917	2.860	2.701	2.172	2.781
	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Theta	3.169	1.146	2.981	2.362	2.511	2.048	3.437	1.879

Table A2. Parameter Estimates and Goodness of Fit Statistics of Negative Binomial Model with 2 Cross Border Dummy Variables. Source: ABS Census of Population and Housing (2016) and Author's Calculations.

	Managers	Professiona ls	Tech & trade workers	Community service workers	Clerical workers	Sales workers	Mach op	Labourers
No. Obs	4,830	4,830	4,830	4,830	4,830	4,830	4,830	4,830
No. zeros	3,078	2,739	2,925	3,068	3,100	3,280	3,853	3,304
% 0's	63.7%	56.7%	60.6%	63.5%	64.2%	67.9%	79.8%	68.4%
Function evaluations								
Number of iterations in BFGS optimization	1	1	1	1	1	1	1	1
Log-likelihood (13 df)	-6,983	-9,575	-7,665	-7,399	-7,236	-6,712	-4,110	-6,543
Voung statistic (AIC)	30.774	28.247	25.072	23.334	24.135	22.823	20.536	22.115
p-value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Overdispersion test	55.275	63.234	47.338	48.550	27.216	43.5388	59.363	60.089

Do State Borders Effect Commuting Flows – A Case Study of the Queensland and New South Wales Border Along the Tweed River

HOW DO POLICYMAKERS DEAL WITH CLIMATE CHANGE? - THE CASE STUDY OF THE MALDIVES

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398

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ABSTRACT: The Maldives lies in two rows of atolls in the Indian Ocean, just across the equator. It has a history of monarchical political systems built on undemocratic constitutional rules that have evolved over eight centuries (1153-1953) of recorded history. It established its first-ever democratic constitution in 2008. For politicians and environmentalists around the world, the Maldives is perhaps better known as islands drowning with the rising sea levels as a result of global warming. Since climate change is a cross-cutting development issue and affects every aspect of the Maldivian way of life and livelihoods, the Maldivian government attempted to address vulnerable sectors and defined several strategies that could prevent the country from the negative effects of climate change and sea level rise. In order to reach the mentioned goal, considering stakeholders' interaction is a key strategy in research and policy-making on climate change adaptation. Stakeholders are variously characterized as authorities, evaluators, watchdogs, local communities, etc. The government as a stakeholder and especially the president of the republic as the head of state who has a major role in decision-making on climate change will be considered in this article.

KEYWORDS: Climate change; Maldives; policy.

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1. INTRODUCTION

Global mean sea level has risen about 8–9 inches since 1880, with about a third of that coming in just the last two and a half decades. The rising water level is mostly due to a combination of meltwater from glaciers and ice sheets and the thermal expansion of seawater as it warms.

In urban settings along coastlines around the world, rising seas threaten the infrastructure necessary for local jobs and regional industries. Roads, bridges, subways, water supplies, oil and gas wells, power plants, sewage treatment plants, landfills, etc. They are all at risk from sea-level rise (SLR) (Lindsey, 2021).

Predicted SLR caused by anthropogenic climate change threatens to drastically alter coastlines around the world. In the case of low-lying atoll states, it threatens to expunge them from the map (Armstrong and Corbett, 2021).

The emergence of climate change as a major issue of global concern since the 1980s has led to the accumulation of a vast amount of academic and policy-relevant research attempting to demonstrate, understand, and address the likely effects of climate change on human development (Intergovernmental Panel on Climate Change (IPCC) 2007) (Morrissey, 2009).

SLR has the potential to threaten the very existence of low-lying atoll nations such as the Maldives. Accordingly, the government of the Maldives is responsible to define the vulnerable sectors and create effective policies to mitigate the detrimental effects of climate change. This article will focus on the role of policymakers, especially the government and the president of the Republic of the Maldives who deal with climate change.

2. GEOGRAPHY AND MORPHOLOGY OF THE MALDIVES

The Maldives lies in two rows of atolls in the Indian Ocean, just across the equator. The country is made up of about 1,190 coral islands formed around 26 natural ring-like atolls, spread over 90,000 square kilometers. These atoll structures are formed upon a sharp ridge rising from the ocean, thereby creating their worldwide uniqueness (Embassy of Maldives-Brussels, 2021).

Not all islands are inhabited. In fact, only about 200 islands are inhabited. The rest are used for various activities the most important of which is tourism.

For politicians and environmentalists around the world, the Maldives is perhaps better known as islands drowning with the rising sea levels as a result of global warming. For reef scientists, the Maldives is known as one of the wonders of the world in terms of biodiversity, marine life, and reef formations. The peculiarity of Maldivian atolls and their unique formation was so intriguing that early reef scientists and geographers decided to borrow the Maldivian term "*atholhu*" which is now used as "*atoll*" in the English language. (Embassy of the Maldives, 2021)

3. THE GOVERNMENT AND POLITICAL SYSTEM IN MALDIVES

The Maldives has a history of monarchical political systems built on undemocratic constitutional rules that have evolved over eight centuries (1153-1953) of recorded history. The Maldives only established its firstever democratic constitution in 2008." Using conceptions of historical institutionalism, it is argued that this new constitutional system acquired both democratic institutions and traditionally-transmitted undemocratic norms of political behavior.

The successful efforts of the government to adopt a democratic constitution and hold a multi-party election by the end of 2008 increased the government's legitimacy and credibility within the international community (Rasheed, 2012).

Currently, the government of the Maldives has three branches including executive, judicial and legislative which can be considered as the main powers.

Executive: The president is the head of state and government, and he is the commander-in-chief of the Maldives National Defense Force. The president is elected by absolute majority vote through a two-round system.

Judicial: The Constitutional Court is the highest court in the country when it comes to the interpretation, protection, and enforcement of the Constitution. Judges are appointed by the president in consultation with the Judicial Service Commission, and upon confirmation by voting members of the People's Majlis.

Legislative: The People's Majlis has the authority to enact, amend, and revise laws aside from the constitution. 77 members are elected by plurality vote in single-member constituencies (Global Edge, 2021).

4. POLITICAL ATTITUDES TOWARDS CLIMATE CHANGE

We can track down the initiation of the policy formulation process by the governance of president Maumoon Abdul Gayoom (Ministry of Housing and Urban Development, 2008). He was approved as president in a referendum on September 30, 1978, and he was inaugurated on November 11, 1978 (University of Central Arkansas, 2013).

It is not clear how was his attitude toward climate change and SLR Because climate change and the related topics were not so trendy, and they were not assumed as an imminent hazard during the early ages of his presidency. Just in the last years of his presidency, he had several interviews and speeches in which he underlined the importance of climate change. In 2007, in an interview with Reuters, Gayoom said "If climate change continues unchecked, local mitigation measures will not be sufficient to safeguard my people" (Gardner, 2007).

A few months later, confronting the climate crisis became Nasheed's key device for fulfilling the promise of a new democratic politics and His rise to the presidency in 2008. Nasheed was preparing to relocate the nation to India, Sri Lanka, or Australia. "We can do nothing to stop climate change on our own", he announced, "so we have to buy land elsewhere". Four months later, he would unveil his plan to make the Maldives the world's first carbon-neutral state. Nasheed complemented his language of neoliberal technocracy with the language of war. The fight against climate change had to be a world war effort. On February 8, 2012, internal tensions came to a head. Nasheed resigned in the wake of mass protest and mounting political violence, in what he called a "coup" (Hirsch, 2015).

In 2015, during the presidency of Abdulla Yameen Abdul Gayoom, the ministry of environment and energy published "the Maldives climate change policy framework". The framework was developed through consultation with representatives of the general public, government institutions, the private sector, non-governmental organizations, and other parties, as well as an extensive array of stakeholders, in order to take into account a wide variety of relevant objective facts, knowledge, and opinions as possible (Ministry of Environment and Energy, 2015). Three years later, Yameen was defeated by joint opposition candidate Ibrahim Mohammed Solih in the 2018 presidential election (British Broadcasting Company, 2018).

In 2019 President Ibrahim Mohamed Solih became the first Maldivian head of state to speak at the United Nations, "While the scientific evidence is irrefutable, there has been an alarming lack of global action. According to the Intergovernmental Panel on Climate Change, if the mean temperatures continue to rise above the two degrees threshold we will be faced with a point of no return. While the Paris Agreement on Climate Change was a breakthrough for what we could collectively achieve, so much more needs to be done" he said (Maldives Independent, 2019).

Despite the dissension between the parties and politicians, there is consistency in policy regarding the imminent danger of climate change and SLR. Apparently, they realized the imminent hazard and they show their will to provide an effective solution. Regularly, the politicians have different ways to deal with climate change and different political interests clearly play a role in how environmental narratives are produced, circulated, and interpreted. Specifically, the risks of climate change to the Maldives are being emphasized to justify resettlement policies (Kothari, 2014).

5. CLIMATE CHANGE AND THE MALDIVIAN GOVERNMENT

Table 1. Climate Change Vulnerabilities of the Maldives. Source: Ministry of

 Environment and Energy (2015).

SECTOR	VULNERABILITY
COASTAL ZONE MANAGEMENT	 Over 80% of the total land area of the Maldives is less than 1 m above mean sea level. Approximately 44% of the settlement footprints of all islands are within 100 m of the coastline More than 50% of the housing structures in 121 islands are within 100 m of the coastline More than 67% of inhabited islands reported beach erosion in 2013 at different scales and of different severity. The adaptation measures to mitigate erosion in the islands, due to its lack of planning and poor design have lead to increased maladaptation countrywide
CRITICAL INFRASTRUCTURE	 The infrastructure of the four international airports are within 50 m of the coastline. More than 90% of all resort infrastructure and 99% of all tourist accommodation are within 100 m of the coastline Approximately 70% of all fisheries infrastructure is within 100 m of the coastline Utility facilities including most powerhouse and waste facilities are located within 100 m of the coastline. More than 75% of communications infrastructures are located within 100 m of the coastline
TOURISM	 Nearly 45% of tourist resorts have reported varying degrees of beach erosion. Rise in tempreature leads to coral bleaching, loss of beach, saltwater intrusion and loss of tropical vegetation. Maldivian tourism product is based on sea, sand and sun. Adverse impacts on climate variability will have negative consequences to the tourism industry.
FISHERIES	 During the 1997/1998 El Niño event the Indian Ocean purse seine fishery shifted to the east, unlike other years, owing to the elevated depth of the 20°C isotherm Over the last few years ocean temperature changes has lead to the transformation of the biophysical conditions of the pelagic environment, resulting in decreased tuna catch in the islands.
HUMAN HEALTH	 Changes in temperature and rainfall regimes are causing higher incidence of vector-borne diseases. There is evidence that dengue outbreaks are becoming more frequent and it appears that there is an association with El Niño Southern Oscilation events. The vulnerability to climate change-related health risks is further compounded by local characteristics such as the level of malnutrition in children, accessibility and quality of healthcare, high population congestion and low income levels Climate change-related impacts on fisheries and agriculture threaten food security in the Maldives. Such impacts will have a direct effect on the nutrition status of children and overall health of the population.
WATER	 Rainwater is the main source of potable water in the outer islands. After the 2004 Indian Ocean Tsunami, there is observed increased demand of bottled water as drinking water, mainly associated with groundwater contamination and reduced precipitation. 7 out of 196 inhabited islands including Capital Male' have access to piped desalinated water.
AGRICULTURE AND FOOD SECURITY	 The total cultivable land area is estimated at 27 km2, including 18 km2 on inhabited islands and 9 km2 on uninhabited islands The agriculture sector is constrained by the limited availability of cultivable land, poor quality of soil and the abundance of cheap imports of vegetables and fruits Due to the high import dependency, the food security of Maldives is vulnerable to climate change-related impacts on the agriculture of other countries Heavy import dependency, limited food storage and ad hoc distribution also pose severe food security risk to the population. The Maldives imports almost all food items except fresh tuna and coconut. Long-term and emergency food storage is virtually absent except for warehousing in Male' and nine other islands

How do Policymakers Deal with Climate Change? - The Case Study of the Maldives

Local governments face a number of issues when planning for future SLR. SLR may accelerate the erosion of coastal margins, threatening land and property (Walsh, 2004).

Since climate change is a cross-cutting development issue and affects every aspect of the Maldivian way of life and livelihoods, the Maldivian government attempted to address vulnerable sectors. Therefore, the ministry of environment and energy published "the climate change policy framework" (Table1) (Ministry of Environment and Energy, 2015).

The government also defined several strategies that could prevent the country from the negative effects of climate change and SLR. According to the strategic framework, there are two parts including the strategic components and the building blocks that would potentially result in the sustainability of the Maldives (Figure 1).



Figure 1. The Strategic Framework. Source: Ministry of Environment and Energy (2015).

The strategic components encompass the following:

Low emission development: To help to achieve stabilization of greenhouse gases concentrations in the atmosphere.

403

Adaptations and opportunities: Natural ecosystem adaptation to climate change, to ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner.

Obligation and commitments: Meeting international obligations and commitments.

The building blocks consist of technology transfer, finance and capacity development which are essential for the implementation of the framework.

Aims of the Framework

The framework has several goals including:

-Foster and guide a national plan of action to address current, short-, medium-, and long-term effects of climate change.

-Set out the strategic priorities for scaling up the commitments of the government to respond to the adverse impacts of climate change.

-Promote a coordinated approach amongst all national stakeholders to strengthen the capacity of Maldives to reduce current and projected climate change impacts and risks such as the risks of loss of land and life, and damage to the environment and property.

-Build and strengthen existing policies, plans, and institutional structures and incorporate those into every sector's development and implementation plans for addressing climate change issues (Ministry of Environment and Energy, 2015).

In order to reach the mentioned goals, considering stakeholder interaction is a key strategy in research and policy-making on climate change adaptation. Thus, engaging stakeholders in research or other projects on adaptation requires careful mapping of the stakeholder landscape and identification of relevant actors at different levels (André, 2012).

6. THE INTERACTION BETWEEN THE MALDIVIAN GOVERNMENT AND STAKEHOLDERS

Arguably, everyone is a stakeholder of climate change and stakeholders are variously characterized as authorities (federal, state, local government), evaluators (scientists, medical professionals, universities) watchdogs (news, media, environmental groups), local communities, etc. (Lindell, 2007).

The emergence of complex socio-environmental challenges such as climate change adaptation, sustainable development, and disaster risk reduction has coincided with calls for more integrative and participatory approaches to scientific research (Thompson, 2017). As well as news and media can put environmental hazards on the public agenda and educate those who do not have direct experience with disasters (Prater, 2000). In the context of adaptation, it is important to analyze stakeholder influence and interest because it determines to what extent and how adaptation can be realized. It is now widely recognized that stakeholder interaction is essential to improve decisions about and awareness of climate change (André, 2012). Hence, the Maldivian government signed several contracts with the stakeholders including institutions and media. One of the agreements that have been signed recently is the agreement between the MaRHE center and the University of Milano-Bicocca.

The Government and Institutions- the Agreement with the University of Milano-Bicocca

In 2021, the University of Milano-Bicocca and the government of the Republic of Maldives came together for the protection of the coral reef. A partnership to reach new important goals on the issues of sustainability and biodiversity.

In the meeting, the rector of the University, Giovanna Iannantuoni, and the Minister of Fisheries, Agriculture, and Marine Resources of the Republic of Maldives, Zaha Waheed signed the agreement and officially launched the project for the development of collaborative research lines.

The agreement is part of a larger project. Since 2009, the University of Milan-Bicocca, thanks to the MaRHE research and advanced training collaboration with the Maldives center. in Marine Research Institute, which is affiliated with the government of the archipelago, studies new solutions for the protection of corals and for the protection of the marine environment such as coral restoration based on the selection of "super-coral " - a generation of corals that can withstand climate change (University of Milano-Bicocca, 2021).

Media- A Tool for the Government

Media plays a key role in communicating risks and shaping particular angles of interpretation. In an attempt to effectively engage the public, visual and emotionally-based appeals are frequently employed within the environmental movement. For example, several movies such as "The Day After Tomorrow" (2004), "An Inconvenient Truth" (2006), and "The Age of Stupid" (2009), have increased people's perceptions of climate risks (Howell, 2011).

Governments also use media to acquaint people with climate change and its effects. The Maldivian leaders have played a crucial role in bringing climate change vulnerabilities and sustainable development challenges facing island nations to the world's attention. Media stunts such as an underwater cabinet meeting, as well as the documentary film "The Island President" (2012), starring former president Nasheed, have further highlighted the country's climate change risks (Shakeela, 2014).

While media can be a useful tool for the government and policymakers to communicate with people, there is increasing concern amongst the Maldivian population that climate change is increasingly being used as a political tool by opposing political parties (Kothari, 2014).

7. DISCUSSION

Since climate change is a serious issue for sustainable development, defining vulnerable sectors is the preliminary action that should be taken by the governments. In the next steps, considering the stakeholders involved in climate change and determining efficient strategies is required. Potentially, everyone is a stakeholder of climate change and stakeholders can be divided into different groups such as local communities, governments, scientific institutions, media, etc. The government as a stakeholder should clarify their attitude toward the imminent hazard and we are able to detect the initiation of the policy formulation process in the last years of Maumoon Abdul Gayoom presidency and the implementation of climate change-related policies by the subsequent presidents.

Although different parties and politicians had different attitudes and ideologies, there was a common sense which led them to recognize the SLR as a momentous hazard.

8. CONCLUSION

Sea-level rise threatens low-lying atoll nations such as the Maldives and this paper has taken a novel approach by assessing how policymakers, especially the president of the republic as the head of state, may deal with climate change and SLR. Hazard mitigation policy is a major political challenge facing hazard-prone communities. Policy adoption is a complex process that begins with the recognition of a problem and its emergence on the agendas of different stakeholders. Therefore, analyzing stakeholder relevance and capacities is important because it lays the foundation for further analysis and understanding of adaptation processes and the necessity of involving many different stakeholders.

The formulation of hazard mitigation policy is facilitated by a focusing event such as a disaster but must be initiated even before one occurs to ensure that feasible solutions are available for adoption when an opportune moment arrives. Thus, recognizing vulnerable sectors and stakeholders should be the first step for policymakers. The government and especially the president of the state have a significant role as a stakeholder since all other stakeholders such as media and institutions can be affected by their decisions.

REFERENCES

- André, K., Simonsson, L., Swartling, A. G. and Linnér, B. (2012). Method Development for Identifying and Analysing Stakeholders in Climate Change Adaptation Processes. Journal of Environmental Policy & Planning, 14, pp. 243-261.
- Armstrong, C. and Corbett, J. (2021). Climate Change, Sea Level Rise, and Maritime Baselines: Responding to the Plight of Low-Lying Atoll States. Global Environmental Politics, 21, pp. 89-107.
- British Broadcasting Company (2018). Maldives election: Opposition defeats China-backed Abdulla Yameen. British Broadcasting Company. Online version accessed October 2021, https://www.bbc.com/news/world-asia-45623126.

Embassy of Maldives- Brussels (2021). Geography and location. Online version accessed October 2021, https://www.maldivesembassy.be/en/about-maldives/geographylocation.

- Gardner, S. (2007). Climate change may sink us this century: Maldives. Reuters. Online version accessed October 2021, https://www.reuters.com/article/us-summit-maldivesidUSSP30709920070928.
- Global Edge (2021). Maldives: Government. Global Edge, Michigan. Online version accessed October 2021, https://globaledge.msu.edu/countries/maldives/government.
- Hirsch (2015). "It won't be any good to have democracy if we don't have a country": Climate change and the politics of synecdoche in the Maldives. Global Environmental Change, 35, pp. 190-198.
- Howell, R. (2011). Lights, camera... action? Altered attitudes and behaviour in response to the climate change film The Age of Stupid. The Age of Stupid. Global Environmental Change, 21, pp. 177-187.

- Kothari, U. (2014). Political discourses of climate change and migration: resettlement policies in the Maldives. *The Geographical Journal*, 180, pp. 130-140.
- Lindell, M. K. and Prater C. S. (2007). Perceived Stakeholder Role Relationships and Adoption of Seismic Hazard Adjustments. *International Journal of Mass Emergencies and Disasters*, 25, p. 218.
- Lindsey, R. (2021). Climate change: Global sea level. Cimate.Gov. Online version accessed October 2021, https://www.climate.gov/news-features/understandingclimate/climate-change-global-sea-level.
- Maldives Independent (2019). Terrorism, climate change and return to democracy: President Solih addresses UN General Assembly. Maldives Independent. Online version accessed October 2021, https://maldivesindependent.com/politics/terrorism-climatechange-and-return-to-democracy-president-solih-addresses-ungeneral-assembly-148153.
- Ministry of Environment and Energy (2015). MALDIVES: Maldives Climate Change Policy Framework. Ministry of Environment and Energy. Online version accessed October 2021, https://policy.asiapacificenergy.org/node/3747.
- Ministry of Housing and Urban Development (2008). Maldives National Housing Policy. Ministry of Housing and Urban Development. Online version accessed October 2021, https://www.mvlaw.gov.mv/pdf/gavaid/minHousing/25.pdf.
- Morrissey, J. (2009). Environmental Change and Forced Migration: A State of the Art Review. University of Oxford. Online version accessed October 2021, https://www.researchgate.net/publication/289374633_Environme ntal_change_and_forced_migration_A_state_of_the_art_review.
- Prater, C. S. and Lindell, M. K. (2000). Politics of hazard mitigation. *Natural Hazards Review*, 1, pp. 73-82.
- Rasheed, A. (2012). An institutionalist approach to understand the recent political change in the Maldives. Lawasia Journal. pp. 159.
- Shakeela, A. and Becken, S. (2014). Understanding tourism leaders' perceptions of risks from climate change: an assessment of policy-making processes in the Maldives using the social amplification of risk framework (SARF). *Journal of Sustainable Tourism*, 23, pp.65-84.
- Thompson, M. A., Owen, S., Lindsay, J. M., Leonard, G. S. and Cronin, S.J. (2017). Scientist and stakeholder perspectives of

transdisciplinary research: Early attitudes, expectations, and tensions. *Environmental Science & Policy*, 74, pp. 30-39.

University of Central Arkansas (2013). Maldives (1965-present). University of Central Arkansas. Online version accessed October 2021,

https://uca.edu/politicalscience/dadm-project/asiapacific-region/maldives-1965-present.

- University of Milano-Bicocca (2021). Restoration of coral reefs, agreement signed between the University of Milano-Bicocca and the Maldives government. Online version accessed October 2021, https://www.unimib.it/comunicati/restauro-delle-scoglierecoralline-siglato-laccordo-luniversita-milano-bicocca-e-governodelle.
- Walsh, K. J. E., Betts, H., Church, J., Pittock, A. B., McInnes, K. L., Jackett, D. R. and McDougall, T.J. (2004). Using Sea Level Rise Projections for Urban Planning in Australia. *Journal of Coastal Research*, 20, pp. 586-598.

409