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International and Internal Migration Dynamics in a Pacific Gateway City: Asian Migrants into and out of Auckland

WARDLOW FRIESEN *

Abstract

An inverse relationship between net international and net internal migration has been noted in migrant gateway cities in the United States, Canada and Australia. This paper proposes that this is also the case in another settlement country, New Zealand, and its gateway city, Auckland. The paper considers whether Auckland also serves as a 'staging post' for migrants, especially those who are visibly different from the mainstream, into the rest of the country.

Two-thirds of all Asian migrants to New Zealand have settled in Auckland, a city which has only one-third of the country's population. This settlement is well-documented, and several studies have considered on-migration and return migration of Asian migrants out of New Zealand. Little is known however, about the internal migration behaviour of Asian migrants within New Zealand. One question of interest is whether migrants who settle in a gateway city tend to 'filter' into other parts of the country as a kind of regional/spatial integration takes place, or perhaps if the opposite is (also?) taking place i.e. that migrants who initially settle elsewhere eventually filter back to the gateway city.

Settlement countries have rarely been able to direct immigrants to particular regions within the country, so the issue of post-immigration internal migration patterns of international migrants is of particular interest to the debates on the impacts of immigration on regional development and on the merits of clustering for both migrants and host societies. This paper uses data on the movements of migrants to New Zealand from the four largest Asian migrant sources, namely China, India, South Korea and the Philippines in an attempt to determine the dynamic relationships between international and internal migration.

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There are many possible measures of migrant integration into a new host society. One that has been used often relates to the spatial integration of settlement, manifest in measures of segregation, or other measures of spatial concentration. Studies have been carried out in Auckland (Johnston et al., 2008; Xue et al., 2012) that show evidence of clustering by ethnic group, most strongly for Māori and Pacific groups, but also for Asian groups. There is some evidence, however, that diffusion of new migrant groups within an urban area may happen over time. For example, Xue et al. (2012) suggest that this has been the case for Chinese in Auckland between recent censuses.

Clustering can also occur on a regional basis, as well as occurring within cities. Many settlement countries have concentrations of migrant populations in their large cities, often described as 'gateway cities'. The gateway metaphor suggests that migrants might move through and on from these cities to other places within the country.

As discussed later in this paper, there has been little research in New Zealand that considers the broader regional clustering of ethnic groups, and whether diffusion beyond the gateway city of Auckland is taking place. A focus on the internal migration behaviour of international migrants must be set within the broader parameters of transnationalism, and its relationship to moving and to staying.

The Relationship between International and Internal Migration and the Role of Gateway Cities

With few exceptions, past models and methods in the study of international migration and internal migration have been carried out separately, and recent efforts have been focused on attempting to integrate these (Skeldon, 2006; King & Skeldon, 2010). Considering Asian migration systems, Skeldon (2006) concludes that "…differences of sufficient magnitude between internal and international migration exist to allow them to be considered as separate systems…" (p.27). However, he then goes on to postulate the linkages between these systems, and finds that while there is no 'natural' progression from internal to international migration, the reverse may be the case (ibid). He asserts that international out-migration from specific areas/cities may create 'vacuums' which will draw in internal migrants, but he does not ask whether international in-

migration tends to result in internal migration, either as a result of longer-term residents being 'pushed out' or by the international migrants themselves as they move on from their first settlement destination.

King and Skeldon (2010) take a broader overview of the potential integration of international and internal migration theory and study. Among other things, they propose that greater use of systems approaches and the application of aspects of integration theory that are usually applied to international migration should also be applied to internal migration. A useful element in their synthesis is the schematising of ten 'migration pathways' which sequence internal, international and return movements - although such a schema appears to be too static to represent the complexity and fluidity of some transnational mobility patterns.

Gateway cities appear to be important in the interlinkages between international and internal migration. The concept of gateway cities originated in transport geography, which defines a gateway city as "the first place of contact of a transport network in a nation or region" (O'Connor, 2009, p.424), and in recent years has more specifically been used to identify the primary points of entry of migrants into a country. Classic examples of gateways in settlement countries are Los Angeles, Miami, Toronto, Vancouver, and Sydney - in each case these cities have much higher proportions of their populations comprised of migrants than their population size might suggest. Auckland is also a gateway city; throughout the twentieth century it evolved as New Zealand's largest seaport, and then airport, for entry of people and products. By the early 21st century, Auckland was clearly also a primate city with about one-third of New Zealand's population and a slightly higher proportion of its labour force and GDP (Auckland Regional Council, 2010).

Empirical studies of the relationships between international and internal migration are not common, and perhaps the most extensively documented case studies are from the United States (Hou & Bourne, 2006). More than one study concludes that high levels of international migration into gateway cities appears to be resulting in internal out migration of the domestic-born to other American cities and regions, which has had an impact on the spatiality of ethnicity across the country (Frey, 2002; Hou & Bourne, 2006). Frey (2002, cited in Hou & Bourne, 2006) asserts that:

> …the differences in immigration and internal-migration flows in the United States are transforming what was once a 'single melting pot' nation into three distinct Americas: a suburb-like 'New Sunbelt' region, a socially diverse and economically vibrant 'Melting Pot' region, and an aging, whiter, and slow-growing 'Heartland' region (p.1505).

Whether or not one accepts that the 'single melting pot' model is desirable, it is of concern if the segregation once manifest mainly in larger urban centres is being replicated on broader national and regional scales.

Similar concerns about increasing spatial differentiation between gateway cities and other regions have been raised in other immigrant-receiving countries (Hou & Bourne, 2006; Ley, 2007). Comparing the Canadian and Australian cases to the American case, Ley (2007) concludes that there is an inverse relationship between international and internal migration, in that cities with high levels of (international) immigration have relatively low levels of domestic in-migration and high levels of domestic out migration. He interrogates three theses as to the reasons for this:

1) out-migration of 'locals' results from 'cultural avoidance',

2) labour market effects e.g. competition for jobs pushes out the less educated, and

3) high housing prices and rents pushes out those less able to pay.

This paper is not able to fully test the relevance of Ley's proposed theses (2007) in the case of New Zealand, because of the lack of data and comparable studies. It does however consider the numerical relationships of international and internal migration in Auckland, query whether Asian migrants tend to move on from this gateway, and finally posit some reasons for the resultant patterns.

The Role of Internal and International Migration in Auckland's Growth

Through the 20th century, Auckland was the most rapidly growing urban centre in New Zealand. While natural increase was a consistent contributor to growth, the relatively more rapid growth was a result of higher rates of both internal and international migration than in other urban areas.

Before World War II, immigration was dominated by British migrants. After the war, New Zealand's economy was highly protectionist which facilitated the growth of manufacturing and resulted in labour shortages in urban centres, especially Auckland. The 1950s were a period of rapid urbanisation of Māori as well as new waves of international migrants, particularly from the Pacific, but also from other countries such as Netherlands. Since then, levels of international migration have fluctuated considerably including periods of net loss, such as that in the late 1970s, when Auckland lost significant numbers through international migration (Table 1). These losses were much greater at the national level, and reflected the ongoing loss of the New Zealand-born population, who mainly went to Australia and the United Kingdom for their OE (overseas experience) and in many cases did not return, or at least stayed away for a lengthy period.

Partly as a response to these losses, the new Immigration Act in 1987 moved New Zealand's policy from one based on 'preferred countries' to one based on immigration criteria focused on education, skills, age and investment capital. The new immigration policy resulted in increased levels of net immigration gain, especially in Auckland, which attracted more than half of all new migrants despite comprising only about one-third of New Zealand's population. Table 1 shows that Auckland's net gain from international migration has been variable, but averaged nearly 20,000 per year in the early 21st century.

Following rapid urbanisation in the 1950s, net internal migration gains for Auckland were relatively high. Between 1976 and 1981, there was a net intercensal gain of about 17,000 (Table 2). The net gain through internal migration has steadily declined however, and Auckland has been losing population to internal migration since the late 1990s. International migration has become the predominant driver of differential population

growth for the city. By the early 21st century, the net internal migration loss was similar to the level of gain 30 years earlier. There is little empirical evidence as to whether these net internal losses have been driven by the increased level of international migration to Auckland. This can be implied however, as analysis of the age structure of these internal movements show that there are net gains in the age cohorts from 15 to 30 but loss in the older cohorts - which can be attributed to lifestyle choices within these older cohorts, partly related to lower house prices outside of Auckland (Friesen, 2003). Housing prices have been shown to increase when immigration levels are high and population has increased significantly, but the causality of this relationship is not clear (Stillman & Mare, 2008, p. 28).

Table 1: Estimated contribution of international migration to growth of Auckland 1976-2006

Census years	International in-migration	International out-migration	Net international migration	Estimated contribution to change
1976-1981	-	-	-23,578	-84%
1981-1986	-	-	13,405	23%
1986-1991	74,050	63,700	10,350	15%
1991-1996	107,600	46,450	61,100	49%
1996-2001	131,220	103,270	27,930	31%
2001-2006	169,500	74,100	95,400	66%

Sources: Friesen, 2003; Statistics New Zealand, Census of Population and Dwellings.

Note: Data for 1976-1986 refers to the Auckland Local Government Region.

Table 2: Estimated contribution of internal migration to population change in Auckland region 1976-2006

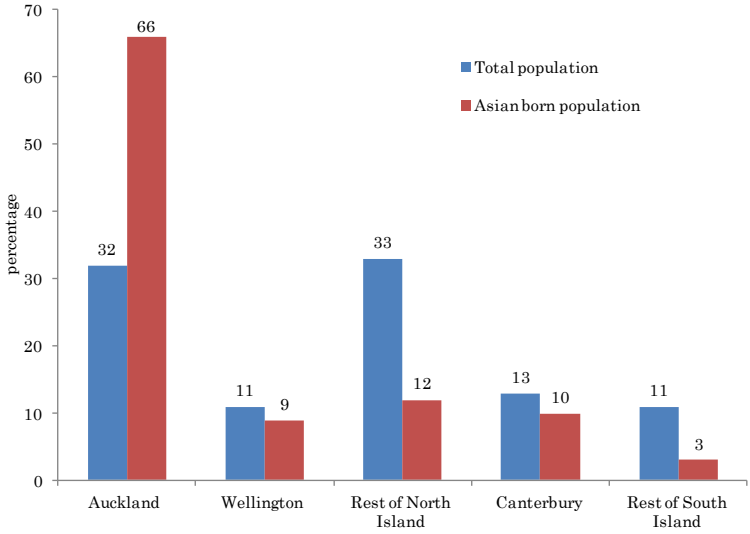
Census years	Internal in-migration	Internal out-migration	Net internal migration	Estimated contribution to change
1976-1981	68,140	51,000	+17,140	61%
1981-1986	65,930	53,900	+12,030	20%
1986-1991	66,400	61,250	+5,150	7%
1991-1996	64,923	59,964	+4,950	4%
1996-2001	65,727	67,971	-2,244	-2%
2001-2006	59,301	75,963	-16,662	-12%

Sources: Friesen, 2003; Statistics New Zealand, Census of Population and Dwellings.

Auckland as an Immigrant Destination

Auckland attracts high numbers of new migrants. Figure 1 shows the distribution of Auckland and other regions of New Zealand in terms of their proportions of the total population of the country and in terms of the Asian born population. At the 2006 Census, about two-thirds of New Zealand's population born in Asia lived in Auckland despite the fact that it only had about one-third of the total population. The second and third most important destinations for Asian migrants were the second and third largest cities, Christchurch and Wellington respectively. All of the other regions in New Zealand accounted for only 15 percent of the Asian population, and most of this was in the larger urban centres in these regions.

Figure 1: Regional distribution of Asian population compared to total population of New Zealand (2006)



It is clear that Auckland, as a gateway city, is the dominant destination for Asian migrants. The reasons for this are varied. If we consider that central government policy is strongly orientated to attracting skilled and/or entrepreneurial migrants, it might be surmised that economic motives are central to migrant's decision to migrate to New Zealand. However, 'employment opportunities' ranked only fourth as a motive in the government's longitudinal survey of migrants (LisNZ) (Department of Labour, 2009, p.49). Nevertheless, whether or not economic factors were the primary motive, most migrants did hope to find a job commensurate with their qualifications, and Auckland's disproportionate share of high-level service sector job opportunities is attractive to highly skilled migrants (Ip & Friesen, 2001).

The LisNZ study found that the leading motive for choosing New Zealand was the 'relaxed pace of life or lifestyle' and the second was 'climate or the clean green environment' (Department of Labour, 2009, p.49). It may seem ironic that migrants whose motives related to relaxed lifestyle or environment would choose to settle in the largest city; nevertheless in an earlier study, Chinese migrants who had settled in Auckland stated these reasons (Ip & Friesen, 2001). Another factor which

attracts migrants to New Zealand is the provision of education for their children. While there are many high quality schools in the country, the choice of both public and private institutions is greatest in the largest city.

Further, many Asian migrants, especially those from China and Korea, and increasingly those from India, first come to New Zealand as students, and then stay. (Auckland is the location of three of the large universities and two of the largest polytechnical institutions in New Zealand). Asian students also tend to find New Zealand cities small compared to those they have come from, so the choice of the largest city for its social and other opportunities is another factor (Collins, 2006). New Zealand's evolving immigration policy has made it increasingly easy for students to make the transition to permanent residency through post-study right to work visas and other means (Ho & Bedford, 2010), and the most likely place to get a skilled job is Auckland.

Other reasons that Asian migrants are attracted to Auckland relate to the accumulation of social, cultural and economic capital over time, such as strengthening of networks, synergies of ethnic clustering and development of 'ethnic entrepreneurial' activities. To some extent these develop *after* settlement, and these may be seen as 'reasons to stay', and will be reviewed after considering whether migrants *do* stay in Auckland.

Is Auckland a 'Staging Post' for Asian Migrants?

The ideal data source for assessing the internal migration dynamics of international migrants is a residential registration system, such as exist in some European countries. New Zealand does not have such a system, and the introduction of one would be controversial.

New Zealand does have sample longitudinal data and census data. The New Zealand Immigration Service, through the Department of Labour, has been carrying out a longitudinal survey of migrants for a number of years (Department of Labour, 2009). Data on the internal migration of international migrants has recently been released (see Table 6), however, this data does not include detailed information on migrant characteristics or motives for moving.

The other available data source is the New Zealand Census of Population and Dwellings. An indicator of internal migration can be derived from the question asked of all usual residents - 'where were you

five years ago?' This question is only an indication of movement as it does not specify intermediary moves in the previous five years and it cannot register migrants who moved out of the country in this period. Hence it is referred to as the 'five year migration indicator' in the following discussion.

An earlier study used a range of variables including the five year migration indicator to assess the settlement and mobility characteristics of migrants, but did not publish results according to specific country of birth or New Zealand region of settlement or resettlement (Mare et al., 2007). The study was focused on Labour Market Areas (LMAs) and whether there was a significant difference in the mobility behaviour of earlier migrants, recent migrants and the New Zealand born in relation to employment opportunity, wage levels and a number of other variables. While earlier migrants became more responsive to local labour market conditions, for more recent migrants, the strength of 'region of birth migrant networks' was a more important determinant of settlement choice, and not surprisingly, these networks were strongest in the larger LMAs (pp.21-22). While this supports part of the reasoning for migrant settlement in the largest urban centres, especially Auckland, it does not provide specific information on the dynamics of movement between these cities and other areas.

To test the 'staging post' hypothesis, the five year migration indicator is used to show movement between different regions of New Zealand between the 2001 and 2006 Censuses. Table 3 presents data for those born in the four largest Asian migrant source countries who were enumerated in Auckland in 2001, and whether they had moved to a different region by 2006. Only 3.6 percent had moved out of Auckland, with slightly higher rates for those born in Korea (4.3 percent), India (4.0 percent), China and the Philippines (both 2.9 percent). This does not provide evidence that Auckland is a staging post for movement into the rest of New Zealand, especially when movement in the other direction is considered. Table 4 shows that, of all of those born in these four Asian countries who were in Auckland in 2006 and also in New Zealand in 2001, 3.6 percent had moved into Auckland from somewhere else – slightly higher than the out-migration rate.

The internal movements of Asian migrants tend to follow predictable patterns. Out-movements from Auckland have followed two patterns: movement to nearby regions such as Waikato and Bay of Plenty; and

movement to the other larger cities of New Zealand, especially Wellington, and Canterbury (Christchurch). Movement to the Otago region is likely to be both to Dunedin and to Queenstown, the latter which is a major destination for Asian tourists. When the movements into Auckland are considered, the pattern is similar. This suggests that Auckland is not so much a staging post for movement into the rest of the country, as the largest node in a movement network which incorporates the larger cities of New Zealand and regions near to Auckland i.e. between areas where there is a significant migrant presence already.

In considering the relatively low rates of internal migration of Asian migrants, and the low rates of on-movement from the gateway city of Auckland, it is interesting to consider these rates for other migrant groups. Table 5 shows the in- and out- migration rates from Auckland for the three largest non-Asian migrant birthplace countries to New Zealand: the United Kingdom (UK); South Africa; and Samoa.

In the case of the UK, the out-migration rate from Auckland is more than twice as high as for the Asian countries and the in-migration rate a little higher. The net out-migration of this group, largely made up of people with European ancestry, may be explained by the fact that British migrants are culturally similar to the predominant European (Pakeha) population of New Zealand, and movement within the country is easier. Such a 'cultural proximity' thesis is consistent with the fact that British migrants are more dispersed spatially within the country in general. Supporting this contention is the fact that South African migrants, who are also mainly of European ancestry, also have higher movement rates than Asian migrants, while those from Samoa, who are culturally and socio-economically distinct from the Pakeha majority have even lower rates of internal mobility than those from Asia (Table 5).

Table 3: Census evidence of movement out of Auckland between 2001 and 2006 by country of birth, of population resident in Auckland 2001

Country of birth → NZ destination region 2006↓	China	India	Korea	Philippines	Total
Northland	33	48	15	9	105
Auckland (no move)	24,348	11,583	8,691	5,031	49,653
Waikato	117	126	99	39	381
Bay of Plenty	51	93	42	18	204
Gisborne	12	0	0	0	12
Hawke's Bay	21	12	0	9	42
Taranaki	51	12	6	0	69
Manawatu-Wanganui	117	15	33	0	165
Wellington	147	72	36	24	279
West Coast	0	0	0	0	0
Canterbury	105	48	57	15	225
Otago	54	39	96	21	210
Southland	0	0	0	0	0
Tasman	0	0	0	0	0
Nelson	6	6	0	0	12
Marlborough	0	0	0	0	0
Total (in Akld 2001, NZ 2006)	25,071	12,063	9,084	5,181	51,399
% who moved out	**2.9**	**4.0**	**4.3**	**2.9**	**3.4**

Data source: 2001 & 2006 Censuses. Statistics NZ, customised data.

Table 4: Census evidence of movement into Auckland between 2001 and 2006 by country of birth, of population resident in Auckland 2006

Country of birth → NZ region of origin 2001 ↓	China	India	Korea	Philippines	Total
Northland	42	9	18	15	84
Auckland (no move)	24,348	11,583	8,691	5,031	49,653
Waikato	228	72	90	45	435
Bay of Plenty	54	54	54	9	171
Gisborne	6	0	0	0	6
Hawke's Bay	36	24	6	0	66
Taranaki	36	21	0	0	57
Manawatu-Wanganui	132	39	27	9	207
Wellington	192	90	60	18	360
West Coast	0	0	0	0	0
Canterbury	141	21	117	12	291
Otago	69	24	54	9	156
Southland	15	0	0	0	15
Tasman	0	0	0	0	0
Nelson	12	0	0	0	12
Marlborough	0	0	0	0	0
Total (in NZ 2001, Akld 2006)	25,311	11,937	9,117	5,148	51,513
% who moved in	**3.8**	**3.0**	**4.7**	**2.3**	**3.6**

Data source: 2001 & 2006 Censuses. Statistics NZ, customised data.

Table 5: Census evidence of movement into and out of Auckland 2001-2006, by selected migrant birthplaces

Country of birth	Moved out of Auckland		Moved into Auckland		net movement (in minus out migrants)
	number moved out 2001-2006	percent of Auckland residents 2001	number moved in 2001-2006	percent of NZ residents 2001	
China	714	2.9	972	3.8	258
India	480	4.0	354	3.0	-126
South Korea	393	4.3	432	4.7	39
Philippines	150	2.9	117	2.3	-33
Total 4 Asian countries	*1737*	*3.4*	*1875*	*3.6*	*138*
United Kingdom	5250	7.7	2586	4.0	-2664
South Africa	861	6.3	639	4.8	-222
Samoa	582	2.1	792	2.9	210

Data source: 2001 & 2006 Censuses. Statistics NZ, customised data.

Table 6: Evidence from Longitudinal Survey (LisNZ) on movement of migrants into and out of Auckland, over 3 years after arrival, by selected nationalities

Nationality	Number in Auckland at Wave 1 (6 months after arrival)	Moved out of Auckland (somewhere else at Wave 3)		Number in Auckland at Wave 3 (3 yrs after arrival)	Moved into Auckland (elsewhere at Wave 1)	
		No	%		No	%
China	3000	70	2.3	3170	240	7.6
India	1690	50	3.0	1680	40	2.4
Other Asia	2140	30	1.4	2180	70	3.2
Asia	*6830*	*150*	*2.2*	*7030*	*350*	*5.0*
United Kingdom	3120	270	8.7	2980	120	4.0
South Africa	1650	160	9.7	1650	160	9.7
Pacific	3190	60	1.9	3230	100	3.1

Data source: LisNZ tabulations released June 2012, Statistics NZ.

Note: Data is based on LisNZ survey of 5,102 permanent resident migrants aged 16 and over (not including refugees) as a sample of about 34,000 who arrived between November 2004 and October 2005. Sample results have been extrapolated to the full population of migrants who arrived over the one year period. Wave 1 interviews were conducted six months after arrival, Wave 2 after 18 months and Wave 3 after 36 months.

The data from LisNZ (Table 6) shows similar trends to the census data, although the time period involved in LisNZ is shorter. Interviews with permanent resident migrants were carried out six months (wave 1), 18 months (wave 2) and 36 months (wave 3) after they had arrived in New Zealand in 2004-2005. Thus the time between wave 1 and wave 3 averaged only 2.5 years, this is half of the intercensal period.

Nevertheless, the proportions within New Zealand who had moved into and out of Auckland, were similar for most Asian migrants as well as those from the UK and South Africa. There were also similarities between the internal migration pattern of those born in Samoa as shown in the census data, with the Pacific sample in the longitudinal survey. The main difference was that the proportion of Asian-born who had lived somewhere other than Auckland at wave 1 but who had moved to Auckland by wave 3 was almost double the proportion shown over the intercensal period. About half of these had moved from the South Island, but the reason for this is not clear since the last survey took place before the first significant earthquake in Christchurch.

International Mobility of Asian Migrants to New Zealand

We have seen that Asian migrants who settle in Auckland tend to stay there rather than move on to other parts of New Zealand. However, how strongly are they 'moored' when international migration is considered?

The only comprehensive data on whether migrants are staying in New Zealand is based on New Zealand Immigration Services data, specifically data on 'long term absences' (12 months or more) from the country of those who have earlier been granted permanent residency. The data for 2005 and 2010 for the largest migrant source countries are shown in Table 7. Of these countries, migrants from China have the highest rate of absence, at 22 percent in 2005 and 20 percent in 2010. It is assumed that a significant number of these absentees have moved on or returned to China, although there is the possibility that some may be 'bi-local' residents who will return to New Zealand although they have expressed the intention to be away for more than 12 months. India and Korea showed increasing rates of absence rising to 17 percent and 14 percent respectively in 2010 with the Philippines having a low rate of six percent. With the exception of the latter, these rates of absence are higher than shown for other significant

migrant source countries, although are not so much higher than the UK at 14 percent. It should be noted that these data do not measure longer-term trends, since they only include those who have received permanent residency up to eight years earlier, but nor do they adequately measure the potential for return to New Zealand of some who are currently absent.

The data published on long term absence does not identify whether migrants are returning to their country of origin or moving on to a third country. There is no doubt that return migration is a significant phenomenon, even if we can not precisely quantify it. A recent study of return migration from New Zealand to China showed that returnees had a range of motives for returning including better employment opportunities, nostalgia for 'home' and family commitments (Liu, 2010). Emphasising the transnational nature of these migrants, some expressed their intention to move again, in some cases to countries of perceived opportunity such as the United States, and in other cases back to New Zealand (ibid). Another study of returnees from New Zealand to Korea, notes that many of those who have returned do not easily fit back into Korean society and economy, and also express the possibility of on-movement or return to New Zealand (Lee, 2011).

Despite the importance of return migration and on-migration, the overall evidence is that the majority of Asian permanent residence migrants to New Zealand are staying in the country, at least in the medium term, and that the great majority of those who settle in the gateway city of Auckland are also staying. If we inverted Table 7 to show the proportion of migrants who are still in New Zealand, it would show that for the four Asian countries which we are focusing on, 80 to 90 percent of permanent residents who arrived in the preceding eight years are still resident. Of those who remained in New Zealand and were resident in Auckland, as shown in Table 3, more than 95 percent stayed there over the five year period leading up to the last census. Thus, it is possible to say that there is a significant group of *stayers* who have usually been overlooked in research in favour of those who have moved.

Table 7: Percentage of migrants absent 'long-term' in 2005 and 2010, of those granted permanent residency one to eight years earlier

Source country	% of PR approvals absent 2005	2010
China	22	20
India	14	17
Korea	11	16
Philippines	8	6
United Kingdom	14	14
South Africa	11	9
Samoa	12	8
All migrants	15	14

Source: Department of Labour 2006; Department of Labour 2010.

Notes: For 2005, includes migrants approved 1998-2004 (December years) and absent December 31, 2005. For 2010, includes migrants approved 2002/03-2008/09 (June years) and absent June 30, 2010.

The Study of 'Staying' within Transnational Research

In assessing research on transnationalism among geographers, Collins (2009) has argued that:

> …geographers have contributed to the unbinding of this field through scholarship that has focussed less on documenting the transnationality of particular migrant practices and more on interrogating emergent subjects, registers and spatialities that a focus on transnationalism reveals….it is through this use of transnationalism as a framework rather than as a definitional tool that geographers have and can continue to make important inroads that unbind and expand our understanding of cross-border lives (p.435).

It is not surprising that in using transnationalism as a definitional tool, the focus of study has been on movements and the linkages that these generate. However, if we use transnationalism as a framework, many of the same processes and practices that surround movement may also have relevance to stasis, and to understand movement we need to also understand the periods of stasis in between. In order to understand the dynamics of the internal migration behaviour of international migrants we need to understand why they stay in particular places for periods of time, since most people are *not* moving most of the time in terms of their 'usual

place of residence' (though some scholars of transnationalism might challenge the use of this term).

In the mid-1990s, Moon (1995), proposed that a 'single schema' for the study of migration motives could be that of 'moorings', and though the concept of moorings has been subsequently developed by other scholars, they have tended to narrow its meaning to focus on immobile infrastructure which facilitates mobility (e.g. Urry, 2003; Hannam et al., 2006; Adey, 2010). Moon's broader conception may be a useful concept for integrating 'staying' into transnational research:

> …moorings can be viewed as those social expressions which not only allow a person to materialize his or her physical, psychological and emotional well-being but also serve to bind a person to a particular place….However, it is not only the cultural and (un)important but it is also the person's own set of personal aspirations within the genre of habitus which provides motivational meaning (1995, p. 514).

Typical moorings include: life course issues such as family structure, career opportunities, personal relationships/partnerships, and care-giving responsibilities; cultural issues such as cultural networks and class structures; and spatial issues such as climate, access to cultural icons and location of recreational facilities (ibid, pp.514-516). The importance of these factors to an individual or family may explain why they decide to move internationally or internally, but also why they decide to stay in a particular place i.e. why they are 'moored' in one place more than another. It should be noted though, that the use of the mooring metaphor in this way is not a refutation of the importance of transnationalism which is the focus of other studies (e.g. Liu, 2010; Lee, 2011), but rather an elaboration.

Empirical evidence as to the reasons for migrants staying in New Zealand, or more specifically for the purposes of this paper, for them staying in Auckland, is fragmentary, and often only indirect. Therefore this paper presents only a brief summary of the reasons for staying based on evidence and speculation, and proposals for research into the phenomenon of staying.

Some of the reasons for staying in Auckland, and research possibilities arising from these, include the following:

- *Employment opportunities strengthening over time and the greater opportunities available in Auckland.* There is evidence of unemployment and underemployment for many migrants soon after settlement (Ip & Friesen, 2001; Trlin et al., 1999), but over time, employment prospects tend to improve (Department of Labour, 2009). More detailed longitudinal studies of employment histories are needed to consider this issue, and life histories in general to consider other contingent issues.
- *Ethnic entrepreneurial activities increase over time and synergies of clustering are greatest in Auckland.* Many self-employed migrants have established 'own-ethnic' businesses which rely on migrants from their own ethnic group. Over time these investments have increased, and there are synergies in the clustering of these activities in particular areas of Auckland (Meares et al., 2010; Xue et al., 2012). Some research has already been undertaken on aspects of ethnic entrepreneurialism and its relationship to community, and more is underway.
- *Social and cultural capital in Auckland has built up over time.* With time, social and cultural networks have developed in Auckland, for example many ethnic associations have developed (Friesen, 2008b), but there are many other examples. In some cases these networks are structured around infrastructural elements such as temples, churches, mosques as well as cultural centres. There is considerable research potential in looking at the ways in which social and cultural capital is built up and its role in mooring people, or not.
- *Educational incentives:* In many cases migrants have chosen Auckland for the diversity and quality of schools available for their children, and they may stay to see their children's education completed. They may also become involved in the education system themselves in order to up skill and increase employment opportunities.

This list is not comprehensive, but it does suggest some areas in which further research would help to elucidate the ways in which migrants become attached to particular places, or in which they may be encouraged to move on.

Conclusion

While there is evidence that a significant proportion of Asian migrants to New Zealand do return to their home country or move to another country, internal migration of migrants is relatively limited. Within New Zealand there appears to be a regionalisation of cultural diversity occurring, as a result of the settlement of migrant populations that are culturally and visibly different from the Pakeha majority in cities - particularly in Auckland. This may be related to the ease with which those who are culturally closer to the 'mainstream' move around the country, but also to the predilection of new migrants to link into existing networks and facilities located in the biggest cities. For the same reason, there is relatively little evidence of on-movement of these migrant populations from Auckland to other parts of the country, so at this point, it is difficult to view Auckland as a staging post for Asian migrants into New Zealand.

While there is evidence of significant out-movement of Asian migrants from New Zealand, the majority stay for the medium to long term. Combined with this, the relative low level of internal migration of these international migrants means that 'staying' in an important phenomenon. The suggestion that the study of staying may contribute to a deeper understanding of transnationalism, is not to suggest that we should return to the paradigm of permanency once assumed as the norm for most migrants in 'settlement countries'. Rather it is an elaboration on the fluid possibilities available to migrants, and many of those who are stayers in the medium term may have apparently transnational practices in relation to their short-term mobility, social and cultural networks and economic activities. At the same time they may have built social, cultural and economic networks and capital in their 'usual residence' of Auckland, and this paper proposes that these are worthy of further study.

Notes

1 This data includes 'overseas' as a response, and for internal migration can be tabulated at various spatial levels; in this paper New Zealand regions are used with a focus on the Auckland region. Customised data based on the five year migration indicator were generated to determine internal migration by country of birth, thereby creating a proxy of internal movement by international migrants.

2 Christchurch is in the Canterbury region. Most migrants have settled in the city rather than in the surrounding small towns or countryside.

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Residential Sorting Across Auckland Neighbourhoods

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Abstract

This paper addresses the extent to which people in Auckland exhibit residential location patterns that differ between groups, i.e. the extent to which they are spatially sorted. To measure patterns of residential location, the paper uses the index of segregation, an isolation index, Gini coefficients, Ellison & Glaeser and Maurel & Sédillot concentration measures, Moran's I and Getis and Ord's G*. Results are presented based on a classification of the population in different ways: ethnicity, income, education, age and country of birth. Both city-wide and local measures are considered. We find that ethnic-based sorting is the strongest indicator of residential sorting patterns, but sorting by income, education and age is also present. Sorting by income and qualifications is strongest at the top and, to a lesser extent, at the bottom of the income and qualifications range. Age segregation is most pronounced for older residents. Clustering is strongest within a range of up to one kilometre and declines significantly over greater distances. Local analysis by means of Getis and Ord's G* calculations suggest significant ethnic clustering. Apart from Māori and Pacific Islanders, ethnic groups tend to locate away from each other, as confirmed with cross-Moran's I calculations. When considering interactions between ethnicity and income we find that the location of ethnicity-income subgroups is more strongly related to neighbourhood ethnicity than to neighbourhood income.

The distribution of households and individuals across neighbourhoods arises through a complex process that is now commonly referred to as residential sorting (e.g. Clark & Morrison, 2012). When choosing areas to live, people make tradeoffs regarding the

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wide variety of housing and neighbourhood attributes associated with the options available (Bayer et al., 2004). Residential segregation can be defined generally as the degree to which groups live separately from each other (Johnston et al., 2007; Massey & Denton, 1988). The sorting of population subgroups into distinct areas may reflect heterogeneous tastes, with segregation supporting the provision of local public goods (Tiebout, 1956) or proximity to amenities valued highly by the subgroup. Alternatively, it may reflect income stratification within housing markets, with different groups making different tradeoffs between convenient locations and lower residential prices. Finally, social sorting may arise if groups prefer to live close to people similar to themselves, or separate from people who are different (see Maré et al., 2011 for further discussion).

The purpose of the current paper is to answer two key questions:

(i) what is the nature and strength of residential sorting in the Auckland urban area?

(ii) how does this differ between different groups?

It adds to a small existing literature on the topic, which to date has focused primarily on sorting by ethnicity (Johnston et al., 2003, 2007, 2011; Grbic et al., 2010). The paper makes three original contributions. First, it presents additional measures to summarise patterns of sorting. Second, it summarises residential sorting within Auckland by country of birth, income, qualification, and age, as well as by ethnicity. Third, it examines the interrelationship of sorting by ethnicity and by income.

In the next section, we discuss the relevance of residential segregation for urban and social policy, and refer to previous studies of the Auckland Urban Area. We then introduce the methods that we use to examine patterns of spatial sorting, and the data on which we base our measurement. After presenting key findings, we conclude by summarising the main insights of the analysis.

Background

With a resident population of about 1.4 million in 2012, Auckland is New Zealand's largest city. It is also one of the most culturally diverse cities among the Organisation for Economic Co-operation and Development (OECD) member countries, with almost 40 percent of the adult population born overseas at the 2006 Census. Auckland's population diversity has

profound implications for the spatial distribution of the growing population. As in all major cities, there is considerable sorting of the population across neighbourhoods, along dimensions such as ethnicity, income, country of birth, and age. As Auckland continues to grow, by an anticipated 31 percent by 2031 (Statistics New Zealand, 2010, medium series), patterns of residential location will reflect the changing population composition, with growth pressures in areas currently housing groups that will increase most rapidly. Measuring and understanding existing patterns of residential sorting is vital for anticipating the future demands for housing, local transport and other infrastructure and community facilities.

Residential location patterns take on a greater significance if social and economic outcomes are also influenced by the composition of the neighbourhoods in which people live. Many studies present results consistent with such local spillovers and externalities, which operate by shaping the range of interactions that residents have in their neighbourhood.

In a study of United States urban ghettos, Cutler and Glaeser (1997) show that segregation can be positive if it increases the interactions that unskilled residents have with skilled and high income residents, and negative if segregation limits such interactions. Other studies have found that individual outcomes are affected by neighbourhood levels of education (Kremer, 1997; Borjas, 1995) and the quality of neighbourhood interactions (Ioannides, 2003). Even fertility can be inversely related with neighbourhood quality (Tumen, 2012).

Particularly relevant for Auckland is the extensive literature on the implications for immigrants of residential sorting. Segregated immigrants may not pick up host country skills and language, which can hinder their access to better jobs and can reduce long term earnings. On the other hand, sorting can provide access to employment opportunities and transportation, reducing the costs associated with assimilation into a host society and increasing the opportunity for gainful trade in the labour market or in business (Cutler & Glaeser, 2008; Edin et al., 2003; Warman, 2007; Andersson et al., 2009; Zhou, 1998).

Outcomes may be affected not only by clustering *per se*, but also by the type of locations in which different groups are clustered. Groups may be disadvantaged by being clustered in areas isolated from key amenities, job growth and transportation networks, giving rise to what has been termed

'spatial mismatch' (Cutler et al., 2008; Kain, 1968; Collins & Margo, 2000). Such clustering may arise from housing market discrimination or stratification, with income differences influencing the combinations of convenience and price that are feasible for different groups.

In Auckland, previous studies have highlighted the strength of ethnic residential segregation in Auckland, especially for the groups facing the worst housing and labour market outcomes. Johnston et al. (2005, 2008, 2009) and Grbic et al. (2010) document ethnic segregation, and hypothesise that segregation contributes to a cycle of poor education, poor labour market outcomes and poorer quality housing for Māori and Pacific residents (Johnston et al., 2007, 2005). The hypothesis is plausible, but the direction of causality is not clearly established.

Measuring Residential Sorting

After reviewing the research literature on residential sorting, Massey & Denton (1988) conclude that "segregation should be measured not with one index, but with several" (p.283). Our study follows this suggestion and summarises residential patterns in the Auckland Urban Area using a range of summary statistics. The chosen measures provide complementary perspectives, highlighting different features of observed patterns of sorting. We distinguish two broad approaches to the measurement, namely fixed boundary measures, which summarise patterns across different areas but do not take account of location, distance or scale; and spatial measures, which take into account the topological relationship of neighbourhoods to one another when considering the degree of clustering (Jargowsky & Kim, 2005). For each of these two approaches, we present global measures that summarise the degree of sorting across the Auckland Urban Area. For localised analysis, we present only a spatial measure. Table 1 presents the formulae used to calculate the various measures. In this section, we provide an overview of the measures and the insights that they provide.

Table 1: Summary measures of residential sorting

A. Global Measures	
A.1 Fixed Boundary Measures	
Segregation index	$S_g = \frac{1}{2}\sum_{a=1}^{A}\left\lvert\frac{P_{ga}}{P_{g\bullet}} - \frac{(P_{\bullet a} - P_{ga})}{(P_{\bullet\bullet} - P_{g\bullet})}\right\rvert$
Adjusted segregation index	$AS_g = \frac{1}{2P_{\bullet\bullet}}\sum_{a=1}^{A}\left(\left\lvert P_{ga} - P_{g\bullet}\frac{P_{\bullet a}}{P_{\bullet\bullet}}\right\rvert + \left\lvert(P_{\bullet a} - P_{ga}) - (P_{\bullet\bullet} - P_{g\bullet})\frac{P_{\bullet a}}{P_{\bullet\bullet}}\right\rvert\right)$ $= 2\frac{P_{g\bullet}}{P_{\bullet\bullet}}\left(1 - \frac{P_{g\bullet}}{P_{\bullet\bullet}}\right)S_g$
Isolation index	$IsI_g = \frac{IsR_g - \frac{P_{g\bullet}}{P_{\bullet\bullet}}}{1 - \frac{P_{g\bullet}}{P_{\bullet\bullet}}}$; where $IsR_g = \sum_{a=1}^{A}\frac{P_{ga}}{P_{g\bullet}}\frac{P_{ga}}{P_{\bullet a}}$
Gini coefficient	See main text
Ellison-Glaeser concentration index	$\gamma_{EG} = 1{,}000 * \frac{\frac{\left\{\sum_{a=1}^{A}\left(\frac{P_{ga}}{P_{g\bullet}} - \frac{P_{\bullet a}}{P_{\bullet\bullet}}\right)^2\right\}}{\left(1 - \sum_{a=1}^{A}\left(\frac{P_{\bullet a}}{P_{\bullet\bullet}}\right)^2\right)} - \frac{1}{P_{g.}}}{\left(1 - \frac{1}{P_{g\bullet}}\right)}$
Maurel and Sedillot concentration index	$\gamma_{MS} = 1{,}000 * \frac{\frac{\left\{\sum_{a=1}^{A}\left(\frac{P_{ga}}{P_{g.}}\right)^2 - \sum_{a=1}^{A}\left(\frac{P_{\bullet a}}{P_{\bullet\bullet}}\right)^2\right\}}{\left(1 - \sum_{a=1}^{A}\left(\frac{P_{\bullet a}}{P_{\bullet\bullet}}\right)^2\right)} - \frac{1}{P_{g\bullet}}}{\left(1 - \frac{1}{P_{g\bullet}}\right)}$
A.2 Spatial Measures	
Moran's I	$M_g = \sum_{a=1}^{A}\frac{\left(\frac{P_{ga}}{P_{g\bullet}} - \frac{1}{A}\right)\left(\sum_{n=1}^{N_a} w_{an}\left(\frac{P_{gn}}{P_{g\bullet}} - \frac{1}{A}\right)\right)}{\sum_{a=1}^{A}\left(\frac{P_{ga}}{P_{g\bullet}} - \frac{1}{A}\right)^2}$ $= \frac{p_1' W p_1}{p_1' p_1}$
Cross-group Moran	$Cross\ M_g = \frac{p_1' W p_2}{p_1' p_1}$
B. Localised measures	
Getis and Ord G*	$G_{ga}^* = \frac{\left(W\frac{P_{gn}}{P_{\bullet n}} - \frac{\overline{P_{ga}}}{P_{\bullet a}}\right)}{S\sqrt{\frac{(A\sum_{n=1}^{A} w_{an}^2 - 1)}{(A-1)}}}$ Where $S = \sqrt{\left(\sum_{n=1}^{N_a}\frac{\left(\frac{P_{ga}}{P_{\bullet a}}\right)^2}{A}\right) - \frac{\overline{P_{ga}}}{P_{\bullet a}}^2}$

Note: P_{ga} refers to the population of group g (=1,2,...,G) in area a (=1,2,...,A). A subscript dot refers to the sum over that particular subscript. $\frac{\overline{P_{ga}}}{P_{\bullet a}}$ refers to the mean share of group g in an area, averaged across all areas. Each area a has a set of neighbourhood areas that are indexed by n and numbered from 1 to N_a. w_{an} is an element of an A by A spatial weight matrix W, row standardised by population shares. For the Moran indices, p_i is an A-vector of population shares of group i.

Global fixed boundary measures

One of the most common global fixed boundary measures cited in the literature is the index of dissimilarity (Duncan & Duncan, 1955). The index measures the proportion of people in a population subgroup that would have to relocate in order to make their distribution identical to that of a reference group. When the index is computed between one group and all other groups combined, it is known as the *index of segregation*. Such segregation indices for ethnic groups in Auckland have been calculated by Johnston et al. (2009). The segregation index is simple to calculate, present and interpret but, as with other global indices, provides very limited information on clustering patterns. It does not reveal whether the areas in which a group is over-represented are clustered together, or whether they are spatially dispersed, as on a checkerboard (Brown & Chung, 2006; Johnston et al., 2009). Interpretation of the segregation index is problematic where groups are of different sizes, as the equalizing reallocation of people may then lead to large changes in the populations of areas. We focus on a variant of this index, the *adjusted segregation index*, which indicates the number of "swaps" required to create a spatial distribution for both the target group and non-target group to be equal to the average distribution (van Mourik et al., 1989), while maintaining the size of each area.

Isolation indices provide a different perspective on residential sorting patterns. They measure the extent to which people locate with other members of their own group. We present an index based on the average group-share experienced by members of a group. Consider a group accounting for 5 percent of the population. If spatially segregated, group members may on average live in areas in which, say, 10 percent of the population belongs to the group. Normalising this measure so that it equals 0 when the group accounts for the same proportion of each area, and 1 when they live only in areas where they account for the entire population, we have an isolation index (*IsI*), as in Cutler et al. (1999).

The degree of spatial sorting can be captured by examining how unequal group shares are across areas. The *Gini coefficient* is a commonly-used inequality measure in this context. A Lorenz-type location curve is constructed through plotting the cumulative percentage of group population in an area on the vertical axis and the cumulative percentage of

the total population from that area on the horizontal axis, where observations are ordered from the smallest group proportion to the largest group proportion. If a group is identically distributed to the total population, the Lorenz-type curve would coincide with the 45 degree line. The total area between the realised Lorenz-type curve and the 45 degree line gives the Gini coefficient of segregation.

The two final global concentration measures that we consider are the closely-related Ellison & Glaeser (1997) and Maurel & Sédillot (1999) *concentration indices*, denoted EG and MS respectively. Both are derived as the correlation between location decisions made by members of a particular group, which can be positive or negative. The measures were originally derived to capture the geographic concentration of firms within an industry. The formulae shown in Table 1 differ from the original formulations to reflect the focus on people rather than firms. Unlike firms, which differ in size, all people carry equal weight, so that the final term in both the numerator and denominator is $1/P_g$ rather than a Herfindahl index, as in the unweighted index of Maurel & Sédillot (1999). A value of zero for either of these indices would indicate a lack of residential sorting. The two indices differ only in the term shown in parentheses in Table 1. The EG index has a more positive value for groups that are concentrated in areas with higher shares of the overall population, as described in Maré (2005).

Global spatial measures

The measures presented so far do not reflect whether areas of concentration are spatially close to each other, or are in isolated pockets. *Moran's I* is a common global measure of spatial autocorrelation which indicates whether spatial dispersion is random or not. It measures the correlation between individual observations and spatially weighted neighbouring observations.[1] It ranges between -1 and 1. The index can be calculated for various definitions of neighbourhood, to capture the strength of correlation over different distances. Moran's *I* can be calculated as the coefficient on area composition in a regression of neighbourhood composition on area composition (Anselin, 1995; Gibson, 2006), though the standard errors differ from the regression standard errors due to spatially correlated errors.

An analogous *Cross-Moran's I* can be calculated to reflect correlation between a group's concentration in an area and the concentration of another group in the surrounding neighbourhood. The cross-Moran's index may be greater than one in absolute value.

Localised spatial measures

Global measures provide "no information with which to identify the location, size, number and intensity of each group's clusters" (Johnston et al., 2009, p.6). To provide a richer summary of concentration patterns, it is necessary to use localised measures, which can then be projected onto maps to show the geography of concentration. We rely on Getis and Ord's G* index to identify areas of neighbourhood clustering significantly different from the average situation in the total study area (Ord & Getis, 2001; Johnston et al., 2009). The index is a normally distributed z score under the null hypothesis of no spatial clustering. A value of G* for an area that is greater than 1.96 indicates that there is less than a 2.5 percent chance that the high degree of concentration that is observed in a neighbourhood around (and including) an area would be observed if location decisions were random. As with other spatial measures such as Moran's I, the distance used for analysis of the neighbourhood can be altered to model clustering at varying definitions of neighbourhood.

Alternative localised measures are possible, but not included in the current study. A localised Moran's LI_{ga} decomposes the global Moran's I into the contributions of each individual area. The sum of all LI_{ga}'s is therefore equal to the global Moran's I value (when the weights matrix has been row-standardized). The Location Quotient (LQ) is another commonly used localised measure based on fixed boundary areas rather than neighbourhoods. The LQ index compares the percentage of a group living in an area to the percentage of that group living in the total study area (Brown & Chung, 2006), indicating whether a group g is over-represented or under-represented in each individual area analysed. We prefer Getis and Ord's G* because it has a clear statistical interpretation, and captures correlations across area boundaries.

Random and systematic segregation

Carrington and Troske (1997) point out that substantial segregation can arise when location is observed across small spatial units, and for groups that account for a small proportion of the overall population. They suggest a modification to standard segregation measures, which they refer to as an 'index of systematic segregation'. This index captures the amount of segregation that occurs in excess of what would occur if allocation across areas were random. For each of the segregation indices listed above, we calculate an analogous measure of systematic segregation. For each population subgroup, we simulate a random allocation using a binomial distribution where the number of group members in an area is simulated based on the actual area population and expected probability equal to the group's share of the total Auckland population. We calculate the value of each segregation measure (Z) in each of 25 independently simulated random allocations. We use the average of these 25 simulations as the estimate of the segregation that would be measured with random allocation (Z_R), and present an index of systematic segregation using the following formula: $Z_{Systematic} = (Z - Z_R)/(1 - Z_R)$. The form of the Isolation Index is already similar to this, so the systematic version is calculated by replacing the actual population share with the Isolation Ratio that would be observed with random allocation, using the following formula: $IsI_{Systematic} = \left(ISR_g - ISR_{g,R}\right)/\left(1 - ISR_{g,R}\right)$.

Data

We used data from the 2006 Census of Population and Dwellings. Unit record data were accessed in the restricted environment of the Statistics New Zealand Data Laboratory under conditions designed to meet the confidentiality and security provisions of the Statistics Act 1975. We examined residential location at the finest available spatial scale – meshblocks. These vary in size, from part of a city block to large areas of rural land. The Auckland Urban Area contains 8629 meshblocks, with an average population size of 137 people. In accordance with strict confidentiality rules, all summary statistics and counts are based on data randomly rounded to base 3.

Our analysis is restricted to people aged over 18 years and living in the Auckland Urban Area, and distinguishes subgroups defined in terms of

self-reported ethnicity, age, income, highest qualification, and country of birth.

The variable ethnicity is self-identified, reflecting the group or groups to which people feel that they belong. The main ethnic groups defined in the 2006 Census by Statistics New Zealand are New Zealand European, Pacific Peoples, Māori, Asian and Other. One person can belong to multiple ethnic groups. When we analyse sorting by ethnicity, people stating multiple ethnicities are counted in more than one ethnic group. Grbic et al. (2010) show that the difference between using mutually exclusive ethnic categories and non-mutually exclusive categories as defined here is very small.

Although ethnicity is a standard dimension along which to measure segregation, it is very broad. Asian ethnicity, for instance, encompasses a wide range of different cultures and country groups. Similarly, Pacific ethnicity refers to a number of distinct cultural groups. We therefore also analysed sorting on the basis of country of birth, which provides a somewhat more detailed breakdown. It complements the ethnicity analysis, since country of birth classification masks the diversity and sorting within the New Zealand-born population, and conflates the possibly distinct sorting patterns for recent and established immigrants. Country-of-birth analyses are presented for each of the 10 largest source countries, including New Zealand.

We used two measures of income – personal and household. For each measure, we divide the population into three groups. Personal income was classified as high if over $50,000 per year, low if below $20,000 per year, and medium otherwise, with a quarter to a third of people in each category. Data on personal income was missing for 11 percent of individuals.

Household income was estimated by aggregating incomes within a dwelling and adjusting for the number of people, and was equivalised by dividing total household income by the square root of the number of individuals, as in Atkinson et al. (1995). Where income was missing for some individuals within the dwelling, either because an individual was absent on census night or because a valid response was not recorded, the individual was assigned the mean income of other residents at the dwelling. Data on household income was missing for 6.6 percent of individuals. Non-missing values were classified as low if annual household

income was below $20,000 (18 percent of residents), and high if it was above $55,000 (33 percent of residents).

To measure educational attainment, qualification variables were created based on Statistics New Zealand's highest qualification indicator which combines highest school and post school qualifications. Our results focus on two qualification groups – those with no qualifications, accounting for 17 percent of the population, and those with a degree qualification, referred to as 'high' qualifications (19 percent of individuals).

Age was classified into four general categories: young (18-29), early middle age (30-49), late middle age (50-65) and retired (65 plus).

Geographical coordinates for the centroids of meshblocks were calculated in ArcGis (for meshblocks with multiple shapes, the centroid of the largest shape was used). For the calculation of spatial measures such as Moran's *I,* a row-standardised spatial weight matrix was used. This gives zero weight to meshblocks with centroids further than a defined distance (one kilometre in our main results) from the meshblock centroid and weights 'close' meshblocks in proportion to their populations. Weighting by population ensures that spatial lags of population shares represent the neighbourhood composition. Using a population-weighted, row-standardised weight matrix, the *I* statistic can be calculated as the coefficient on group share in a regression of a group's share of 'neighbourhood' population on the group's share of meshblock population. The calculation of standard errors is more complicated. We calculated standard errors under alternative assumptions of standardisation and normality (Cliff & Ord, 1981; Maré, 2005; Pisatio, 2001). All Moran's *I* statistics reported in the paper are statistically significant.

We classified the population on the basis of individual characteristics. Household income was treated as a (shared) characteristic of individuals within a household. Focusing on individuals is a common approach in studies of residential location (Andersson et al., 2009; Cutler & Glaeser, 1997; Eberts & Gronberg, 1981; Reardon et al., 2008), although comparable studies have focused on household characteristics, reflecting the relevance of household decision making for location choice (Bayer & McMillan, 2012; Jargowsky & Kim, 2005; Iceland et al., 2010). Our measures of residential sorting thus included the influence of the sorting of individuals into households, as well as sorting across areas.

Results

The Auckland Urban Area contains a diverse population mix. The first column of Table 2 summarises the composition of the adult population along six key dimensions – ethnicity, age, country of birth, qualification, individual income and household income. Compared with New Zealand overall, Auckland had a high proportion of people identifying themselves as of Asian ethnicities (19.1 percent compared with around 9 percent nationally), and also a low proportion of people born in New Zealand (57.6 percent, compared with 73.2 percent nationally). Aucklanders also had higher incomes and higher qualifications than average.

The remaining columns of Table 2 present global measures of residential segregation, as described above. The overall picture is of relatively strong ethnic sorting, with people identifying with Pacific ethnicities having the highest level of segregation on most measures. These findings are consistent with the findings of Johnston et al. (2009) and of Grbic et al. (2010), who find Pacific to be the most segregated group, with Māori and Asians experiencing lower segregation in more recent times.[2] We extend these previous findings to show evidence of sorting of immigrants by country of birth. We also document less pronounced sorting by personal and household income, by qualification, and by broad age group.

Table 3 contains analogous information to that in Table 2, adjusted for the degree of segregation that would be measured if groups were randomly allocated across meshblocks. Appendix Table 1 shows the index values arising from random allocation. Some of the measures suggest substantial segregation even when there is none. The overstatement is particularly pronounced for small population groups, and for the segregation index, Gini coefficient, and Maurel-Sédillot index. Given these biases, and our interest in small groups such as country-of-birth subpopulations, our presentation and interpretation will rely primarily on the measures reported in Table 3.

Table 2: Global segregation measures: Auckland Urban Area

	Percent of population 18yrs + (%)	Isolation ratio (%)	Isolation index (×100) (%)	Segregation index (%)	Adj Segregation index	Ellison-Glaeser index (×1000)	Maurel-Sedillot index (×1000)	Gini (%)	Weighted Moran (1km)
Ethnicity									
European	60.5	70.5	25.2	42.9	20.5	0.02	0.02	19.5	0.72
Asian	19.1	32.1	16.1	41.5	12.8	0.11	0.15	47.6	0.54
Pacific	11.1	35.6	27.5	58.4	11.6	0.28	0.27	66.0	0.74
Māori	8.3	16.5	8.9	38.4	5.9	0.12	0.11	45.6	0.58
Birthplace									
NZ	57.6	61.3	8.7	24.3	11.9	0.01	0.00	7.0	0.51
UK	7.9	12.4	4.9	31.3	4.6	0.07	0.08	39.1	0.57
PRC	5.5	15.5	10.6	52.7	5.5	0.32	0.39	68.2	0.44
Samoa	3.5	15.8	12.8	63.6	4.3	0.43	0.43	76.7	0.64
India	2.8	9.9	7.3	55.0	3.0	0.34	0.40	72.0	0.38
Fiji	2.7	10.4	7.9	56.5	3.0	0.38	0.43	72.5	0.45
S.Africa	2.0	7.0	5.1	53.4	2.1	0.27	0.34	70.2	0.49
Tonga	1.7	10.9	9.4	70.1	2.4	0.55	0.58	82.6	0.50
Korea	1.6	8.5	7.1	65.4	2.0	0.67	0.80	82.1	0.39
Australia	1.5	3.8	2.3	37.1	1.1	0.04	0.10	49.0	0.15
Income									
Below $20k	33.7	36.3	3.9	15.9	7.1	0.01	0.02	10.2	0.30
$20k - $55k	25.6	27.4	2.4	13.6	5.2	0.01	0.01	8.3	0.26
Above $55k	29.7	35.8	8.7	26.4	11.0	0.03	0.02	21.7	0.59
Household income									
Below $20k	18.1	23.4	6.5	25.6	7.6	0.04	0.05	26.6	0.30
$20k - $55k	42.0	45.6	6.2	19.8	9.6	0.01	0.01	10.8	0.32
Above $55k	33.3	42.2	13.4	31.6	14.1	0.04	0.04	25.8	0.53
Qualification									
None	16.9	22.9	7.2	28.9	8.1	0.04	0.04	29.5	0.65
High	19.4	26.6	9.0	30.6	9.6	0.05	0.05	32.2	0.71
Age									
18-29	24.5	29.7	6.9	21.4	7.9	0.05	0.08	19.6	0.49
30-49	42.1	44.4	4.1	15.2	7.4	0.01	0.00	6.3	0.20
50-65	21.1	23.9	3.6	17.9	6.0	0.02	0.01	18.4	0.29
Over 65	12.3	22.3	11.5	31.5	6.8	0.17	0.18	37.2	0.20

Table 3: Systematic global segregation measures (Carrington & Troske, 1997): Auckland Urban Area

	Percent of population 18yrs + (%)	Isolation ratio (%)	Isolation index (×100) (%)	Segregation index (%)	Adj Segregation index	Ellison-Glaeser index (×1000)	Maurel-Sedillot index (×1000)	Gini (%)	Weighted Moran (1km)
Ethnicity									
European	60.5	70.5	25.2	38.9	17.9	0.02	0.02	19.0	0.72
Asian	19.1	32.1	16.1	36.3	10.5	0.11	0.14	45.4	0.54
Pacific	11.1	35.6	27.5	53.6	9.8	0.28	0.26	63.3	0.74
Māori	8.3	16.5	8.9	30.3	4.2	0.12	0.10	39.8	0.58
Birthplace									
NZ	57.6	61.3	8.6	19.0	9.0	0.01	0.00	6.3	0.51
UK	7.9	12.4	4.9	22.0	2.9	0.07	0.07	32.2	0.57
PRC	5.5	15.5	10.5	44.9	4.1	0.32	0.37	63.1	0.44
Samoa	3.5	15.8	12.7	55.9	3.1	0.43	0.41	70.9	0.64
India	2.8	9.9	7.3	44.1	1.9	0.34	0.37	63.5	0.39
Fiji	2.7	10.4	7.9	45.6	2.0	0.38	0.40	63.8	0.45
S.Africa	2.0	7.0	5.1	39.5	1.2	0.27	0.30	57.8	0.49
Tonga	1.7	10.9	9.3	60.2	1.5	0.55	0.53	74.2	0.50
Korea	1.6	8.5	7.0	53.4	1.2	0.67	0.75	72.9	0.39
Australia	1.5	3.8	2.2	14.4	0.3	0.04	0.05	21.4	0.15
Income									
Below $20k	33.7	36.3	3.8	9.8	4.2	0.01	0.01	8.4	0.30
$20k - $55k	25.6	27.4	2.3	6.7	2.4	0.01	0.00	5.6	0.26
Above $55k	29.7	35.8	8.6	20.8	8.3	0.03	0.02	19.8	0.59
Household income									
Below $20k	18.1	23.4	6.4	18.8	5.2	0.04	0.05	23.2	0.30
$20k - $55k	42.0	45.6	6.2	14.2	6.7	0.01	0.01	9.5	0.32
Above $55k	33.3	42.2	13.3	26.6	11.4	0.04	0.04	24.2	0.53
Qualification									
None	16.9	22.9	7.2	22.2	5.8	0.04	0.03	26.0	0.65
High	19.4	26.6	8.9	24.5	7.2	0.05	0.04	29.4	0.71
Age									
18-29	24.5	29.7	6.9	15.0	5.3	0.05	0.07	17.0	0.49
30-49	42.1	44.4	4.0	9.2	4.3	0.01	0.00	5.0	0.20
50-65	21.1	23.9	3.5	10.8	3.4	0.02	0.01	15.3	0.29
Over 65	12.3	22.3	11.4	24.0	4.8	0.17	0.18	32.8	0.20

Sorting by ethnicity

Residents with Pacific ethnicity accounted for 11.1 percent of the adult population in the Auckland Urban Area. The isolation ratio shows that, on average, they lived in areas where 35.6 percent of the population was Pacific, giving an isolation index value of 27.5. The next-most isolated ethnic group, with an isolation index value of 25.2, was European. On average, they lived in areas that were 70.5 percent European, despite being only 60.5 percent of the population. Although the geographic concentration of minority ethnic groups has been the focus of prior studies, the distinct location patterns of the majority European group are an equally relevant factor in Auckland's population geography. This fact is further reinforced by the adjusted segregation index, which indicates that 17.9 percent of Auckland residents would have to swap places to achieve equal distribution of European and non European populations across meshblocks. Lesser changes would be needed for Asian (10.5 percent) Pacific (9.8 percent) or Māori (4.2 percent).

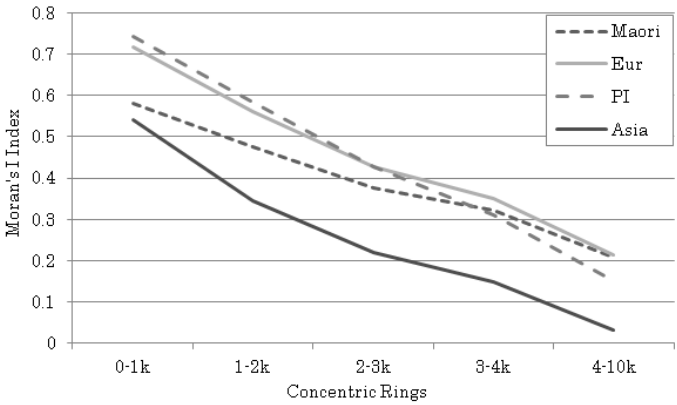
The closely related Ellison-Glaeser and Maurel-Sédillot indices capture the relatively strong correlation between location choices among Pacific peoples. The scale of the indices is affected by the number of spatial units used in the calculations. Due to the fine spatial scale, with over 8,000 meshblocks, the values presented here are much smaller than those reported for industry clustering by Ellison & Glaeser (1997), Maurel & Sédillot (1999) or Maré (2005). We multiplied the index values by 1,000 to improve readability, and we focused on relative index sizes. In contrast to the indications from the isolation and adjusted segregation indices, the correlation of location choices among European residents was much lower than for other groups. The measured isolation of Europeans, and the strength of their segregation, thus reflect the fact that they were numerically dominant, and is not a result of correlated location choices. Asian and Māori ethnic groups had intermediate levels of concentration.

The Gini coefficient shows moderately strong inequality of population shares for all groups, confirming the insights from the other measures. Shares were more unequally distributed across areas for Pacific than they were for Māori or Asian ethnic groups, and least unequal for the European ethnic group.

The final columns of Table 2 and Table 3 present Moran's *I* index, which summarise the extent to which concentrated meshblocks were located close to each other. It thus provides quite different information from that provided by the other global indices. The highest spatial autocorrelation measured by Moran's *I* (0.74) is for the Pacific ethnic group. The value of 0.74 indicates that meshblocks where a relatively high proportion of residents are of Pacific ethnicity are likely to have other high-Pacific meshblocks within one kilometre. The index value for European ethnicity is similar (0.72), indicating that concentrations of Europeans are also likely to extend across contiguous meshblocks. Moran's *I* values for Māori (0.58) and Asian (0.54) groups are not as high, but still suggest strong spatial correlation.

The values of the Moran index presented here are considerably higher than those presented by Johnston et al. (2009), whose study also used 2006 Census data for the Auckland Urban Area. Our study measured spatial association at a smaller spatial scale of one kilometre whereas they used a scale of around four kilometres to ensure that all meshblocks had at least one neighbour.[3] Figure 1 shows the relationship between Moran's *I* and the distance at which neighbourhoods are measured. Results are compared for neighbourhoods defined as concentric rings of varying width around, and distance from, each meshblock. The strength of spatial autocorrelation declined as we captured more distant neighbourhoods and calculated a weighted average across a larger number of meshblocks.[4]

Figure 1: Distance decay in Moran's *I* by ethnicity



The Māori values of the Moran's *I* index suggest that each ethnic group is concentrated in one or more clusters of neighbouring meshblocks. A single index value is, however, consistent with a broad range of spatial patterns. To understand the patterns that lie behind the global measure, we use a localised measure of concentration – the Getis and Ord G^* index, which is mapped in Figure 2. The darkest shaded areas reveal where each group is most strongly clustered and the lightest shades show areas in which a group is significantly underrepresented. The strongest concentrations of Pacific Peoples and Māori were in the south of Auckland urban area and pockets in the west. Māori clusters extended further down to Papakura. These two groups were underrepresented in northern and central Auckland, as well as in the east. The Asian population was strongly clustered in the eastern suburbs such as Howick, non-coastal North Shore and in central Auckland, most probably due to the large student population in this area. Asian people were largely absent from those areas with high Pacific Island, Māori or European populations such as Titirangi and Devonport (which are largely European areas) and Manukau. European clustering appears to be of a more dispersed form, in addition to Titirangi and Devonport; pockets of clusters occur at Mission Bay and along coastal North Shore.

The maps indicate that people of Māori and Pacific ethnicities have similar spatial distributions. The strength of such relationships can be measured using the Cross-Moran index. Table 4 presents the values of the cross-group Moran index for ethnicity groups.

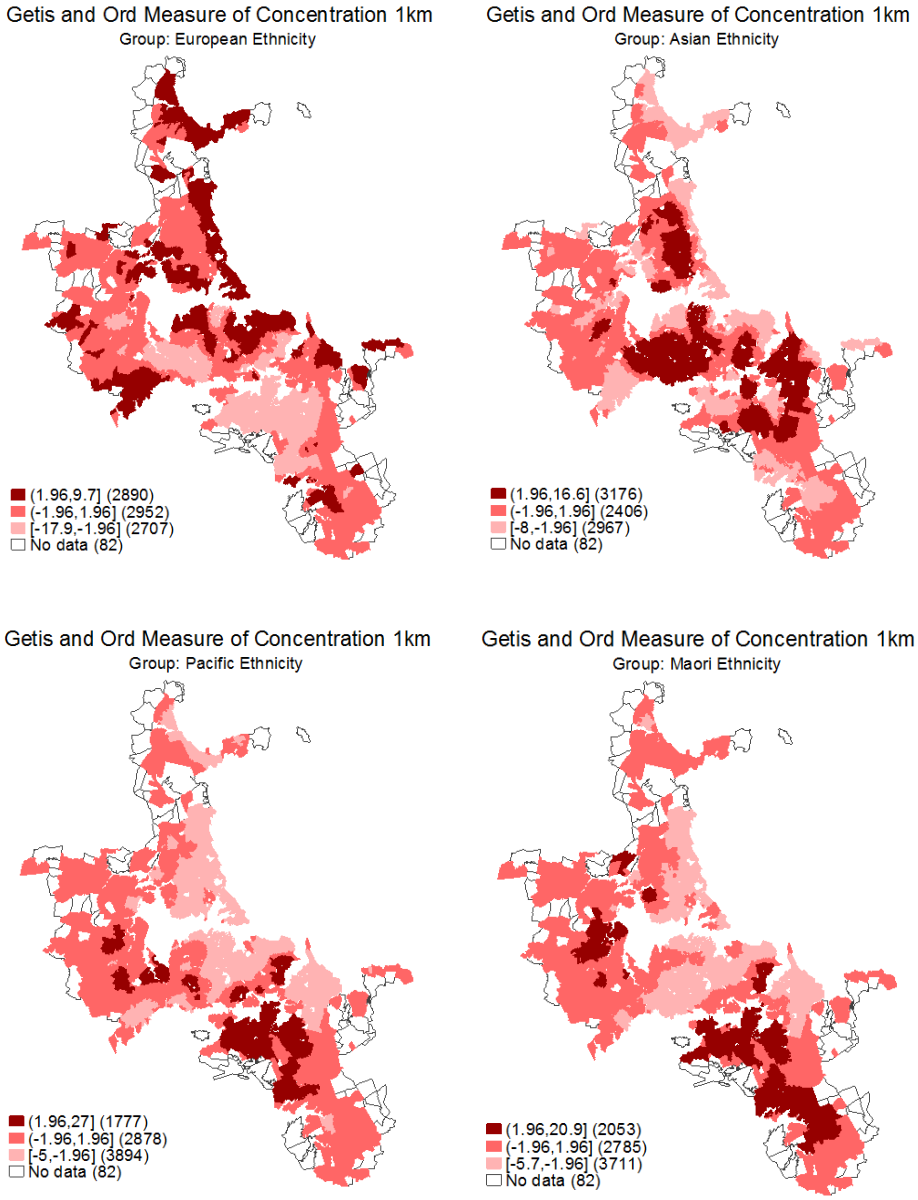
Table 4: Co-location indices – Cross-Morans by ethnicity

	Neighbourhood %			
Meshblock %	European	Asian	Pacific Island	Māori
European	0.716	-0.176	-0.400	-0.112
Asian	-0.426	0.541	-0.078	-0.089
Pacific Island	-0.867	-0.074	0.742	0.204
Māori	-1.000	-0.335	0.843	0.580

Note: Highlighted cells are Own-group Moran's I indexes, as shown in Table 2.

As expected there was a very high index value between Māori and Pacific Peoples of 0.84, indicating that a meshblock with a high Māori proportion will be highly likely to have a neighbourhood strongly represented by Pacific Islanders. Interestingly, the reverse is less true. A meshblock with a high Pacific Islander proportion was not surrounded by a neighbourhood strongly represented by Māori. Both groups tended to locate away from Europeans, as reflected by the negative index values of -1 and -0.867 respectively. Cross-Moran results also confirm that Asians tend not to locate close to European, Pacific or Māori. These results echo the findings of Johnston et al. (2009), who found considerable overlap between Māori and Pacific clusters: three-quarters of meshblocks where Pacific Islanders were over-represented also showed Māori over-representation. Similarly, Johnston et al. (2005) found that 20 percent of Māori lived in meshblocks that were at least 40 percent Pacific in their composition.

Figure 2: Maps of residential segregation in Auckland, by ethnicity, 2006



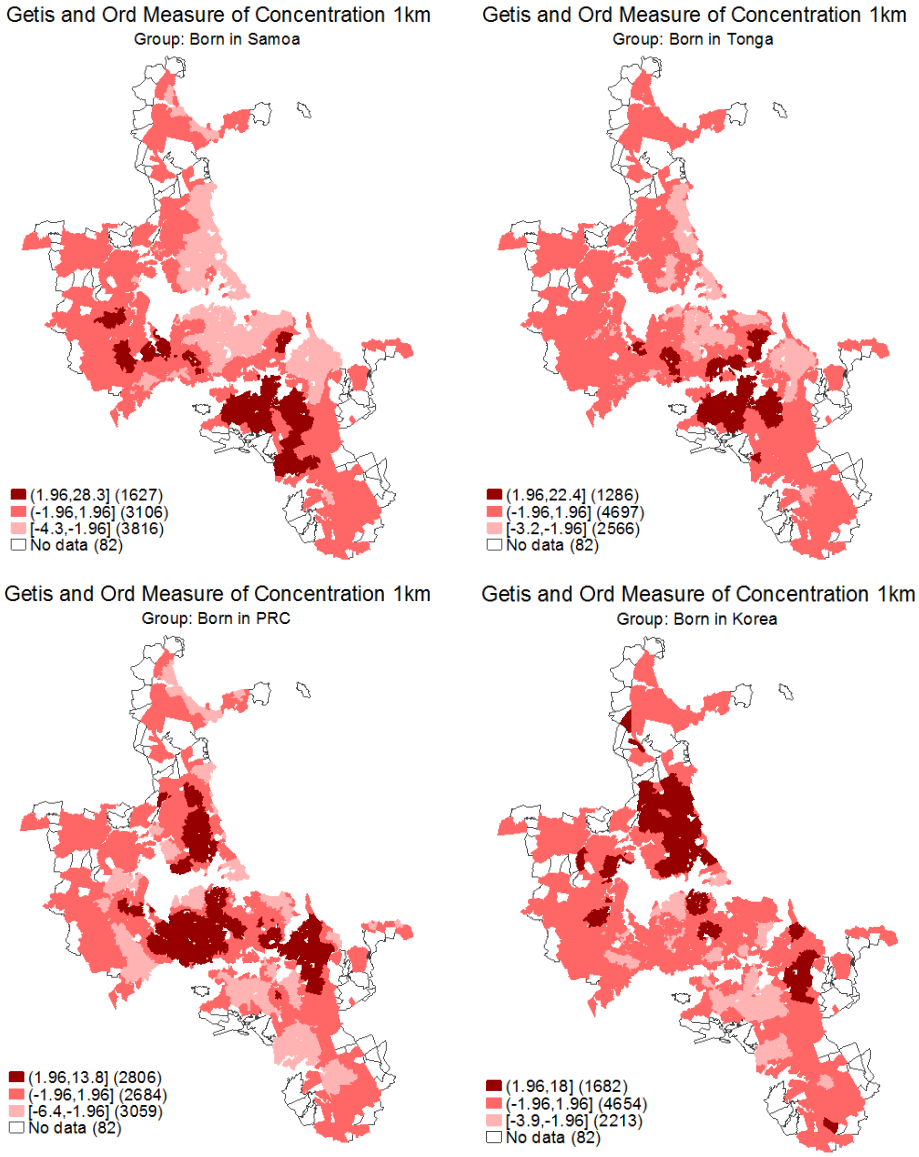
Sorting by other characteristics

One major limitation of measuring sorting on the basis of ethnicity is that ethnic classification are very broad, and may obscure patterns of sorting within or between ethnic subgroups. To complement the analysis of ethnic sorting, we therefore present summary measures of sorting by the 10 main countries of birth.

There is not a simple relationship between ethnic and country of birth classifications. All ethnicities are represented among the New Zealand born, and other countries also have more than one dominant ethnic grouping, as in the case of Fiji, which contains substantial subpopulations of Asian (Indian) and Pacific ethnicity. Furthermore, sorting by country of birth will reflect the residential patterns of recent migrants, which may differ from those of their more established compatriots.

The country-of-birth patterns presented in Table 3 show residential segregation of immigrants from each of the 10 main source countries. The strength of segregation is, however, particularly strong for Samoan and Tongan immigrants, and for Korean and Chinese (PRC) immigrants, consistent with the ethnicity results for Pacific and Asian groups. The value of the isolation index is highest for Samoan (12.7) immigrants and also high for Tongan (9.3) immigrants. These groups also have high values of EG and MS indices. Furthermore, both Samoan and Tongan neighbourhoods extend over adjacent meshblocks, with values of Moran's I index of 0.64 and 0.50 respectively, though neither is individually as spatially correlated as the Pacific ethnicity group overall, reflecting that Samoan and Tongan neighbourhoods tend to be close to each other. The similarity of Samoan and Tongan spatial distributions to each other, and to the distribution of residents of Pacific ethnicity, is shown in the upper panels of Figure 3.

Figure 3: Maps of residential segregation in Auckland by selected countries of birth, 2006

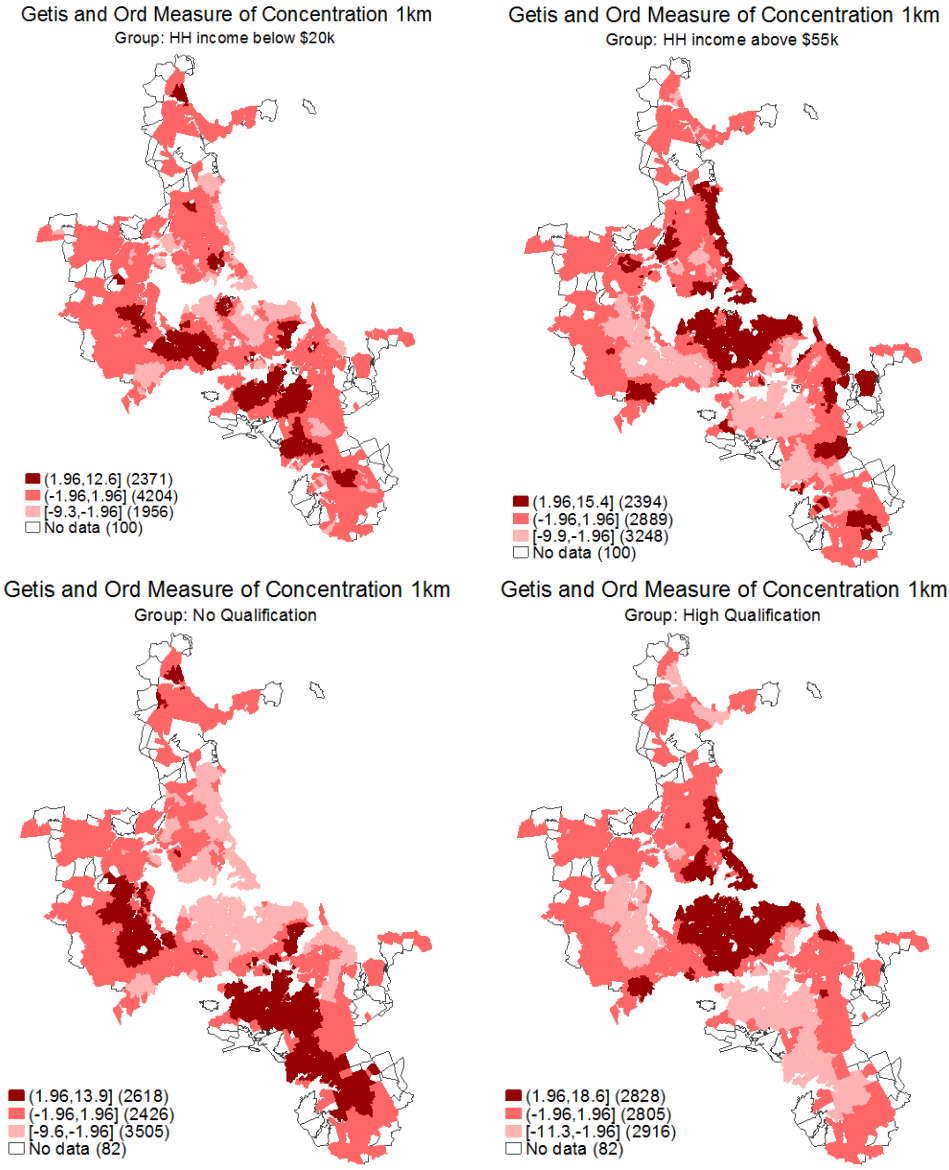


Korean immigrants showed the strongest correlation of location decisions, as measured by the EG and MS indices, though the degree of spatial autocorrelation (Moran's *I* of 0.39) was not as strong as for other country of birth groups. This suggests that Korean immigrant segregation may occur in a number of spatially separate pockets (see Figure 3). The spatial distributions for two of the main source countries for the Asian ethnic group, Korea and the People's Republic of China, differ markedly. The distribution of immigrants from India (not shown), another significant source country for the Asian ethnic group, has a distinct pattern that overlaps with but does not coincide with either the Chinese or Korean patterns. The distribution of the Asian ethnic group therefore provides a poor indication of the distribution of the distinct country-of-birth communities that it contains. Finally, immigrants from the UK and from South Africa displayed relatively low levels of isolation, segregation and concentration, but they sorted into neighbourhoods that were spatially close to each other, as indicated by relatively high values of Moran's *I*.

Sorting on the basis of ethnicity and country of birth is considerably stronger than sorting on other factors tabulated in Table 3, such as income, qualification and age. Residents with high or low levels of personal or household income were more segregated than those with intermediate income levels. High income earners and those in households with high equivalised household income displayed the greatest sorting, and the highest degree of spatial autocorrelation. Sorting on the basis of income is consistent with housing market stratification – an interpretation that is reinforced by the fact that sorting on household income is more pronounced than that on personal income. There is also consistent evidence of sorting on the basis of education. A person's highest qualification is correlated with lifetime income, and is a less volatile measure than annual income, and may thus be more correlated with housing choices. Segregation was somewhat stronger for residents at the upper end of the qualification and personal and household income distributions than for low-income residents and those with no qualifications.

The maps in Figure 4 show the similarities between the distribution of residents with low household income and those with no qualifications, and between the degree-qualified and those with high household income.

Figure 4: Maps of residential segregation in Auckland by household income and highest qualification, 2006



The final panel of Table 3 show patterns of sorting by age. The most pronounced sorting is evident for residents over the age of 65 years, who showed moderately strong isolation, segregation and concentration. However, in contrast with other concentrated groups, the degree of spatial autocorrelation is particularly low for older residents. A likely explanation for this pattern is the existence of small geographic retirement villages and communities that house a larger number of older citizens. In addition, the older members of the 65+ group often move to be close to facilities such as hospitals and social services (see e.g. Baxendine et al., 2005). At a meshblock level, this is picked up by the fixed boundary global indices. However because these are usually small compact areas, clustering at a neighbourhood level, as reported by a Moran's *I,* will undoubtedly be much lower.

Ethnicity and income

Actual patterns of residential sorting are, of course, more complex than is implied by group-specific measures. Particular individuals may belong to more than one subgroup shown in Table 3, and may potentially belong to groups with quite different patterns of residential sorting. The groups may have different degrees of sorting as well as being concentrated in different areas. A fuller understanding of residential patterns in the Auckland Urban Area could be built from examining the interactions and relative strengths of the different influences. In this section, we confine ourselves to a comparison of sorting by ethnicity and by income.

Māori, Pacific and Asian ethnic groups have relatively low average personal and household incomes. Table 5 provides a summary of the differences. Median incomes for Asian residents are 60 to 70 percent of the overall Auckland median. Comparable figures for Pacific and Māori residents are around 80 percent and 90 percent respectively. There is, however, considerable income diversity within each ethnic group. Thirty percent of Auckland residents have incomes over $50,000. Although Asian, Pacific and Māori ethnic groups have lower median incomes, there is still a sizeable proportion of each ethnic group with high incomes (17 percent, 14 percent, and 24 percent respectively). We examine whether members of these ethnic groups live near neighbourhoods that reflect their income or their ethnicity.

Table 5: Income distribution by ethnicity, 2006

	Total popn	Euro (%)	Asian (%)	Pacific (%)	Māori (%)
Median income	$28,700	120	59	79	94
Median hhold income	$43,000	117	72	80	92
Personal income (%)					
Low (below $20k)	34	30	50	38	34
Medium ($20-$50k)	26	26	25	33	33
High (over $50k)	30	40	17	14	24
Missing	11	4	8	15	10

The maps in Figure 2 to Figure 4 highlight similarities between the location patterns of Pacific ethnicity, and country of birth groups and those of low personal income or low qualification groups. We will examine whether high-income Pacific residents had similar locational distribution to the Pacific ethnic group generally. There is a less clear visual similarity between ethnic-based and income-based sorting for Asian residents. Although the Asian ethnic group had the lowest median incomes, the locations of concentrations of Asian residents bore some similarity to those of high-income residents. The lack of clear concordance may reflect the cultural and country diversity within the Asian ethnic group, particularly combining low income tertiary students with households of skilled migrants.

Table 6 presents values of Cross-Moran indices for sub-populations defined by ethnicity and income. The first column shows the strength of correlation between the ethnicity-income groups and the presence of people of similar ethnicity in surrounding neighbourhoods. The indices are strong and positive for all ethnicity-income groups. The first block shows the patterns for Asian residents. The first entry is the Moran's I index, shown in Table 4, for the relationship between the concentration of Asian residents in a meshblock and the presence of Asians in surrounding meshblocks (within one kilometre). The relationship is even stronger when we consider the relationship between the presence of low-, medium- or high-income Asian residents in a meshblock and the prevalence of Asians in surrounding meshblocks. A similar pattern is evident for the other ethnic groups.

Columns 2 to 4 of Table 6 show whether the subgroups locate near residents with similar income levels. The relationships are relatively weak, with no strong evidence of income sorting within any of the ethnic groups.

The most notable pattern is that while high income Asian residents are surrounded by high income neighbourhoods, this is not the case for Māori and Pacific Islanders. The final three columns of the table show a starkly different pattern, with uniformly positive index values. These suggest that co-location near other members of one's ethnic group is a strong pattern, regardless of personal income level of a meshblock or of the surrounding neighbourhood.

Table 6: Co-location indices – Cross-Morans by ethnicity and income

Meshblock %		Neighbourhood % (Income)					
Asian		Low-	Med-	High-	Low-Asian	Med-Asian	High-Asian
Total Asian	0.54	0.13	0.02	-0.11	0.29	0.13	0.09
Low-income	0.90	0.23	-0.02	-0.18	0.49	0.21	0.13
Med-income	1.62	0.34	0.06	-0.39	0.82	0.42	0.26
High-income	2.01	0.22	-0.10	0.11	0.98	0.49	0.42
Pacific		Low-	Med-	High-	Low-Pacific	Med-Pacific	High-Pacific
Total Pacific	0.74	0.09	0.09	-0.40	0.30	0.24	0.06
Low-income	1.62	0.21	0.17	-0.86	0.66	0.52	0.14
Med-income	2.05	0.26	0.26	-1.12	0.82	0.67	0.18
High-income	4.60	0.50	0.67	-2.52	1.81	1.52	0.45
Māori		Low-	Med-	High-	Low-Māori	Med-Māori	High-Māori
Total Māori	0.58	0.08	0.21	-0.61	0.22	0.21	0.07
Low-income	1.16	0.24	0.39	-1.34	0.46	0.41	0.12
Med-income	1.33	0.20	0.51	-1.40	0.50	0.48	0.16
High-income	1.31	-0.17	0.52	-0.77	0.45	0.48	0.22

Summary

The purpose of this paper was to answer three key research questions: First, what is the nature and strength of residential sorting in Auckland? Second, how does this differ for different socio-economic groups? Third, what is the relative strength of sorting by income and by ethnicity?

We have presented a range of empirical indicators to capture different aspects of residential location patterns across the Auckland Urban Area in 2006. We showed that, especially for small population groups and small geographic areas, some of these indices identified segregation even when population groups were randomly allocated across areas. Our main table of results (Table 3) therefore presents measures of 'systematic segregation',

which control for this bias, adopting the approach of Carrington and Troske (1997).

Our main findings with respect to ethnic segregation in Auckland confirm and extend the findings of previous studies. We confirm relatively strong residential sorting for the Pacific ethnic group, and for residents of Asian ethnicity, and a tendency of Māori and Pacific ethnic groups to co-locate. There is also evidence of pronounced sorting of the numerically dominant European ethnic group, although the Ellison and Glaeser (1997) and Maurel and Sédillot (1999) concentration indices show that this does not reflect strong correlation of location choices. We present new evidence on the segregation of immigrants, classified by country of birth. This reveals particularly strong sorting for Korean immigrants, though with less strong spatial autocorrelation than is observed for other groups. The residential patterns of Samoan and Tongan immigrants are characterised by strong isolation, segregation, concentration, and spatial autocorrelation.

We also report measures of sorting by personal and household income, by highest qualification, and by age. None of these groupings shows sorting of the same strength as seen for ethnic and country-of-birth groups. There is evidence of moderate residential segregation by income and qualifications, which is strongest at the top and, to a lesser extent, at the bottom of the income and qualifications ranges. Finally, age segregation is most pronounced for older residents, who are concentrated within meshblocks, though with relatively weak spatial clustering of high-concentration meshblocks.

We explore the relative strength of sorting by income and sorting by ethnicity, through the use of Cross-Moran indices of co-location. Asian, Pacific and Māori ethnic groups are sub-classified according to personal income levels. The location of ethnicity-income subgroups is more strongly related to neighbourhood ethnicity than to neighbourhood income composition.

We will be examining further the patterns of residential segregation by country of birth, to test for evidence that immigrants become more spatially dispersed over time as they become more integrated. We also hope to extend our work to look at the consequences of residential segregation in Auckland on socioeconomic outcomes. This further work will be able to highlight potential policy responses that may be considered in response to our findings.

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Notes

1 Formally, Moran's *I* is calculated as a covariance, scaled by the variance of individual area values, although it is referred to as a measure of spatial autocorrelation.

2 Johnston et al. (2009) estimate an index of isolation, index of segregation, Moran's *I* and G* to the four main ethnic groups over the last four census years from 1991-2006. Grbic et al. (2010) examine the levels of segregation between ethnic minority groups and Europeans using an index of dissimilarity and index of exposure, another basic global index which has not been presented in this paper.

3 We are grateful to Mike Poulsen and Ron Johnston for their generous assistance in identifying the reasons for the differences. In our calculations, 290 meshblocks have no neighbours within one kilometre, and so are omitted from our calculations.

4 Using a one kilometre radius, neighbourhood composition is based on an average of 42 meshblocks. Circle geometry leads to larger numbers for more distance concentric rings: 105 meshblocks within 1-2 kilometres, 191 meshblocks within 2-3 kilometres, 289 meshblocks within 3-4 kilometres, and 1785 meshblocks within 4-10 kilometres. The total number of meshblocks in the Auckland Urban Area is 8,629.

Appendix Table 1: Segregation Indices calculated based on random allocation

Subgroup share of total population (%)	Isolation Ratio	Isolation Index (*100)	Segreg-ation index (*100)	Adj Segreg. index	Ellison Glaeser index (*1000)	Maurel-Sedillot index (*1000)	Gini	Moran (1km)
%	%		%	%			%	
1	1.1	0.06	32.4	0.6	0.00	0.08	44.0	0.00
2	2.1	0.06	23.0	0.9	0.00	0.04	29.2	0.00
5	5.1	0.06	14.8	1.4	0.00	0.02	14.9	0.00
10	10.0	0.05	10.8	1.9	0.00	0.01	8.2	0.00
15	15.0	0.06	9.0	2.3	0.00	0.00	5.4	0.00
20	20.0	0.05	8.1	2.6	0.00	0.00	3.9	0.00
30	30.0	0.04	7.0	2.9	0.00	0.00	2.3	0.00
60	60.0	0.03	6.6	3.2	0.00	0.00	0.7	0.00

Note: Index values are calculated by randomly allocating population subgroups of varying sizes to meshblocks within the Auckland Urban Area, using total meshblock population as observed in 2006. The reported values are based the average of values from 25 independent random allocations using a binomial (n,p) distribution with n=meshblock population and p=subgroup population share.

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A New Approach to Funding the Costs of New Zealand's Ageing Population

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Abstract

Population ageing has major implications for the way in which programmes designed to support older people are funded. While social security and means-tested social assistance programmes for long-term care protect the living standards of the poorest, middle income groups face under-appreciated risks, such as outliving their capital or needing expensive long-term care. This paper proposes a social insurance approach to cover these risks which combines a life-time annuity with long-term care insurance. This funding approach encourages intragenerational cost sharing and thus may lessen potential intergenerational conflict. New Zealand may be in a unique position to design new policies and products of this type which better share the costs of an ageing population.

As older populations age in the Organisation for Economic Co-operation and Development (OECD) countries, new ways may be needed to meet and pay for the associated costs. This is made more urgent in New Zealand because of its large baby-boom cohort born between 1946 and 1966, that will swell the ranks of those aged over 85 by mid-century, and because of the trend for gains in longevity at older ages (Jackson, 2011). While social security and means-tested social assistance programmes for long-term care protect the living standards of the poorest in countries like the United States, United Kingdom and New Zealand, middle-income groups face under-appreciated risks, such as outliving

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capital or needing expensive long-term care. The working age population may be less willing to bear these costs, either as taxpayers or as the children of long-living parents.

Seldom discussed in the New Zealand context is whether the over 65 year old group should both bear more of their own costs, and spread those costs among themselves by means of insurance. This approach to funding would put more emphasis on intragenerational cost sharing and by so doing may lessen concerns about possible intergenerational conflict (St John & Chen, 2010).

In the past, New Zealand occupational retirement schemes often paid an on-going income or pension to retirees. Middle-income retired people with good private pensions in addition to the universal state pension, New Zealand Superannuation (NZS), were able to fund their own health costs including, for some, long-term care (LTC).

Since the 1990s, when tax advantages were removed from all forms of saving for retirement, there has been a marked decline in the use of defined benefit pension schemes that pay an ongoing income in favour of defined benefit schemes that give lump-sums (St John, 2007). Most in the baby-boom cohorts will not have the protection of a pension or annuity to supplement the NZS in old age, but may have illiquid assets, especially housing (St John, 2009).

In 2007, the government introduced an opt-out workplace-based saving scheme called KiwiSaver (St John & Dale, 2011). Breaking with the former tax-neutral policy for saving for retirement, KiwiSaver is subsidised, albeit modestly, in various ways. Despite this, savings accumulated via Kiwisaver will be paid out in a lump-sum in the same way as unsubsidised superannuation savings are. As a result, from 2012, many New Zealand retirees entering retirement will have access to increasingly large lump-sums that must be managed over an uncertain lifespan in an uncertain investment climate, including unknown levels of inflation and possibilities of tax changes.

In countries where annuity markets are significant, the state may compel the annuitisation of either part or all of certain tax-subsidised retirement savings. Special tax advantages may be applied to the annuity itself, or some favourable treatment granted, such as under the state pension's means-test in Australia. Evidence of substantial state intervention in countries with viable annuities markets confirms the

obvious and widespread 'market failure' problem. Conversely, the almost complete absence of an annuities market in New Zealand demonstrates both the efficacy of NZS in providing a basic income and the reality of market failure when there is no explicit state intervention.

To place the issues into context, this paper begins with some projections of the changes that are expected to occur in the age distribution of the New Zealand population over the next 50 years. We then discuss LTC and in particular residential aged care (RAC). We reflect on the justifications for state intervention in the annuities market, including how annuities may be adapted to provide insurance for LTC costs to spread the burden more equitably both inter- and intra-generationally. We argue that state leadership is required because the nature of the insurance problem means that solutions will not arise spontaneously in the private market.

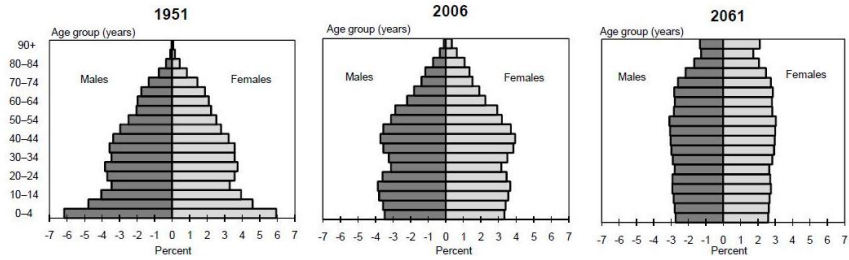
The Demographic Context

Figure 1 shows the New Zealand pattern of structural ageing (growth in the percentage of the older age groups in the population by sex). This pattern follows trends in population ageing in other developed countries, and as Khawaja & Boddington (2010) note,

> … future population projections will require constant vigilance on the part of official statisticians in monitoring international progress in reducing mortality by cause of death at older ages, as well as a rigorous analysis and assessment of the impact of advances in medical knowledge and treatment, to ensure a more realistic figure on future longevity levels and numbers of senior New Zealanders (p.125).

Importantly, Jackson's (2011) research shows that New Zealand had the longest, most pronounced baby-boom of the OECD countries, making numerical ageing very significant regardless of structural shifts. Structural ageing is driven by lower fertility and by a significant loss to net migration at the younger ages, creating a "deep bite in today's age structure at ages 20-39 years" (Jackson, 2011, p.2).

Figure 1: Estimated and projected age-sex distribution

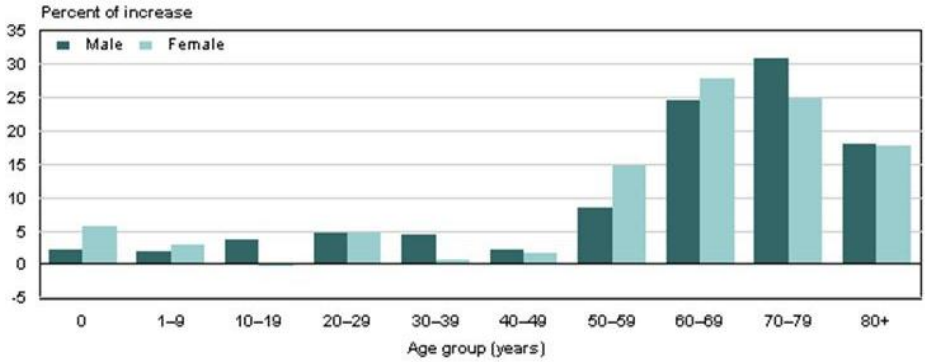


Source: Statistics New Zealand, 2009.

Of particular relevance to care and support needs is the projected increase in number of those aged 85 years and over. The latest national population projections released by Statistics New Zealand (median series) suggest that within the 65+ age group, the number of people aged 85 and over (85+) is expected to increase significantly. From 76,000 in 2012, it is highly likely that there will be 180,000 to 210,000 people aged 85+ in 2036, and 290,000 to 430,000 in 2061. By 2061, about one in four people aged 65+ will be 85+, compared with one in eight in 2012 (Statistics New Zealand, 2012, p.7). Even under series 3, the high mortality projection, the numbers over 85 are projected to grow to 250,200 in 2061. Under series 7, the low mortality projection, there would be 423,000 people aged 85+ in 2061.

Jackson (2011, p.11) argues that the projections for average months life expectancy gained each year have been consistently underestimated even using the low mortality assumptions. One clear trend has been for the increased life expectancy at birth to reflect improvements at the older ages as shown in Figure 2.

Figure 2: Age contribution to increase in life expectancy at birth (percentage); total population by sex, 2000-02 to 2005-07



Source: Statistics New Zealand, 2010.

Long-Term Care

At the last New Zealand census (2006), 5.4 percent of people aged 65+ were in RAC. This comprised one percent of those aged 65-74 years, 5.6 percent of those aged 75-84 years and 21 percent of those aged 85+ (Statistics New Zealand, 2007).

Some of the increased demand for LTC implied by the demographic projections discussed above is likely to be taken up by the shift towards in-home services, and technology improvements (Dale & St John, 2011). To encourage 'ageing in place', several strategies, such as raising the dependency threshold at which a person becomes entitled to subsidised RAC, have already been implemented. When appropriate, in-home care is preferable to RAC for the individual as it maintains independence and community links, among other benefits; and preferable for the state, as the public and private cost of in-home care may be less than for RAC.

The Financing of RAC

New Zealand residents who have been assessed as requiring permanent RAC are eligible for a government subsidy, subject to an asset test that determines eligibility, and an income test that determines their individual contribution to the cost of care. For people with assets below the threshold and income from assets below an exempt level, the government pays up to the full cost of care (over and above the contribution from NZS). Any income above the exempt level goes towards the cost of care up to a

maximum equal to the contract price paid by the local district health board (DHB) for rest home care. If the cost of care exceeds this maximum contribution (as it does for hospital level care) the government pays a top-up subsidy which covers the difference, regardless of a person's wealth.

In 2009/10, New Zealand's DHBs spent $800 million, exclusive of goods and services tax (GST) on RAC, while residents contributed around $650 million inclusive of GST, about $250 million of which came from the residents' NZS. This suggests that about 42 percent of total expenditure on RAC was paid for by the individuals' own state pension or other savings and income (Ministry of Health, personal communication). Of those in RAC, about 70 percent were (fully or partially) state-subsidized while the remaining 30 percent were paying privately up to a maximum limit.

The history of the means test for RAC reflects two tensions: first the desire to ensure that costs are sustainable for the state, and second the desire to reduce the historic harshness of the test which had encouraged older people to divest themselves of assets, sometimes prematurely. In 1999, an incoming Labour-led government promised to remove asset-testing for RAC. However that legislation was slow to emerge and the 2004 Social Security (Long-term Residential Care) Amendment Act did not take effect until July 2005. This legislation raised the thresholds for the asset test, most significantly for a single person, less so for a married couple in care, and least significantly for a married couple with one in care, although the exemption for their house was retained (Table 1). The exemption thresholds were raised by $10,000 each year for all groups. The effect of the changes was immediate with a spike in the numbers of residents who suddenly became eligible for the residential care subsidy (Grant Thornton, 2010). However, from July 2012, asset thresholds will increase each year by the rate of increase in the Consumer Price Index (Auckland District Health Board, 2012).

Table 1: Exemptions under the asset test for residential care subsidy

Years	Single person	Married couple, one in care	Married couple, both in care
1994 - 1998	$6,500	$40,000 + house and car	$13,000
1998 - 2005	$15,000	$45,000 + house and car	$30,000
From July 2005	**$150,000***	$55,000* + house and car ***or $150,000 total assets***	**$150,000***
As at July 2011	**$210,000**	$115,000 + house and car ***or*** $210,000 of total assets	**$210,000**
As at 1 July 2012	**$213,297**	$116,806 + house and car ***or*** $213,297 of total assets.	**$213,297**

Source: Work and Income, 2011; Auckland District Health Board, 2012.
Note: *Exemption levels were raised by $10,000 each year, commencing July 2006 until June 2012.

Initially, there was no intention to change the income test but after hearing submissions, the government decided to exclude from the test any personally-earned income by a spouse whose partner is in RAC. The 2005 changes were based upon a narrow view of fairness that did not consider intergenerational equity issues:

> It is unfair that people aged 65 and over are required to use up their assets to contribute to the cost of their care, whereas younger people are not. The gradual removal of asset testing will balance these important human rights considerations against the very substantial costs involved. The policy is expected to cost $103 million in 2005/2006, rising to $163 million in 2010/11 and $345 million in 2020/21. Around 5,600 additional people are expected to receive the subsidy from 1 July 2005, taking to 70 percent the proportion in care who receive the subsidy. (Dyson, 2003)

Equity Under the Current RAC Means-Test

While the asset-test exemption threshold is being progressively raised, the asset-test itself will never be 'removed', despite the original claims by the government. The $10,000 annual increase is not indexed and represents an average of only 4.7 percent increase per annum over the period 2005-2020. This is little more than an inflation adjustment, providing inflation remains low. The next 30 years would see an annual average increase of just 2 percent and a negligible increase thereafter. Property is a popular asset in New Zealand, and it is likely that another property boom will cause rapid rise in house prices - so that the exemption is set to fall in real terms under the current policy settings. In addition, the family home, irrespective of its market value, is exempt from the asset-test for a couple with one in care, and couples with expensive houses are treated the same

as couples with more modest houses. In New Zealand, tax advantages, particularly the absence of a capital gains tax, are associated with saving via investment in one's own home. The asset-test reinforces this bias, especially as financial assets are comparatively harshly treated.

While the means-test prior to 2005 was in need of reform, and a rise in exempt assets was needed to offset the effects of accumulated inflation, the changes have not resolved many of the existing inequities in the system. For a married couple both in RAC, the exemption is now exactly the same as for a single person, and if they fail the asset-test they must both pay the maximum weekly contribution, whether or not they are sharing accommodation. This creates a perverse incentive to divorce, so they can each access the exemption of $210,000. And although the annual income from assets up to $2,690 for a couple with one in RAC is now exempt from the income-test, this barely provides maintenance of the real value of the exempt $115,000 of joint capital.

In comparison, in the United Kingdom, council-funded home help and care home places for the elderly and adults with disabilities are currently only offered to those with under £23,250 of assets. The Commission on Funding of Care and Support (Dilnot et al., 2011) in July 2011 recommended some changes to the harsh asset-test along the lines of New Zealand's policy. The Report suggested capping the cost of a lifetime of personal care at £35,000 per person. The cost of board and lodging in a residential home should be limited at £10,000 a year per person. The Commission also proposed setting a maximum lifetime cost, in order to allow people to plan ahead for how they wish to meet these costs (thus the possibility of new insurance products); and raising the means-tested threshold at which people will have to start paying for care from £23,250 to £100,000. A new tax may be proposed for removing the exemption for national insurance contributions for those over 65 years.

In New Zealand, single people are now significantly better treated as their asset threshold has been raised from $15,000 in 2005 to $210,000 in 2011. Also, the exemption of a spouse's earned income from the income-test has reduced some of the inequity between married couples with one in care, and single people who may live with others. In addition, from July 2006, a married person whose spouse or partner is in RAC became eligible for the single, living alone rate of NZS, rather than one half of the married rate (Dyson, 2006).

Some wealthier residents requiring care pay their fees entirely out of the income from their assets. As the cost of hospital-level RAC can exceed $1,500 a week, and the cap on personal contributions in 2011 is $786 - $864 per week depending on the region (Ministry of Health website undated), taxpayers are effectively subsidising the further asset accumulation of some RAC residents. As estate duties were abolished in New Zealand in 1992, taxpayers are also effectively subsidising the bequests of such wealthy residents.

However, as the world financial crisis began to impact in 2008, interest income used to pay for the costs of care fell sharply, and residents of RAC facilities increasingly needed to draw down on their capital, the value of which may have been eroded significantly. For the rest of the population, the intergenerational burden increases as, inevitably, more of the costs are shifted to taxpayers through the increased use of the residential care subsidy.

The spectre of asset-testing of RAC may also encourage an early divestment of assets (Frawley, 1995). The use of trusts as a means of asset protection has expanded markedly in the last 20 years, especially among the baby-boom generation. In a 2010 review of the use of trusts, the Law Commission noted:

> ...the residential care subsidy... is often credited with creating a significant incentive for people to transfer assets to a trust. The legislation relating to the subsidy allows a settlor to use a trust to reduce his or her assets and income in order to satisfy the eligibility criteria for the subsidy. In the 2009–2010 year the Ministry of Social Development processed approximately 10,000 applications for the residential care subsidy that involved a trust.

Exacerbating these issues, removal in 2011 of gift duty provided more financial incentives for using trusts to alienate assets that count for the residential care subsidy, and there are no constraints on the use of reverse mortgages to reduce equity in the home to the asset-test threshold. The means test for RAC is still likely to encourage avoidance, even after the raising of the asset thresholds.

For those who require expensive RAC, the current practice of 'user pays' can mean that individual estates are quickly depleted, thus diminishing children's inheritances in an arbitrary way. The capped amount payable by a resident in 2012 varies by district but for Auckland

city is $46,422 (Ministry of Health, 2012, p.1969), requiring a single person to find roughly an additional $30,000 from their own resources to supplement the pension.

Perhaps the most important criticism of New Zealand's approach to financing RAC concerns the implications for intergenerational equity. Those who have taken advantage of avoidance opportunities to protect their assets are better able to provide for their heirs. Subsidising RAC from general taxation redistributes money from the working population to those in care, a burden that will become more acute as the population ages and the proportion of workers in the population declines. If all of the population who are at risk (i.e. all of those aged 65 years and over) were to share more of the costs of the few who turn out to need RAC, the perceptions of intergenerational equity may improve.

Longevity and Long-Term Care Risks

The two important risks faced by those over 65 are:

- The risk of excess longevity: living longer than expected and outliving capital;
- The need for in-home or residential LTC, and the run down in assets before the public program steps in.

New Zealand's state pension, NZS, provides some protection for the longevity risk, but only at a basic income level (Table 2). Average life expectancy at age 60 or 65 is a poor guide to the number of years an individual may actually live, with a spread of mortality around the average (Wadsworth et al., 2001) - some will live more than twice as long as the average. Drawdown products such as fixed-term annuities, or managed funds release can be unsatisfactory when retirees live longer than the average. Today there are few, if any, suitable annuity products to meet the risk of outliving savings. As noted above, fewer employers are offering private pensions and of these, few provide protection from erosion by inflation.

Table 2: The 2012 annual rate of New Zealand Superannuation (NZS)

Individual's status	Annual Net NZS*
Married person (each)	$13,957
Single person sharing accommodation	$16,748
Single person living alone	$18,143

Source: Work and Income (2012).
* Taxed as primary income.

The probability of needing RAC is a function of the probability of living to older age and the probability of needing care at that age. The total cost is determined by the time spent in care and can be highly variable. This suggests there is an insurance problem that a suitable product at age 65 might address.

Private Long-Term Care Insurance

Private insurance works best when the probability of the event occurring is low so that risk pooling among a large population is possible. For example, the probability of needing care at age 95 is too high for insurance at that point to be a rational solution. Private insurance contracts work best for insurers if they are annually renewable so that changes in risks and loss experience can be incorporated into the premium; however, this can leave people vulnerable to being risk-rated out of the market as they age, as is occurring with private health insurance. Suppliers of RAC insurance are affected by the uncertainties of future costs and demands, including the inflation risk, which makes it difficult to price as a single premium product. Exclusions for higher risk purchasers are likely. As Fenn (1999) notes, the risks of getting it wrong in the face of multiple uncertainties are high, and significant loading charges are likely to make the insurance unduly expensive.

As would be predicted, LTC is not well covered by private insurance. Yet there would be gains from pooling risks, as otherwise large costs can fall on the uninsured and/or the financially naïve, and on the state. If each person tries to save enough to pay for the maximum time they might be in care, given that the majority will not need such care, many people will die leaving unplanned bequests. The obvious welfare gains to be had from pooling risks are not well exploited by private providers because of the special difficulties of private LTC the insurance contract. Some of these are discussed in Barr (2001):

- How will the care be allocated? How much, what type and on what basis?
- How might costs and types of care be affected by new technological developments?
- Can premiums rise if the patient becomes more risky (older, or unwell)?
- Will there be a ceiling on reimbursement of the cost of care?
- Is there a maximum duration over which benefits are paid, if so what happens if the individual lives beyond this period?
- How will wage and price inflation affect the cost of care?
- How are disagreements/bankruptcy of the insurer to be dealt with?
- How much insurance is adequate, ie. should there be any minimum level?
- How integrated is it with existing public funding and/or provision for long-term residential care and what if policy changes?

It is clear that an all-encompassing, single-premium product, say at age 65, will be near impossible to draw up, given these and other difficulties. As discussed in Barr (2010), private insurance can cope with risk, but not certainty or uncertainty, and uncertainty makes probabilities of future cohorts requiring care, and the costs of that care, indeterminate. Moreover the independence of probabilities necessary for insurance does not hold: for example, medical advances that prolong life may place everyone in a similar situation. Adverse selection problems are high and may require intrusive questioning from the insurer. Moral hazard may arise from several sources: for example, the person concerned may be more likely to demand care, but there are also worries that the family may encourage older relatives to move into care if there is insurance, "since the cost to him or her (at the time of use) is zero" (Barr, 2010, p. 365).

Given these considerations, the use of private insurance internationally would be expected to be limited. Table 3 gives a breakdown of the different types of public and private sources of funding. New Zealand, along with Australia, Norway, Denmark and Sweden, is unusual in that a high proportion of financing for LTC comes from general revenue sources and none from social insurance arrangements such as social security. Private insurance plays only a very minor role in LTC financing in all OECD countries including New Zealand. Out-of-pocket expenses also

look very low, although the OECD suggests that these may be underestimated, for example, in how the non-custodial expenses of care are accounted for. In New Zealand, the proportion paid out-of-pocket for RAC is certainly significantly higher than the 4.4 percent reported for all LTC because all residents are required to contribute from income or savings towards their cost of care. For many, this contribution is limited to their NZS, which in turn is financed by the state.

Table 3: Long-term care expenditures by source of funding, 2007

Country	HF11	HF12	HF21-22	HF23	HF24	HF25	Total
Switzerland	11.7	27.1	0.4	58.4	2.4	-	100
Portugal	2.0	51.4	1.1	45.4	-	-	100
Germany	12.5	54.7	1.7	30.4	0.6	0.1	100
Spain	61.7	10.2		28.1	-	-	100
Slovenia	18.3	57.1	0.5	24.0	-	-	100
Korea	46.2	30.7		17.8	5.3	-	100
Austria	81.1	0.7		17.1	1.0	-	100
Canada	81.6	0.4	0.4	16.8	-	0.8	100
Finland	77.2	7.6		14.2	1.0	-	100
Estonia	48.2	39.3	0.1	12.4	0.0	-	100
Norway	89.3			10.7	-	-	100
Denmark	89.6			10.4	-	-	100
Australia	88.9		0.3	8.5	-	2.3	100
Japan	44.2	44.8	4.0	7.1	-	-	100
New Zealand	92.0		1.3	4.4	2.3	-	100
Hungary	60.1	30.2	0.9	2.4	6.4	-	100
Sweden	99.2			0.8	-	-	100
France	44.8	54.4	0.4	0.4	-	-	100
Poland	43.1	49.2		0.3	7.4	-	100
Belgium	31.4	58.7	9.8	0.2	-	0.0	100
Iceland	39.4	60.6	-	-	-	-	100
Czech Rep	30.5	69.5	-	-	-	-	100
Netherlands	9.5	90.4	-	-	-	0.1	100

Source: OECD (2007).
HF 11: General government (excl. social security)
HF 12 : Social security funds
HF 21-22: Private insurance
HF 23: Private h-holds out-of-pocket exp.
HF 24: Non-profit institutions serving households
HF 25: Corporations (other than health insurance)
Note: Data on out-of-pocket spending for some of the countries may be underestimated. For example, in the Netherlands, cost-sharing on LTC services is estimated to account for 8 percent of the total LTC expenditure.

To summarise, New Zealand does not provide middle income citizens with a mechanism to annuitise lump-sums on retirement that might protect them from outliving their savings. While NZS provides longevity

protection at a basic level, in the future there will be more emphasis placed on accruing savings, for example, in KiwiSaver. As in other countries, private insurance for LTC in New Zealand is non-existent, or minor.

A Social Insurance Solution

The UK Royal Commission report on long-term care cited by Barr (2001, p.83) concluded that private insurance without state intervention was not ever likely to become significant. In practice, few countries have grappled successfully with providing protection for RAC or in-home LTC costs, but it is increasingly the focus of attention. Japan and Germany have most comprehensively addressed the issue, and Austria, the Netherlands and Korea also have LTC social insurance. Barr (2010) notes:

> Social insurance… differs from private insurance in two important respects. First, because membership is generally compulsory, it is possible … to break the link between premium and individual risk. Second, the contract is usually less specific than private insurance, with two advantages: protection can be given against risks which the private market cannot insure, or cannot insure well (long-term care is one); and the risks can change over time (p. 368).

There is a clear case of market failure both in the provision of suitable annuity products to meet the longevity risk, and in the provision of private insurance for long-term care. Annuities are seen as a lottery, with the size of the annuity critically dependent on the time of retirement, the gender of the retiree, and the way in which inflation impacts on the real value. New Zealand provides a good case of what happens when there is no state intervention of any kind in these markets. With no compulsion to annuitise, no tax incentives in the accumulation phase, and no encouragement of long-term care insurance, the markets are thin or non-existent (St John, 2009). This suggests that faith in market-based solutions is misplaced.

What is required is a re-envisioning of social insurance solutions on grounds of both individual welfare and public interest. Without such insurance, it is likely that capital will be run down too early by those who live a long time, and the costs of supplementary income top-ups, care, and other age-related health expenditures will fall on the working-age population, either through higher taxes or as the families concerned meet the costs of their parents directly or through receiving lower bequests.

Means testing can lead to inappropriate divestment of assets too early in retirement and/or the setting up of trusts to disguise income and wealth. The costs of RAC or in-home LTC fall unevenly and unfairly on the unsophisticated, while the trust mechanism allows cost shifting to the working-age population, an impact that is arbitrary and inequitable.

> … there is a strong case for extending social insurance to provide mandatory cover for long-term care. Social insurance is able to address the major insurance-market problems …, is well understood politically, and in administrative terms piggybacks on to existing arrangements. Such a system should be large enough to cover all, or almost all, the costs of a good standard of care, covering both clinical needs and 'hotel' costs. Topping up should be an option, either from private saving or through supplementary private insurance, if that is available on terms that people are prepared to pay…. As with other elements of social insurance, and increasingly with private insurance, the system should be based on unisex probabilities. (Barr, 2010, p.372)

From a societal point of view, a requirement to annuitise a portion of accrued savings not only spreads the risk of longevity, but prevents the early spending of lump-sums and ensures an income stream to pay for at least some of the costs of healthcare and long-term care later in retirement. This was the thinking behind compulsory annuitisation in the UK where extensive tax subsidies to retirement savings permitted such rules. Unfortunately, as has been argued in the UK, compelling annuitisation without attention to design may simply force people to take unsuitable products.

Intragenerational Funding to Address Intergenerational Inequity

Using suitable insurance mechanisms for intragenerational funding of increasing longevity, RAC, and other risks of old age, improves intergenerational equity by removing some of the burden from the working-age population. Without such insurance, taxes must be higher and some families must bear the disproportionate costs of the asset depletion of their parents. If parents do not have enough resources and become dependent on their children, the children could in turn find it difficult to prepare for their own old age. The shifting and sharing of the burden can become an important rationale for the use of an intragenerational approach to funding long-term care.

In this approach a life annuity plus LTC insurance purchased with a single premium at age 65 or 70 could be designed specifically for middle income groups. This could be made attractive and might capture a wide pool of annuitants. Those who die early and do not need care, along with those who live into old age but do not need LTC (the vast majority of those who survive), subsidize those who do need care. The younger the age of purchase, and the greater number who purchase, the increased sharing of the risk. Those whose health status makes them poor risks for RAC insurance are good risks for life annuities, so that linking the two risks is likely to increase RAC coverage of the population, reduce the need for medical underwriting, and address the issue of adverse selection in the annuities market.

Surprisingly there has been little literature to date devoted to exploring the potential of pooling risks of longevity (requiring lifetime annuities) with the risk of needing RAC. Murtaugh et al. (2001) proposed a method for linking the two risks in a single product in a voluntary market that has the potential to be cheaper by reducing adverse selection, and providing cover for more people. Warshawsky et al. (2002, p.198) argue that the combination of a life annuity and long-term care insurance "has the potential to make them available to a broader range of the population, with minimal underwriting and at lower cost". Mayhew (2009) also explored the affordability of products for the UK market, such as a disability-linked annuity, that might offer some insurance for long-term care.

There is also some interest from some providers of annuities emerging worldwide. For example, preliminary modelling for the UK by actuarial consultants Watson Wyatt Worldwide shows that, for modest reductions in the initial annuity, worthwhile income increases could be paid once RAC became necessary. They see the demand for purchases for such annuities arising later in retirement, at above 70 years (Watson Wyatt Worldwide, 2002).

More recently, the OECD report: *Help wanted, providing and paying for long-term care* (Colombo et al., 2011) has described development of private sector innovations and mixed insurance products. The options include combining LTC insurance products with other types of financial products such as life insurance. The market for combined annuities and LTC insurance exists in both the UK and the US but these annuities still

have a low take-up rate as the purchase requires a significant up-front single premium payment.

There are several issues to consider in designing a life annuity with RAC insurance:

- The age at which the policy is to be purchased.
- The role of deferral of purchase
- The nature of the costs to be covered: the policy may either indemnify the actual costs or pay a specified amount for an assessed condition. For the latter, once the highest level of dependency is diagnosed, the annuity increases by a given factor regardless of the nature of the care chosen
- The size of the policy and whether maximums should apply. This may be important if there are significant subsidies or government guarantees to this product
- The kind of inflation adjustment that applies and who pays for it
- The source of the purchase price. Can it include home equity and if so on what basis? The unlocking of home equity to help pay for this kind of annuity may make it very attractive.

It is unlikely that an enhanced annuity product as envisaged here would be forthcoming without strong state involvement. The next section considers a possible way forward for New Zealand.

A New Approach for New Zealand

We consider here an annuity with a LTC rider for New Zealand. If we start with $16,000 net as the value of NZS for someone in care, another $30,000 would be sufficient to meet the annual capped fee for RAC of up to around $46,000.

Suppose a retiree's private saving, including KiwiSaver, is used to buy an inflation-adjusted annuity of up to $10,000 per annum, an insurance rider could provide that this annuity would treble if the recipient is assessed as needing RAC (St John, 2005). Based on the probabilities of being alive, a purely actuarial calculation at age 65 (averaged for male and female) assuming a real rate of interest of 2 percent, gives the cost of an annual real $10,000 annuity as approximately $140,000 or $150,000 with a

10 year guarantee period (authors' calculations using 2005-2007 mortality data).

If the annuity is designed to treble to $30,000 of LTC when required, then the capital needed to buy this annuity at age 65 should reflect the probability of needing care at older ages and the average length of this care. Tentative modelling based on the combined probability of living to a particular age and being in care at that age with a trebled annuity of $30,000 suggests an additional capital sum for the annuity purchase of the order of $13,000-$14,000. This tentative RAC premium is conditional on the assumptions of a real rate of 2 percent and on assumptions of future probabilities of needing care and does not include overheads. It does however suggest that the cost of purchase at 65 compares favourably with the costs of setting up and running trusts to shelter assets to avoid the RAC asset test.

It must be emphasised the RAC premium would not itself purchase full coverage. The insurance operates on the original annuity, so that the costs of RAC of $46,000 would be paid for from $16,000 net state pension plus $30,000 enhanced annuity. The capital sum required for such an annuity may be made up from KiwiSaver lump-sums, other saving, and possibly a home equity share. The state itself would offer this annuity and provide an implicit subsidy to guarantee inflation proofing. Options such as treating the annuity as an add-on to NZS are possible.

This voluntary option could be offered to the cohort aged 65-74 with the state operating the scheme as social insurance. The implicit premium for in the annuity provision could be used to help pay for the current RAC costs or used to build a trust fund to be drawn on later. Table 4 shows how numbers in the younger 'old' population are expected to rise. Under current Statistics New Zealand's medium assumptions, there will be around 465,000 people aged 65-74 years by 2021.

Table 4. Projected population aged 65-74, 2011 to 2041

Year	Number
2011	325,400
2021	465,900
2031	568,900
2041	550,100

Source: Statistics New Zealand National Population Projections, medium series.

There is little recent detailed information about the distribution of net wealth by age bracket for those over 65. As a proxy, the Survey of Family, Income and Employment (SoFIE), conducted in 2003/04, found that the median net worth among those aged 65 plus was $149,500 but the mean net worth was much higher, at $233,750 (Cheung, 2007, p.9).

Assuming that one half of the four deciles (5th to 9th) use their cash saving, perhaps with a home equity share to buy a capped, inflation-adjusted annuity of up to $10,000, a sizeable fund could be generated by 2021. From this, the state social insurance programme would pay an annual annuity to the annuitant, and a further amount each year to a dedicated RAC fund. To encourage participation, the asset and income test for RAC would remain and be enforced. As successive cohorts enter retirement, there will be a growing number of people providing RAC contributions, and some or all of the funds could be applied on a Pay As You Go basis to care for the existing and increasing frail population.

Conclusion

Rapid demographic change raises important questions about how the costs of ageing can be shared in ways that are both equitable and sustainable. Concern about intergenerational equity is likely to become an increasingly important issue in New Zealand as the population profile begins to change rapidly in the next decade.

As a group, older people in New Zealand have in past decades improved their income and wealth positions, including increased home equity. Thus as a group they appear more able to pay for some of the support they need during old age. Further, owing to better health for at least some members in this group, the financial capability of older people could also be expected to increase from continued part-time or full-time work.

The model considered here would shift some of the costs of ageing from the working aged population to the older population. It would also shift the risks within the retired generation itself from those who live longer and need income over a longer period, to those who do not live as long; and from those who are less healthy (or more dependent) to those who are healthier (or less dependent). Not explored further here is the

possibility of using the enhanced annuity for home-based care, but encouraging less expensive forms of care is clearly important.

By encouraging the older age group to fund more of their long-term care needs themselves, more resources may be freed to meet the increased demands of an ageing population. Such intra-generational risk sharing can improve both the perceptions and the reality of intergenerational equity.

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New Zealand's Sole Parents and their Marital Status: Updating the Last Decade

RACHAEL HUTT *

Abstract

New Zealand's sole parents are often portrayed by both the media and government as being primarily teenagers, never married, welfare dependent, and a growing 'problem' - a discourse which has arisen through the misuse, and/or absence of statistics. This article examines three aspects of New Zealand's sole parents: marital status of sole parents, a factor not often considered; age of parents, a factor frequently misrepresented in the discourse; and income source of sole parents, assumed by some to be solely the Domestic Purposes Benefit.

In New Zealand, sole parents are broadly portrayed by both the media and government as: primarily teenagers; never married; and welfare dependent (Collins, 2010; Pool, 1996). The associated discourse also frames sole parenting as a growing phenomenon. A cursory analysis of the available data, however, suggests that this is simply not the case (Davies et al., 1993; Jackson & Pool 1996; Pool et al., 2007). It is also of some relevance that the Population Division of the United Nations Secretariat (2010, p. 346) reports that, until 1996, the New Zealand Government expressed 'no concern' with adolescent fertility, whereafter it became noted as a 'major concern' and policies and programmes were implemented to address it.

Reforms to New Zealand's welfare system implemented in 2012, for example the Social Security (Youth Support and Work Focus) Act implied that not only the nation's female sole parents, but also their teenage daughters, were in need of state-provided contraception (Chapman, 2012). This paper argues that one reason for the apparent misunderstanding of

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the situation may be that there has been little published work on the topic in recent years. This paper draws on data from the 2001 and 2006 censuses to update that literature.

The paper begins with a brief comparison of trends in New Zealand's sole parent households and other household types. It then examines New Zealand's sole parents in three sections: age of parents, a factor frequently misrepresented in the discourse (Davies et al., 1993); marital status of sole parents, a factor which does not appear to have been previously published on; and income source of sole parents, assumed by some to be solely the Domestic Purposes Benefit (DPB).

Data Issues

As this analysis relies primarily on data collected in the five-yearly Census of Population and Dwellings, it is necessary first to differentiate between how Statistics New Zealand define 'families' and 'households'.

'Family nucleus' is defined for the purposes of the census by Statistics New Zealand (2006) as

> …a couple, with or without child(ren), or one parent and their child(ren), usually resident in the same dwelling. The children do not have partners or children of their own living in the same household. (p.11)

A 'household' refers to

> …either one person who usually resides alone, or two or more people who usually reside together and share facilities (such as eating facilities, cooking facilities, bathroom and toilet facilities, and a living area), in a private dwelling (p.14).

This approach to categorisation has several limitations - for example, sole parent families may be subsumed within other household categories, such as parents-plus-others (Pool et al., 2005; Davies et al., 1993). Data on households also pertain to the 'occupier', who is the person who completed the Census Dwelling Questionnaire (Statistics New Zealand, 2006). For multiple adult households, this person is somewhat arbitrary. They may be male or female, and their age may or may not provide insight into the life cycle stage of their 'family'. However, in the case of sole parent and single-person households, the age of the occupier directly correlates with life cycle

stage. For these reasons, this article uses data at both the family and household level.

New Zealand's Households

In 2006, sole parents accounted for 9.7 percent of all New Zealand households (Figure 1, Tables 1 and 2). While this represents a 25 percent increase over 1986 (when sole parents accounted for 7.9 percent), it is arguably a relatively small proportion with respect to the disproportionate amount of media and political attention it receives (cf. Brennan-Tupara, 2011; Collins, 2010; Gooder & Larose, 1999; NZPA, 2008; Rotorua Peoples Advocacy Centre, 2007; Taylor, 2011; Torrie, 2011).

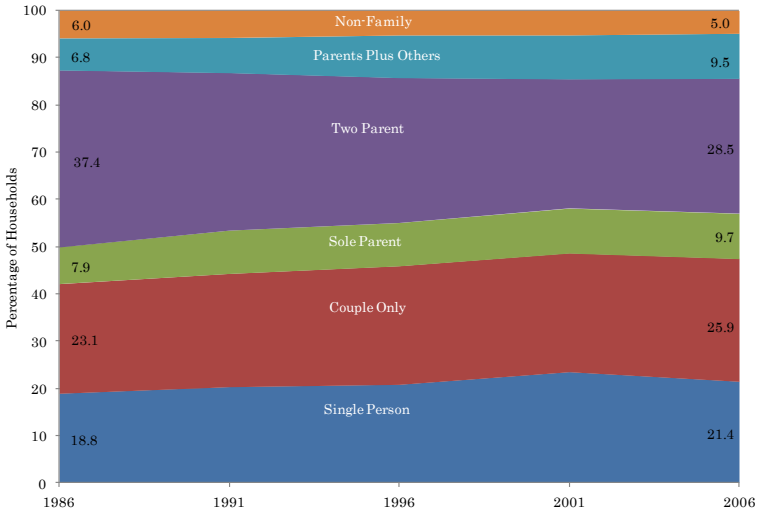
By comparison, the two-parent household has continued to be New Zealand's dominant household type, although it has declined over the period by a similar margin (24 percent) (Jackson & Hutt, 2012).

These two trends are often linked in media commentary, leading to perceptions that 'the family' is under threat (NZPA, 2008; Family First NZ, 2008; New Zealand Institute of Economic Research, 2008). However, changes in other household types are very much part of the overall story. Between 1986 and 2006, couple–only and single-person households increased by 12 and 14 percent respectively, while parents-plus-others households increased by 40 percent. Each of these changes has broader societal and age-related features which in part explain the decline in the two-parent household.

For example, significant fertility decline at younger ages (Statistics New Zealand, 2012) means that fewer young adults are now to be found in a two-parent household, while they have an increased likelihood of being in a couple-only (no children yet) household. Fertility decline *per se* also means that couples move in to, and out of, the two-parent household category in a shorter space of time than previously, simply because parenting of one to two children is completed in a shorter period than it is for three or four. By late middle age, parents of small families are more likely to be in couple-only household, now an 'empty-nest' (Pool et al., 2005). Later partnering and childbearing also means that younger adults are more likely to live in a single-person household than previously, while improving life expectancy and mortality rates mean that older people have an increasing propensity to be in a single-person household. Together,

these subtle structural changes account for much of the decline in the two-parent household.

Figure 1: Percentage of households by type in New Zealand, 1986-2006



Source: Statistics New Zealand Customised Database adapted from Jackson and Hutt (2012 – forthcoming).
Notes: Excludes data labelled 'Not Elsewhere Included' and 'Household Composition Unidentifiable'.

Age of Sole Parents

Table 1 shows that in both 2001 and 2006, New Zealand sole parent households were most heavily concentrated at 30-49 years of age, where they accounted for almost 61 percent of all sole parent households. This was not too different to the situation for two-parent households (71 percent aged 30-49 years at both observations). In 2006 sole-parent occupiers aged 15-29 years accounted for 15 percent of all sole parent households, a slight decrease from their 16.8 percent share in 2001. Meanwhile at both observations, sole parents aged 15-29 years accounted for half as much again as young two-parent households (i.e. in 2006, 15.1 and 9.7 percent respectively), but still lower than at 50-69 years (19.8 percent in 2006 and 17.6 percent in 2001).

Table 1: Household type by broad age group, New Zealand, 2001 and 2006

Household Type	15-29	30-49	50-69	70+	Total
			2001		
Single person	8.2	26.5	31.2	34.1	100
Couple only	11.5	21.8	46.6	20.2	100
Sole parent	16.8	60.5	17.6	5.0	100
Two parent	10.9	71.4	16.5	1.3	100
Parents plus	23.4	49.0	23.9	3.6	100
Non-family	47.8	31.3	15.4	5.4	100
Total (%)	14.1	43.1	28.2	14.5	100
Total (numbers)	185,109	565,512	370,479	190,416	1,311,516
			2006		
Single person	6.9	26.5	34.5	32.1	100
Couple only	11.5	21.8	47.6	19.1	100
Sole parent	15.1	60.6	19.8	4.5	100
Two parent	9.7	71.0	18.1	1.1	100
Parents plus	24.6	47.1	25.1	3.1	100
Non-family	46.0	31.0	18.1	4.9	100
Total (%)	13.3	43.5	30.1	13.1	100
Total (numbers)	190,275	620,760	430,014	187,233	1,428,282

Source: Statistics New Zealand customised database adapted from Jackson and Hutt (2012 – forthcoming).
Note. All tables and charts in this report excludes data labelled 'Not elsewhere included' and 'Household composition unidentifiable'

In 2006, sole parents aged 15-19 years accounted for just 1.4 percent of all sole parents, while the single-largest proportion was aged 40-44 years (17.5 percent); slightly older than the largest group in 2001. Collectively, sole parents aged 30 years and older accounted for 81 percent of sole parents in 2001, and 84 percent in 2006, generating a median age for all sole parents of 43 years in 2006. This is fractionally older than for two-parent occupiers whose median age in 2006 was 42.4 years. Therefore, only a minority of sole parent households are at younger ages, while the median age of sole parent occupiers is slightly older than that of two-parent occupiers.

Table 2 reinforces this, showing that for occupiers aged 15-29 years, sole parent households were also the minority household type, accounting for just 11 percent of occupiers at that age in both 2001 and 2006. In 2006, among the 30-49 year age group (which accounts for the majority of sole parent households), this household type accounted for just 13.6 percent of occupiers. For both age groups (at both observations), sole-parent occupiers were well outnumbered by two-parent occupiers.

Table 2: Percentage of broad age group by household type, New Zealand, 2001 and 2006

Household type	15-29	30-49	50-69	70+	Total	Total (numbers)
			2001			
Single person	13.6	14.4	25.9	55.1	23.4	307,542
Couple only	20.5	12.7	41.5	34.9	25.2	330,183
Sole parent	11.4	13.4	6.0	3.3	9.6	125,610
Two parent	21.0	45.1	15.9	2.4	27.2	356,874
Parents plus	15.3	10.5	7.8	2.3	9.2	120,915
Non-family	18.2	3.9	2.9	2.0	5.4	70,392
Total (%)	100.0	100.0	100.0	100.0	100.0	1,311,516
			2006			
Single person	11.1	13.0	24.5	52.3	21.4	305,163
Couple only	22.3	13.0	41.0	37.8	25.9	370,281
Sole parent	11.0	13.6	6.4	3.3	9.7	138,819
Two parent	20.9	46.6	17.2	2.4	28.5	407,118
Parents plus	17.5	10.3	7.9	2.3	9.5	135,534
Non-family	17.3	3.6	3.0	1.9	5.0	71,367
Total (%)	100.0	100.0	100.0	100.0	100.0	1,428,282

Source: Statistics New Zealand customised database adapted from Jackson and Hutt (2012 – forthcoming).

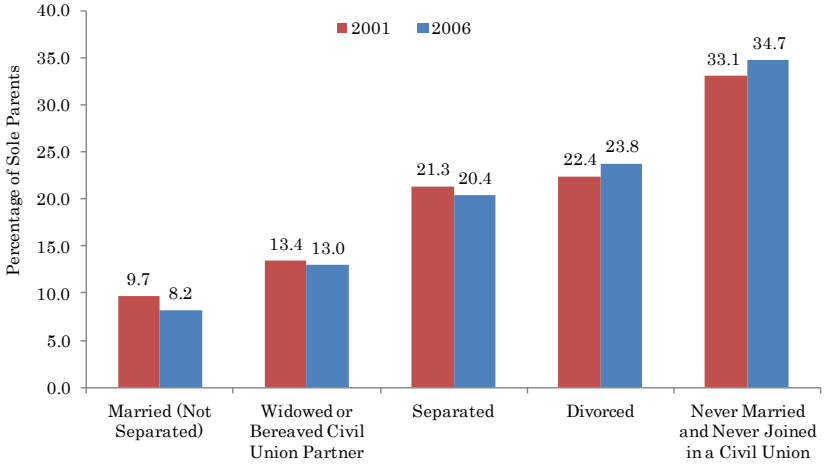
As Pool et al. (2007, p. 12) argue, those 'teenage mothers' who indicate the moral collapse of society appear to be few and far between – and are diminishing in proportion (cf. NZPA, 2008; Family First NZ, 2008; New Zealand Institute of Economic Research, 2008). Historical analyses of sole parent data similarly show a very small percentage of sole parents in the younger age groups (15-29 years), the proportion in both 2001 and 2006 (11 percent) both stable, and not that much greater than in 1986 when it was eight percent (Jackson & Hutt, 2012; Jackson & Pool, 1994; Jackson & Pool, 1996; Rockford, 1993; Rockford et al., 1992).

Marital Status of Sole Parents

At the 2006 Census, almost two thirds of New Zealand's sole parents had been previously married or in a civil union; a situation almost identical to that in 2001 (refer to Figure 2). There was a small increase in the 'never married' category (increase of 1.5 percentage points) and a decrease in the 'married' category (1.5 percentage points). In 2006, 8.2 percent were still married (median age 44 years) and 20 percent were separated (median age of 43 years). Almost a quarter (24 percent) were divorced (median age 46 years). Widowed and bereaved persons accounted for a further 13 percent of sole parents; however, these are not youthful widows and widowers with presumably young/dependent children, but rather, are disproportionately at older ages (median age 65 years), indicating that this is a special category of sole parents (Figure 2, see also Table 3).

The data for each marital status category are similar for both 2001 and 2006. Thus, at both observations, just one-third of all sole parents had never been married, supporting the argument that sole parenting is a phase that people can move in and out of as changes occur in patterns of partnering, family formation, marriage and divorce, and essentially the social life cycle (Davies et al., 1993; Jackson & Pool, 1996; Pool et al., 2007).

Figure 2: Percentage of sole parents by marital status, New Zealand, 2001 and 2006



Source: Statistics New Zealand customised database.

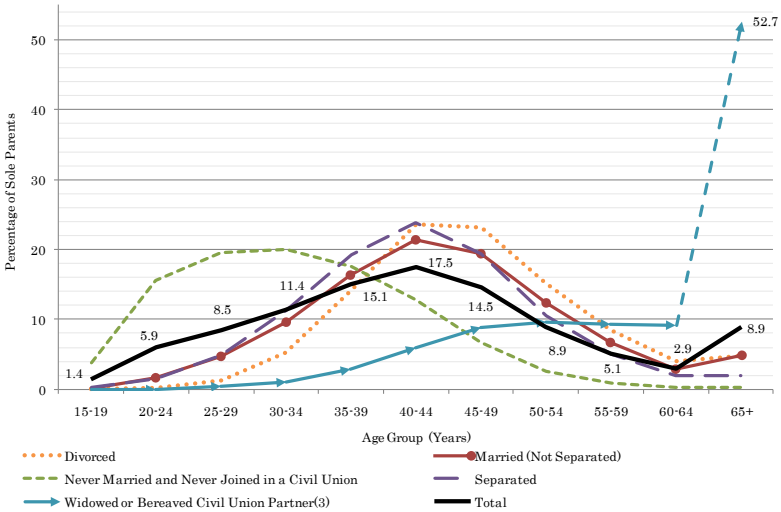
Marital Status by Age

As indicated above, the marital status of sole parents is largely a function of age. Overall, the marital status category for sole parents that had never been married or in a civil union accounted for one-third of sole parents (median age 33 years), as seen in Table 3. For both 2001 and 2006, within the 'never married' category, 3.8 percent were aged less than 19 years, 35 percent were aged 20-29 years and 61 percent were aged 30 years and over.

Sole parents in the first four age groups (15-19, 20-24, 25-29 and 30-34 years) were largely 'never married and never joined in a civil union'. For age groups 35-39 and 40-44 years, sole parents are most likely to be legally 'separated' from their spouse or partner than not married. Overall, 35-39 year olds accounted for 15 percent of all sole parents in 2006 (down from 17 percent in 2001). Meanwhile, sole parents aged 40-44 year olds accounted for 17 percent of sole parents who stated their marital status at both observations, and were most likely to be separated or divorced (Figure 3, Table 3). Moving through the age groups, sole parents in age groups 45-49 and 50-54 years were more likely to be 'divorced' or otherwise 'separated'. The largest percentage point change between 2001 and 2006 occurred in the 45-49 year age group as it increased by 2.4 percentage points, while all other age groups changed by less than 2 percentage points, with the

exception of the 30-34 year age group, which decreased by 2.2 percentage points (Table 3).

Figure 3: Sole Parents: Percentage in each marital status category by five year age group, New Zealand, 2006



Source: Statistics New Zealand Customised Database.
Notes: 1. Data based on individual's role in family nucleus
3. Data at 65+ years pertain to an anomalous group of sole parents
3. For raw data refer to 2006 section in Table 3.

Finally, the three oldest age groups, encompassing those aged 55 to 65+ years, are most likely to be sole parents because they are 'widowed or a bereaved civil union partner'. Notably, in 2006 the three older age groups collectively account for a slightly larger share (17 percent) of sole parents than those at the three youngest age groups (15 to 29 years, accounting for 16 percent).

For older sole parents (50+ years), the likelihood of being 'never married' decreases proportionally as age increases (Figure 3), because by this stage, most or all of their children have left home, another reflection of life cycle implications. While those aged 65+ years account for a relatively high proportion (8.9 percent in 2006 and 8.3 percent in 2001) of all sole parents who stated their marital status. Due to the aggregation of age groups, over half of sole parents aged 65+ are widowed or bereaved, thus as indicated they comprise an anomalous group of sole parents.

Table 3: Sole Parents[1]: Percentage in each marital status category by five year age group, New Zealand, 2001 and 2006[2,3]

Age group	Never married and never joined in a civil union	Married (not separated)	Separated	Divorced	Widowed or bereaved Civil Union partner	Total
2001						
15-19	3.8	0.2	0.0	0.0	0.0	1.3
20-24	18.4	1.9	1.3	0.2	0.1	6.6
25-29	23.7	5.9	6.3	2.1	0.5	10.3
30-34	21.9	12.7	14.6	8.1	1.4	13.6
35-39	16.8	18.9	23.0	18.5	3.7	17.0
40-44	9.3	21.1	24.1	25.1	6.8	16.8
45-49	3.7	17.1	16.2	20.5	8.5	12.1
50-54	1.4	10.4	8.4	13.1	9.8	7.5
55-59	0.5	5.0	3.5	6.1	8.8	3.9
60-64	0.2	2.7	1.5	2.9	9.7	2.6
65+	0.3	4.2	1.3	3.5	50.6	8.3
Total (%)	100	100	100	100	100	100
Total (numbers)	85,647	25,071	55,155	57,996	34,695	258,564
Median Age	30.9	42.5	41.0	47.9	65.1	40.4
2006						
15-19	3.8	0.2	0.2	0.0	0.0	1.4
20-24	15.6	1.6	1.6	0.2	0.1	5.9
25-29	19.5	4.7	4.9	1.3	0.4	8.5
30-34	19.9	9.6	11.3	5.3	1.1	11.4
35-39	17.5	16.3	19.3	14.1	2.9	15.1
40-44	12.8	21.5	23.9	23.7	5.9	17.5
45-49	6.7	19.4	19.5	23.1	8.9	14.5
50-54	2.6	12.3	10.6	15.1	9.6	8.9
55-59	0.9	6.7	5.0	8.4	9.3	5.1
60-64	0.3	2.8	2.0	4.0	9.2	2.9
65+	0.3	4.9	1.9	4.8	52.7	8.9
Total (%)	100	100	100	100	100	100
Total (numbers)	92,526	21,906	54,462	63,411	34,602	266,907
Median Age	32.8	44.1	42.7	46.2	65.3	42.2

Source: Statistics New Zealand Customised Database.

Notes: 1. Data based on individual's role in family nucleus

2. Data at 65+ years pertain to an anomalous group of sole parents.

Income Source of Sole Parents

Many sole parents have multiple sources of income, thus the following data do not refer to numbers of sole parents but rather the number of times the particular source was specified. With this caveat in mind, the largest source of income for New Zealand's sole parents of all age groups combined in both 2001 and 2006 was wages, salaries, commissions and bonuses paid by employers (Table 4).

Receipt of the Domestic Purposes Benefit (DPB) declined by 14 percent, from 41.9 percent of income sources in 2001 to 36 percent in 2006, while receipt of the Unemployment Benefit also declined, by almost 35 percent.

Other notable trends during the two census periods were that self-employment grew by 5 percent, while receipt of the Sickness Benefit and Invalid's Benefit increased by 25.8 and 37.0 percent respectively (Table 5).

Table 4: Income source for sole parents of all age groups combined, New Zealand, 2001 and 2006

Income source	2001	2006	% change 2001 to 2006
Wages, salary, commissions, bonuses etc	46.5	50.1	7.7
Domestic Purposes benefit	41.9	36.0	-14.1
Interest, dividends, rent or other investments	11.4	10.7	-5.9
Self-employment or business	8.5	8.9	5.4
Other govt. benefits, payments or pensions	7.5	7.6	1.2
NZ Superannuation or veterans pension	7.7	7.5	-2.7
Other sources of income	5.1	6.4	25.2
Sickness benefit	2.9	3.7	25.8
Invalids benefit	2.6	3.5	37.0
Unemployment benefit	5.4	3.5	-34.9
No source of income during that time	1.6	1.8	9.0
Payments from a work accident insurer	1.7	1.5	-10.6
Other super, pensions, annuities	1.7	1.5	-15.5
Student allowance	1.3	1.0	-20.7
Not stated	3.6	4.0	10.2
Total (%)	100	100	…
Total (numbers)	721,920	762,459	…

Source: Statistics New Zealand Customised Database.

Notes: 1. Data based on individual's role in family nucleus

2. Many sole parents have multiple sources of income therefore 'number' does not refer to number of sole parents, but rather the number of times the particular source was specified as a source of income.

Similar trends showed up among the 15-19 year age group, although for this group wages and salary were the second largest source of income, after the DPB (Table 5). Wages and salary increased by 28 percent between 2001 and 2006, while receipt of the DPB declined by 15 percent. Income derived from the Unemployment Benefit also declined for sole parents aged 15-19 years, while that from self-employment increased (from 0.3 to 0.9 percent).

Table 5: Income source for teen sole parents (aged 15-19 years), New Zealand, 2001 and 2006

Income source	2001	2006	% change 2001 to 2006
Domestic Purposes benefit	60.9	51.7	-15.1
Wages, salary, commissions, bonuses etc	22.6	28.8	27.5
Sickness benefit	15.4	13.0	-15.3
Other govt. benefits, payments or pensions	12.1	11.2	-7.9
No source of income during that time	6.2	8.6	38.2
Unemployment benefit	12.7	7.9	-37.4
Student allowance	4.0	3.5	-13.8
Other sources of income	2.2	2.5	10.9
Interest, dividends, rent or other investments	0.8	1.1	31.6
Invalids benefit	0.8	1.0	13.6
Self-employment or business	0.3	0.9	184.7
Payments from a work accident insurer	0.5	0.7	36.1
NZ Superannuation or Veterans pension	0.0	0.0	0.0
Other super., pensions, annuities	0.1	0.0	-100.0
Not stated	5.1	6.8	32.0
Total (%)	100	100	…
Total (numbers)	4,974	5,940	…

Source: Statistics New Zealand Customised Database.

Notes: 1. Data based on individual's role in family nucleus
2. Includes data labelled 'Not Elsewhere Included'
3. Many sole parents have multiple sources of income therefore 'number' does not refer to number of sole parents, but rather the number of times the particular source was specified as a source of income.

Sole Parents Receiving the Domestic Purposes Benefit

Finally, examination of the data for sole parents receiving the DPB by marital status indicates that a large proportion (55 percent in 2001, 58 percent in 2006) had never been married or part of a civil union, while the proportions who were separated (22 percent in 2001, 20 percent in 2006) and divorced (19 percent in 2001, 18 percent in 2006) also remained similar.

In 2006 the census recorded 2,874 sole parents aged 15 to 19 years receiving the DPB, compared to 2,865 in 2001. This group accounted for just 2.2 percent of sole parents of all age groups who received the DPB, up from 2.0 percent in 2001. The majority had never been married or part of a civil union (94.9 percent). However, as shown above (Table 5) only 52 percent of this group were reliant on the DPB in 2006, down from 61 percent in 2001. The remaining 49 percent (in 2006) obtained their income from a range of other/additional sources, predominantly salary and wages (29 percent), sickness benefit (13 percent) and 'other' government payments (11 percent).

Reflecting the foregoing analysis, the two largest age groups receiving the DPB in both 2001 and 2006 were sole parents in the 30-34 and 35-39 year age groups (Table 6). The proportion of these groups reduced between 2001 and 2006, whereas the proportion in the older age groups (45+ years) increased. In 2001 the third largest age group was 25-29 years, (18.1 percent) while by 2006, the third largest age group was marginally 40-44 years (16.4 percent). At the oldest age groups, DPB uptake was much smaller, further indicating that they are an anomalous group of sole parents.

Table 6: Sole parents who received the Domestic Purposes Benefit, by age, 2001 and 2006

	2001		2006	
Age group	number	%	number	%
15-19	2865	2.0	2874	2.2
20-24	19,173	13.1	16,596	12.7
25-29	26,439	18.1	21,357	16.3
30-34	29,682	20.3	23,526	18.0
35-39	29,607	20.3	24,651	18.8
40-44	21,837	14.9	21,411	16.4
45-49	10,275	7.0	12,615	9.6
50-54	3870	2.6	5019	3.8
55-59	1494	1.0	1767	1.4
60-64	711	0.5	819	0.6
65+	219	0.1	231	0.2
Total	146,181	100	130,866	100

Table 7: Sole parents who received the Domestic Purposes Benefit, by marital status, 2001 and 2006

	2001		2006	
Marital status	number	%	number	%
Divorced	27,129	18.6	23,316	17.8
Married (not separated)	3240	2.2	2223	1.7
Never married/never joined in a civil union	80,301	54.9	75,993	58.1
Separated	32,310	22.1	26,304	20.1
Widowed or bereaved civil union partner	3195	2.2	3024	2.3
Total	146,181	100	130,866	100

Source: Statistics New Zealand Customised Database.

Notes: 1. Data based on individual's role in family nucleus

2. Many sole parents have multiple sources of income therefore 'number' does not refer to number of sole parents, but rather the number of times the particular source was specified as a source of income.

3. All numbers are rounded to base 3 by Statistics New Zealand for confidentiality.

Discussion and Conclusion

This paper has outlined recent patterns and trends in sole parenting in New Zealand in the context of other household types, the age of sole parents, the marital status of sole parents, and the income source/s of sole parents. It reinforces previous studies (Pool et al., 2007; Davies et al., 1993; Rockford, 1993) which found that New Zealand's sole parents are neither very young, disproportionately 'never-married' or welfare dependent, and that sole parenting *per se* is by no means escalating out of control.

Instead, it finds that in 2006, only 1.8 percent of the nation's sole parent households had occupiers aged less than 19 years, while the vast majority (84 percent) of sole parent occupiers were aged 30 or more years. This generated a median age for the nation's sole parent occupiers of 43 years, fractionally higher than that of two-parent occupiers (41 years).

Analysis of the sole parent population by marital status showed that the majority (two-thirds) were previously married or in a civil union; that is, the majority of sole parents are sole parents because their marriage or relationship has ended. Marital status is also largely a function of age, with the median ages for 2006 of widowed and bereaved sole parents the highest at 65 years, followed by divorced sole parents (46 years), those separated or still married (both 43 years), and the never-married (33 years). While one-third of all sole parents in both 2001 and 2006 were never-married, those aged less than 19 years accounted for just 3.8 percent of this group.

Analysis by income source was equally enlightening. The single-largest source of income for New Zealand's sole parents of all ages in both 2001 and 2006 was wages, salaries, commissions and bonuses paid by employers. Accounting for 50 percent of income sources for sole parents in 2006, this source had increased by nearly 8 percent since 2001. Notably, receipt of both the Domestic Purposes and Unemployment benefit had declined, by 14 and 35 percent respectively. For sole parents aged 15-19 years, wages, salaries, commissions and bonuses was the second-largest source, and had similarly increased (by 28 percent), while receipt of the majority source, the DPB had declined (15 percent), as had Unemployment Benefit (37 percent).

Focusing on just DPB recipients, the analysis found that the majority had never been married (55 percent in 2001 and 58 percent in 2006).

However, as throughout the analysis, just 2.2 percent of sole parents receiving the DPB are teenagers.

These findings indicate that sole parenting in New Zealand is not the 'problem' it is sometimes portrayed to be. Overall, the proportion of New Zealand households categorised as sole parent increased by 25 percent between 1986 and 2006, but that proportion remains below 10 percent, and its members are disproportionately middle aged, previously married/partnered, and self-supporting through wages and salaries.

Acknowledgements

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Notes

1 Sole parents can have the legal marital status of 'married not separated' because they are still legally married but not legally separated, although they will mostly be living apart from their spouse or partner and caring for the children.

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The Role of Australia's Extended Baby Boom in Past and Future Population Ageing

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Abstract

How has the baby boom affected Australia's population ageing up to the present, and how might it affect it over the rest of the 21st century? The baby boom is viewed as a deviation from an alternative trajectory in which Australia follows the textbook demographic transition model and maintains low fertility from the 1930s onwards. Thus the boom is seen as an extended baby boom from the mid-1930s to the mid-1970s. This research note uses some simple cohort-component scenario projections to illustrate the role of the extended boom generation in population ageing and what ageing Australia would have experienced had it followed the demographic transition model uncomplicated by a fertility rise. It provides answers both in terms of numerical ageing and structural ageing. The scenario projections demonstrate that the boom caused a permanent upwards shift in numerical ageing and a long-run, but ultimately temporary, change in the development of structural ageing.

Australia's baby boom generation is defined by the Australian Bureau of Statistics (ABS) as the population born between 1st January 1946 and 31st December 1965 (ABS, 2003). During these two decades the Total Fertility Rate (TFR) was around, or above, 3.0, and the number of births recorded totalled 4.19 million compared to 2.56 million during the preceding 20 years (ABS, 2008). Between 2011 and 2030 members of the baby boom generation will be celebrating their 65th birthdays and thus entering what is traditionally described by demographers as the 'elderly population'. As Jackson (2001), Pool (2007) and others have noted there appears to be a belief in some quarters that the boomers will be the primary cause of population ageing over the coming decades. Is this correct, partly right, or simply a myth? To shed light on the issue this research note addresses the questions:

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- How has the baby boom influenced Australia's population ageing up to the present? and
- To what extent is this generation likely to affect population ageing over the rest of the century?

Although quite a number of previous studies have examined the general issue of how population ageing is affected by different rates of fertility, mortality and overseas migration (e.g. Young, 1988; McDonald & Kippen, 1999; Kippen, 2002; United Nations, 2000), few authors have specifically focussed on the impact of the baby boom generation on the ageing of Australia's population. Exceptions include Kippen and McDonald (2000), a brief consideration by the Productivity Commission (2005) as part of its major report *Economic Implications of an Ageing Australia*, and references to the phenomenon in a limited number of publications on ageing, such as Rowland (1991, 1996). Kippen and McDonald (2000) produced several simulations of Australia's population from 1945 to 2000 to determine what Australia's population would have looked like at the end of the 20th century if the country had experienced a number of alternative demographic pathways. One of their scenarios revealed what the size and shape of the population would have been in 2000 in the absence of the baby boom. They assumed a Total Fertility Rate of 2.0 between 1945 and 1977 and observed fertility thereafter, together with recorded mortality rates and net overseas migration numbers. Their results showed how Australia's population would have been several million smaller and much older by the year 2000 in the absence of the boom. The Productivity Commission (2005) produced several projections as part of its study of population ageing, including a 'no baby boom' scenario, although using different assumptions from Kippen and McDonald (2000).

This note extends the earlier work of Kippen and McDonald and the Productivity Commission. It does so with two simulations of Australia's population from 1936 to 2101. One follows actual trends in population up to 2011 and then uses fertility, mortality and migration assumptions to project out to the turn of the century; the other assumes that fertility remained low from the mid-1930s onwards but that all other demographic rates are identical to the first scenario. Thus the official baby boom definition of 1946 to 1965 is not actually used. From a long-run historical

perspective the baby boom is arguably a more prolonged phenomenon (Vallin, 2002). If the attainment of replacement fertility in the 1930s is taken to mark the end of fertility transition, then the departure from the low fertility path in the 'standard' demographic transition model which occurred between the mid-1930s and the mid-1970s can be viewed as an *extended* baby boom. It therefore makes sense to compare Australia's actual demographic trends with those which would have resulted if fertility had followed the classic demographic transition low fertility path from the mid-1930s onwards. Data and methods are described in the next section, with results and conclusions following in turn.

Data and Methods

Population projections from 1936 to 2101 were produced using a simple cohort-component model disaggregated by sex and five year age groups 0-4, 5-9, … , 100-104 and 105+. Data were obtained from the Human Mortality Database (HMD, 2011) and the ABS website except for net overseas migration which was calculated as the residual of total cohort population change over a five year period minus deaths. Although residual net migration is imperfect in that it combines net migration with errors in other components and definitional changes in population estimates, it does enable the simulations to exactly replicate Estimated Resident Populations (ERPs) up to 2011. The 2011 ERPs used in this paper are preliminary 2011 census-based figures released in June 2012 (ABS, 2012); all other population estimates are final figures.

Two scenarios were formulated. The Extended Boom scenario uses actual fertility and mortality rates and net overseas migration numbers up to 2011. Between 2011 and 2101 the Total Fertility Rate is set at a constant 1.85. Life expectancy at birth is assumed to rise gradually to 95.1 years for females and 93.2 years for males by 2096-2101. Net overseas migration of 180,000 per annum is assumed throughout the 2011-2101 period. Of course, we cannot possibly predict demographic rates with any degree of certainty several decades ahead, let alone to the end of the century. Users requiring some estimate of likely uncertainty should consult probabilistic population forecasts (e.g. Bell et al., 2011). Nonetheless, the assumptions of this scenario represent one of a number of plausible demographic pathways for Australia's demographic development.

In the No Boom scenario, fertility is assumed to have remained low following its long-run decline over the second half of the 19th century and the first few decades of the 20th (Caldwell & Ruzicka, 1978; Rowland, 1991). The Total Fertility Rate is set at 2.00 from 1936 to 1976 before joining the observed fertility trend from 1976 to 2011 (Figure 1). This assumption is consistent with the fertility trajectory described in the classic demographic transition model in which there is a clear end to the declining fertility stage, followed by relatively stable fertility in the post-transition stage (Weeks, 2005). Projected fertility from 2011-2101 is the same as for the Extended Boom scenario. Past and future life expectancy assumptions are also identical to those of the Extended Boom scenario. As for overseas migration, there are various ways in which assumptions could have been formulated. Observed net overseas migration numbers up to 2011 could have been used, as could immigration numbers and emigration rates. However, in the absence of the baby boom and with resulting smaller cohort sizes this would have implied higher net migration *rates*. The decision was taken to use net migration rates so that the amount of net migration as a proportion of cohort size was the same in both scenarios. Doing so restricts differences between the two scenarios solely to the absence or presence of the baby boom.

In the presentation of results both forms of population ageing are discussed. The more commonly discussed *structural ageing* is defined as an increase in the proportion of the population aged 65 years and above, whilst *numerical ageing* describes a rise in the numbers aged 65 years and above (Jackson, 2001). Both types of ageing are considered because numerical ageing is more relevant to some types of policy formulation and planning (e.g. aged care provision) whilst structural ageing is more relevant to other types (e.g. pay-as-you-go pension systems).

Figure 1: Two trajectories of Australia's Total Fertility Rate by five year period, 1901-2101

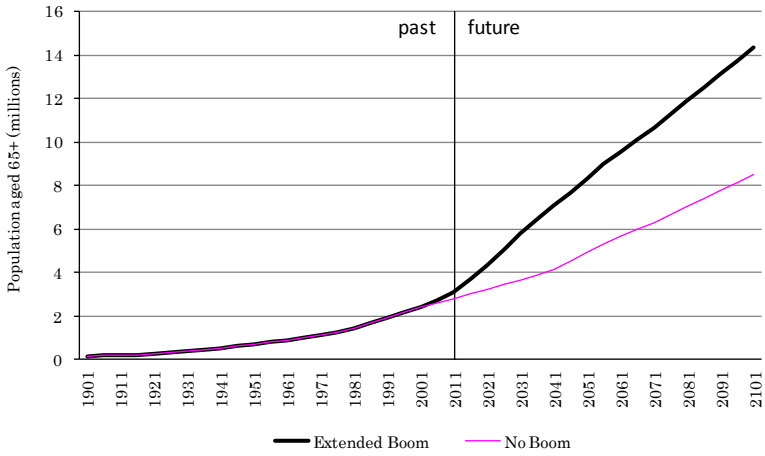
Source: 1921-2011 TFRs sourced from ABS; estimates of pre-1921 TFRs are author's calculations based on Commonwealth Bureau of Census and Statistics data; post-2011 TFRs are author's assumptions.

Results

Numerical population ageing

Numerical population ageing results are presented first because they are useful in understanding structural ageing. Figure 2 shows how Australia's population aged 65+ grows under both Extended Boom and No Boom scenarios. Although there is little difference between the two scenarios at present, by 2051 the projected numbers aged 65+ stand at 8.3 million (Extended Boom) and 4.9 million (No Boom), whilst by 2101 the two scenarios project 14.4 and 8.5 million respectively. The impact of the extended baby boom on numerical population ageing over the rest of the current century is substantial.

Figure 2: The size of the Australian population aged 65+ according to two scenarios, 1901-2101



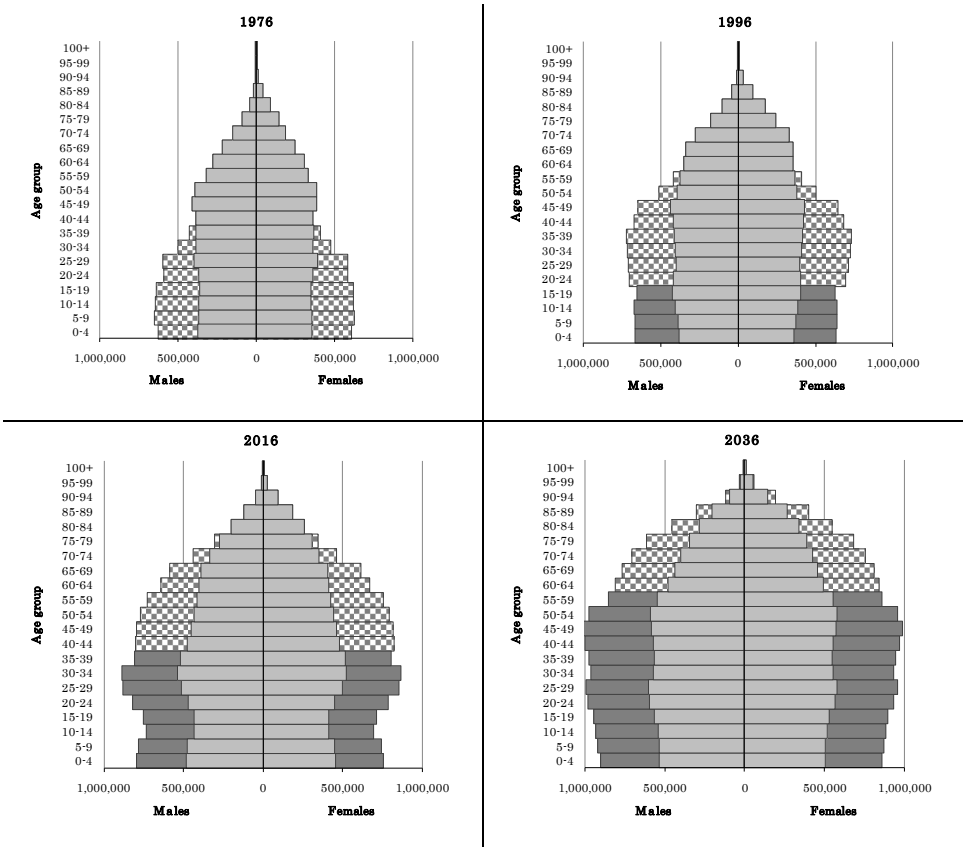
Source: ABS; author's simulations.

Why has the impact of the extended boom on numerical ageing (shown in Figure 2) only recently started to appear, and why does it appear to continue indefinitely into the future? The explanation begins with the birth of the extended baby boom cohorts between the late 1930s and the early 1970s due to high fertility rates. The cohorts born during these decades were much larger than would have been the case if Australia had experienced a simple demographic transition and remained at low fertility from the 1930s onwards. These larger cohorts can be seen in the 1976 population pyramid of Figure 3. The extended baby boom generation is marked out in the pyramids by the checkerboard pattern; the official baby boomers of 1946-65 sit in the middle four of these age groups.

The impact of the extended boom then continued down the generations. Once these larger cohorts reached childbearing ages they produced many more children than they otherwise would have done. Although both Extended Boom and No Boom scenarios consist of the same fertility rates from 1976 onwards, the larger populations-at-risk ensured that large cohorts of children were produced throughout the 1970s, 80s and 90s. The results of this can be seen in the childhood ages of the 1996 and 2016 pyramids in Figure 3. In addition, both Extended Boom and No Boom scenarios experience the same net overseas migration rates at each age so the larger Extended Boom scenario cohorts expand numerically more over

time than those in the No Boom scenario. However, it takes until the turn of the century for the first of these larger cohorts (born in the late 1930s) to begin entering the 65+ age group. The process of larger cohorts giving birth to larger numbers of children will continue down the generations, explaining why the numerical ageing trend shown in Figure 2 extends throughout this century (and beyond).

Figure 3: The age-sex structure of Australia's population under two scenarios, selected years.



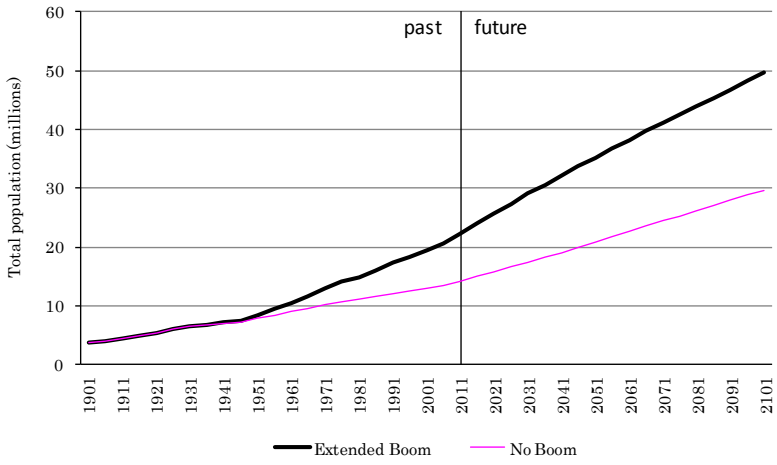
Source: ABS data and author's simulations.
Note: The baby boom generation is illustrated by the checkerboard pattern.

In sum, the extended baby boom generation produced a permanent upwards shift in the size of cohorts born in Australia, and these larger cohorts are gradually moving up the population age structure. The first of these larger cohorts started entering the 65+ age group in the early 2000s, and the very first of the official baby boomers born in the mid-1940s have

just turned 65. By 2041 all extended baby boomers will have entered this age group, to be followed over time by cohorts much larger than those projected by the No Boom scenario, as indicated by the 2036 pyramid in Figure 3. The reason why the extended baby boom generation does not form a prominent 'overhanging bulge' in the population pyramids above is due to the combination of momentum generated by the baby boom, post-boom fertility not too far below replacement and net overseas migration gains.

The effect of this permanent upward shift in cohort sizes on total population growth is, not surprisingly, substantial, as Figure 4 demonstrates. Unlike the 65+ population, the extended baby boom began to impact on total population numbers from when its first members were born in the late 1930s. In the absence of the extended baby boom the population in 2011 would have been 8.1 million lower: 14.2 million rather than the actual 22.3 million. By 2101 the difference would be about 20 million: 49.6 million (Extended Boom) versus 29.7 million (No Boom).

Figure 4: The size of the Australian population according to two scenarios, 1901-2101

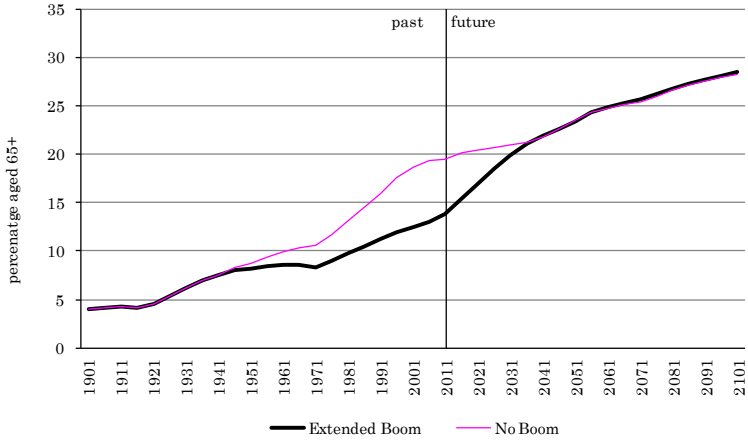


Source: ABS; author's simulations.

Structural population ageing

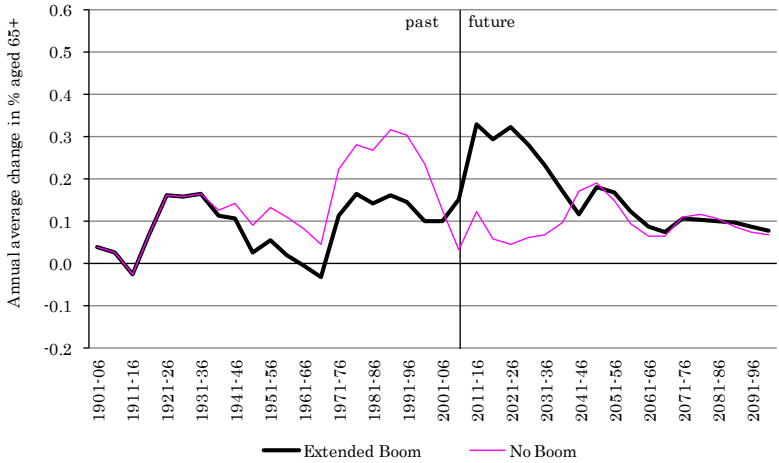
The impact of the extended boom on structural population ageing is rather different. Figure 5 presents the percentage of the population aged 65+ from 1901 up to 2101 for the two scenarios; Figure 6 depicts the rate of ageing expressed as the annual average percentage point change in the percentage of the population aged 65+. In the Extended Boom scenario, which consists of actual trends up to 2011, population ageing was brought to a halt during much of the extended baby boom period before resuming again in the 1970s (Rowland, 1991). By 2011 the proportion of the population aged 65+ reached 13.8 percent. Extended Boom scenario projections indicate an acceleration of ageing over the next two decades as the large baby boom cohorts shift into the 65+ age group, followed by a more modest rate of ageing from the mid-2030s onwards.

Figure 5: The percentage of the population aged 65+ according to two scenarios, 1901-2101



Source: ABS; author's simulations.

Figure 6: The rate of structural population ageing according to two scenarios, 1901-2101



Note: The rate of population ageing is defined here as the percentage point change in the percentage aged 65+ per annum.
Source: calculated from ABS data and author's simulations.

In the absence of the extended baby boom, much more structural population ageing would have occurred in the last three decades of the twentieth century, resulting in 19.5 percent of the population being aged 65+ by 2011. The acceleration of ageing during these decades would have been due to fast growth in the 65+ age group and more moderate growth in age groups under 65. The cohorts born in the 1920s and 1930s, which were larger at birth and surviving to a greater extent than preceding cohorts, would have moved into the elderly ages during these decades, whilst growth in the under 65 age group would have been more modest due to low fertility from the 1930s onwards (demonstrated in Figure 3).

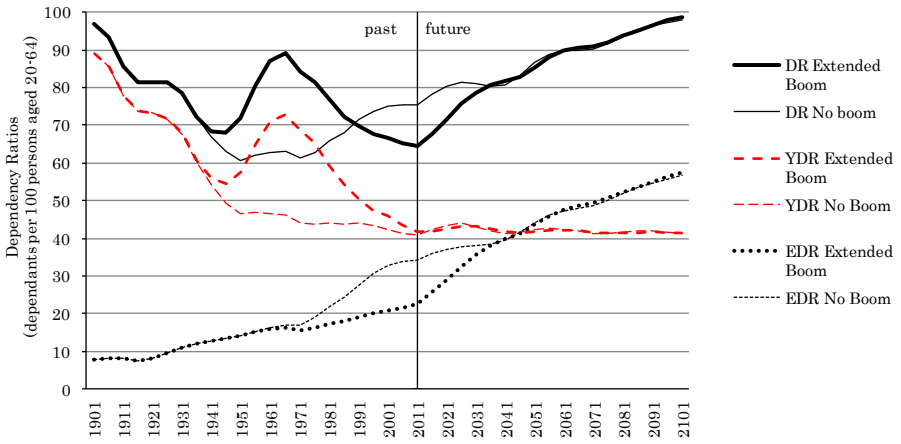
This is the typical age structure shift resulting from a smooth transition from high to low fertility, a shift which continues for many decades after fertility has declined (Rowland, 1996; Lee, 2003). Once all these larger cohorts had completed their shift into the elderly ages by the end of the 20th century the rate of ageing would have eased.

Interestingly, as Figures 5 and 6 illustrate, under both the No Boom and Extended Boom scenarios, projected ageing from the 2040s onwards is almost identical. The key point is that the extended baby boom generation has altered the pace of structural ageing over the second half of the 20th

century and the early decades of the 21st, but not the long-run outcome. The baby boom generation has acted as a discontinuity in the population age structure, but once it has passed up to the very highest ages in the population pyramid, the identical rates of fertility, mortality and net overseas migration in the two scenarios have worked to create convergence in the population age distributions (although with very different total populations).

A similar conclusion can be drawn with regard to dependency ratios. Figure 7 shows for both scenarios Elderly Dependency Ratios (EDR; the numbers aged 65+ plus per 100 persons aged 20-64), Youth Dependency Ratios (YDR; those aged 0-19 per 100 persons aged 20-64), together with total Dependency Ratios (DR). The extended boom shifted the minimum total Dependency Ratio to the late 20th and early 21st centuries, rather than the 1950s and 1960s. This nadir of dependency has been referred to by some authors as the 'demographic dividend', a period when the capital and labour required to sustain the economically inactive age groups in the population is at its lowest, allowing maximum use of resources for economic growth (Bloom et al., 2003). There is no guarantee of strong economic growth in these circumstances, but the argument is that a favourable age structure can facilitate it. According to this thesis, recent decades in Australia have been demographically advantageous to economic growth, but the coming decades will be more challenging. Such a view underpins the preparation of the federal government's intergenerational reports on planning for the long-term economic development of the country in the context of population ageing (Attorney-General's Department, 2010).

Figure 7: Dependency ratios according to two scenarios, 1901-2101



DR: total Dependency Ratio; YDR: Youth Dependency Ratio; EDR: Elderly Dependency Ratio
Source: calculated from ABS data and author's simulations.

Conclusions

Through some simple cohort-component simulations this research note has demonstrated how the extended baby boom has affected the size and age structure of Australia's population and how it will continue to do so for the rest of the present century. It will substantially increase the amount of numerical population ageing to be experienced over the course of the 21st century (and beyond) whilst significantly altering the path of structural ageing, but not its eventual long-run outcome. Thanks to the extended baby boom Australia has 'borrowed' a demographic dividend of reduced structural ageing from the mid-20th century up to the present, with 'repayment' in the form of increased structural ageing during the next three decades in order to return it to where it would have been without the boom.

Many discussions of population ageing invoke stable population models or simplified accounts of demographic transition in which there are smooth trajectories of crude birth and death rates (and an absence of migration). Population ageing is caused by falling fertility and, in low mortality populations, declining mortality (Goldstein, 2009), and is thus an integral part of individual countries' long-run demographic transition from high rates of fertility and mortality to low rates (Chesnais, 1990). Whilst correct, explanations of ageing based on simple demographic transition

models have been subject to a number of criticisms, including the assumption of stable and similar crude fertility and mortality rates in the post-transition stage, the lack of migration, the dominance of fertility in explaining ageing, and the lack of consideration given to baby booms (Rowland, 2009, 2012). As Pool (2005, p. 17) expresses it, "much of the literature on ageing, especially in applied fields, carries with it more or less the notion of a monotonic evolution towards ageing. The reality may instead be one of the effects of turbulence coming from significant cohort oscillations, co-varying in time with a structure also inexorably marching towards ageing". This note has illustrated the impact of structural ageing in Australia generated by one very large cohort oscillation.

Of course, the simulations presented above represent simplified realities, especially over the projection horizon from 2011 to 2101. We do not know precisely what will happen to fertility, mortality and migration over the next couple of decades, let alone by century's end. And in the No Boom scenario perhaps labour demand would have caused net overseas migration to rise much higher, rather than at the same net rates as the Extended Boom scenario. In addition, large cohort oscillations may well occur in the decades ahead, altering the future path of population ageing from those shown here. Nonetheless it is believed the simulations presented here remain useful in illustrating the broad picture of the extended baby boom's temporary and permanent impacts on the nation's population ageing.

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