POLICY Quarterly

The ebbing of the human tide. What will it mean?

Foreword

Theoretically speaking, while a country's population is expanding it is expected that the majority of communities will grow more or less continuously; and growth is still almost universally recognized as a positive and normative condition of modernity. Conversely, population shrinkages are usually considered aberrations requiring correction by re-establishing growth.

Despite this, there is little acknowledgement that growth rates commonly achieved in the 20th century were anything but 'normal' in the *longue durée*. And there remains as yet inadequate acknowledgment of possible alternatives, of whether and for how long growth is sustainable, or of whether and under what circumstances shrinkage is preferable. This is partly because nearly every country in the world is still growing and there are few examples of national shrinkage of a sufficient duration from which to draw valuable empirical lessons.

There is a very real possibility that by the end of this century global population growth will cease, and by the 22nd century, the world's population will be shrinking. The prospect of the end of global growth is potentially good news, as rapid population expansion is contributing to catastrophic and irreversible environmental losses which are already having a serious impact on the quality of human life and the sustainability of our communities.

We should not assume, however, that the impacts of depopulation will present the reverse image of growth. Shrinkage creates its own disruptions and disturbances; but it would also be a mistake to attempt to travel backwards into growth once more. There is a pressing need, therefore, to understand the processes of demographic transition into shrinkage so that its risks be avoided and opportunities grasped and speedily enacted with maximum effect.

Depopulation is occurring predominantly in the richer developed countries, whose per capita contributions to humanity's bio-capacity deficit are the largest, and whose economic and technological resources are greatest. This presents tremendous opportunities for reconfiguring our lives and reducing environmental losses – for achieving a 'depopulation dividend'. Nevertheless, in developing countries the slowdown in the population growth rate is counteracted by the changing production and consumption effects of their rapidly growing economies. They will need assistance and advice from countries that have already experienced depopulation processes.

Despite every country's journey through development being an outcome of its own circumstances, distinct patterns of demographic change are emerging in the Asia-Pacific region, in East Asia and among other groups of countries, such as Anglophone Australia and New Zealand. Japan is in the vanguard, but China, South Korea, Taiwan, and others are expected to begin shrinking soon. Japan's experience is significant, therefore, because adaptive responses there might inform prospects for other Asia-Pacific countries experiencing their own post-growth pathways.

What was immediately surprising for me, as international advisor to this research project, was learning that New Zealand is also showing signs of a post-growth regime in formation. Despite being familiar with depopulation processes in East Asia and Europe, for a Briton raised on assumptions of New Zealand as a young, vigorous and rapidly growing country, the fact that ageing and shrinkage are pressing issues in some regions, came as a jolt. In this context, therefore, we

might need reminding that Japan was also considered young, dynamic, energetic and rapidly growing as recently as the 1980s.

Recently throughout the Asia-Pacific region, extreme differences in rural-urban population size and density have appeared. Huge urban metropolises have emerged, supplied with sophisticated high cost infrastructure to enable complex economies and diverse societies to function. These cities generate an enormous gravitational pull of people and resources, widening the gap between dynamic and prosperous metropolitan centres and declining and disconnected peripheries. In Japan and New Zealand, the Tokyo and Auckland regions account for approximately one third of each country's population. Tokyo continues to grow, with inevitable consequences for most of the rest of the country.

One thorny issue is the incidence of disasters in communities whose resilience is already weakened by ageing and depopulation, and whose physical reconstruction and emotional recovery are consequently more challenging. The complexities present in the intersection between the long-run 'disaster' of ageing and depopulation, and the punctuated shock of a natural calamity can multiply the costs and difficulties of recovery, such that governments begin to have second thoughts about the continued viability of remote settlements. Japan and New Zealand potentially have a great deal to give each other in learning how to create resilient ageing and shrinking communities.

Our tendency to compare countries and group them according to their similarities and differences implies that change at the national level is uniform. However, the New Zealand research shows us that demographic processes have great sub-national spatial variability, with differing levels of growth and shrinkage occurring within metropolitan, suburban, and rural regions, and between areas with differing levels of capital accumulation. The same is true of Japan, as elsewhere. The causes are difficult to disentangle, and outcomes likely to be more complex still. Nevertheless, this is a story that needs to be understood more broadly, and the inclusion of New Zealand within the world literature on this issue is a significant step forward, because it enables us to understand with greater clarity where depopulation processes are occurring, to what degree, and then to make adjustments in affected communities. What I have come to appreciate as a result of being involved in this project, is the breadth and scale of the ageing and depopulation phenomenon, and the potential not just for 'pioneer' shrinking countries to inform others, but for 'latecomers' also to contribute.

So, I would like to congratulate Professor Natalie Jackson and her team in bringing together such an important contribution to world knowledge about post-developmental demographic processes. And I would like to thank them sincerely for inviting me to be their project's International Advisor. It has been enormously helpful for me to learn about their work. I look forward to incorporating their research on New Zealand into my own on East Asia, and encourage others to do the same.

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Introduction and overview

Since its original formulation in the 1940s (Davis 1945; Notestein 1945), the phenomenon known as 'the global demographic transition' has been used to understand the trend of structural population ageing, and with it, the slowing and ultimately the ending of population growth – now anticipated globally around the end of the present century (Lutz, Sanderson & Sherbov 2004). However as originally conceptualised, the theory pertained to 'closed' populations, in which the only dynamics were births and deaths. Falling death rates cause populations to first become younger and to grow in size, while falling birth rates eventually cause them to become older, and growth to slow – the increased numbers of survivors at older ages becoming an increased proportion of the population (Coale 1972; Chesnais 1990).

Increasingly, migration has made the progression of population ageing much more difficult to study, as the majority of those who move are at young adult/ reproductive age, and their leaving and arriving affects the age structures of the populations from which they left and to which they arrive (Bedford & Pool 2001; World Bank 2009; Dyson 2011). By and large, leavers of youthful ages cause the population to age; arrivals cause it to become younger.

But there is also the growing trend of older people moving, typically for retirement and/or to be close to family, services and facilities (Champion 1992; Rogers & Raymer 2003). Older people moving out of an area slow its structural ageing, older people moving in accelerate it. Similarly, the movement of families affects the age structure across the childhood and reproductive ages – leavers cause populations to age, arrivals cause them to become younger.

The question, then, is to what extent overall migration is accelerating or ameliorating structural ageing, and with it hastening or slowing the theorized shift to the ending of population growth; and, does the situation unfold differently at national and subnational level?

We examine these questions in this Supplementary Issue of *Policy Quarterly*, with a focus on subnational New Zealand. Compared to other developed countries, New Zealand's total fertility rate is relatively high – although having recently fallen below 2.0 it is now somewhat below the intergenerational replacement level of 2.1 births per woman. There is also considerable international and domestic (internal) migration, per capita. Simultaneously, the national population aged 65+ years has continually increased, from 9 percent around 1976, to 12 percent in 2001 and almost 15 percent in 2016. At subnational level, that figure exceeds 20

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percent in 41 percent of towns and 29 percent of rural centres (see Jackson and Brabyn *infra*). However, rather than these differences reflecting either ultra-low birth rates or overly large subnational discrepancies in birth and death rates, they are primarily explained by differences in 'age-selective' migration, as indicated above. This age-selective migration is causing many areas to age far more rapidly than they would from demographic transition alone. They have the same outcome as advanced structural ageing, and therefore need appropriate policies,

planning, resources and facilities, but they are ageing from a very different cause to that conventionally understood as the primary driver of structural ageing: low fertility. In this regard subnational New Zealand is following its Japanese, United States and European counterparts (Matanle & Rausch 2011; Johnson, Field & Poston 2015).

Because migration is not conventionally understood as a driver of structural ageing, there is a danger that affected areas will not see the timely policy development that is required: in New Zealand, policy development on advanced structural ageing is not yet on the agenda. *We hasten to note that the ageing-driven end of national population growth and onset of national level depopulation is still well over the horizon in New Zealand*. With one of the developed world's highest birth rates and per capita international migration intakes, total New Zealand is assured of relative youth and growth for many years. However, reflecting international findings, our empirical

evidence shows that the onset of depopulation begins sub-nationally, at different times, in different ways. For many of New Zealand's depopulating areas, the trend has long been and currently remains the direct outcome of net migration loss – although in the majority of cases, that loss was reduced through natural increase (more births than deaths). Increasingly, however, subnational decline will be driven by a new set of dynamics: the onset of natural decrease, and in a more potent form, combining with net migration loss.

Bucher and Mai (2005, cited in Matanle & Rausch 2011: 19-20, 46-47) propose that the trends represent a fundamental shift from what they refer to as the 'old' form of depopulation, where there was positive natural increase but it was insufficient to offset net migration loss, to this 'new' form, net migration loss and natural decrease in tandem, increasingly intractable, self-reinforcing, and, for many areas, permanent.

Is youthful New Zealand following its older counterparts?

Faced with empirical evidence of widespread subnational depopulation in New Zealand across the period 1996 to 2006, the six authors of this issue wished to know the extent to which subnational New Zealand might be following its international counterparts – and therefore, if there might be a tipping point which would provide early warning of the onset of national level depopulation. Moreover, if subnational New Zealand is following its international counterparts, while at

the same time being relatively youthful and growing strongly at national level, are there broader theoretical implications? We noted that the mainstay of demographic theorising about population change and the ending of population growth – global demographic transition theory, as outlined above – pays scant attention to migration, while mobility transition theories that assist in understanding the migration movements of people pay equally little attention to demography (among the few exceptions are Zelinsky 1971; Skeldon 1997; Bedford & Pool 2001; Dyson 2011). Specifically, as noted above, we argued that migration is by definition age- and sex-selective, and therefore alters the age and sex structure of both origin and host regions. If migration is in fact *interacting with* the structural ageing of some regions, and, in some cases, causing or accelerating that structural ageing, a study drawing the two together would provide a new basis for understanding contemporary and future population change, and potentially have the power to contribute to a theory of depopulation.

We felt that it was timely that such a study be done, as early reports on depopulation were overwhelmingly negative, such as: '… *reduced local tax revenues and reductions in redistributed income from urban regions; obsolete public infrastructure and reduced investment in the rural economy; … abandonment of residential and business properties; decline in the quality of the built environment; and severe damage to the natural environment*' (Matanle & Raush 2011: 37-38; see also Haartsen & Venhorst 2010; Matanle 2014, 2017a). At the same time, the idea that depopulation will have many positive benefits is also beginning to emerge (Demeny 2009; Reher 2011), as is the concept of a possible 'depopulation dividend' (Matanle 2017a, 2017b). For these opportunities to be successfully converted to beneficial outcomes, it will be necessary to engage with them long before local councils and similar agencies are overwhelmed with depopulation that they had not been anticipating (Matanle & Sato 2010; Audirac 2012; Martinez-Fernandez, Kubo, Noya & Weyman 2012; Jackson 2014; McMillan 2016).

In 2014 we received funding from the Royal Society Marsden Foundation to

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examine '*The subnational mechanisms of the ending of population growth. Towards a theory of depopulation*'. We felt that its Māori title, *Tai Timu Tangata. Taihoa e?* in English, 'the ebbing of the human tide - what will it mean for the people?' sustained our motivation for the three years of subsequent research, and have titled this issue accordingly.

We report here on a selection of the project's main findings, with additional analyses available from the reference lists accompanying each article. Each member of the research team worked on a different strand of the research, although in many cases they worked in pairs.

The 'when', 'how' and 'why' of New Zealand's new demographic regime

Ian Pool was the team's historian and research advisor, guiding the project's conceptual, theoretical and interpretive aspects. His article in this issue, '*The when, how and why of New Zealand's population and development path*', provides the backdrop to today's spatial and demographic setting. In particular he asks whether urbanisation and 'rurbanisation' (a form of peri-urban growth where previous rural functions have been replaced by lifestyle blocks, from which people may commute long distances into cities, through to retirement zones that may be relatively isolated) unfolding since the 1970s and 1980s, coupled with the longer-term trend to low fertility, are continuities – or accelerations – of past trends, or are period-bound, or represent a major demographic and social disjuncture that will see New Zealand's population growth slow and eventually end, as elsewhere. He proposes that New Zealand may well have entered what has been termed elsewhere a 'low fertility trap', but one that is unfolding in New Zealand for contradictory reasons, and differs spatially. On the one hand, reflecting long-term migration patterns and trends, today's rural areas have fewer young adults and children, and relatively old age structures. Peri-urban and 'rurban' settlements, similarly, are the destination of many more recent retirees, also resulting in fewer children. On the other hand, the majority of young adults and potential parents move to and

live in or near the cities and large towns, but will paradoxically produce low birth numbers because of prolonged education, subsequent career-development, work-family life imbalances and high housing costs. Partially offsetting these outcomes are the *probably temporary* effects of subnational ethnic differences in family formation and fertility (see Cochrane & Pool *infra* on the important role of Māori reproduction in New Zealand's development; also Cochrane & Maré *infra*). Drawing on Italy's unsuccessful attempts to reverse ultra-low fertility trends in its southern *Mezzogiorno*, Pool suggests that even undocumented migrants attempting to enter the country are seeking a different life, and are more likely to adopt local demographic regimes than bolster declining birth numbers. Instead, he argues, today's subnational population growth and decline differentials were foreshadowed years ago in the theory of *total social production* (Cordell, Gregory & Piché 1994), which holds that people must both produce (on a daily basis) and reproduce (generationally) if populations are to survive. That the factors of production increasingly involve migration is leading us to a very different demographic regime (see Jackson and Pool forthcoming). Migration defined as a movement from one place to another includes commuting. This is not only a statistically significant phenomenon (Cochrane & Maré *infra*), but is a key factor in widely separating place of work from residence, a trend of increasing importance, the downstream effects of which include peri-urbanisation and even rurbanisation that are dramatically changing NZ's population geography.

Ten key observations

The second article in this issue, by Natalie Jackson and Lars Brabyn (*Subnational mechanisms of population growth and decline 1976-2013*), is really three inter-related articles condensed into one compact story. The first paper expanded on Grimes and Tarrant (2013) to examine overall trends in population size for 143 New Zealand towns and 132 rural centres, for the period 1976-2013 (Jackson, Brabyn & Maré 2016). It found similar clustering to Grimes and Tarrant, and in particular, the presence of 'runaway' growth and decline areas that had

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previously been similarly sized, at our baseline in 1976; however, our analysis went further to examine the extent to which growing and declining areas have been doing so because of natural increase and/or net migration. By and large, net migration loss was widespread across most years of the period, while natural increase was almost everywhere positive, resulting in the latter offsetting the former in the majority of cases, or alternatively, augmenting net migration gain. The second paper (Jackson et al, forthcoming) applied these data to a new framework – developed as part of the project – which explicitly recognizes three interactions between natural increase and net migration that result in growth, and three that result in decline. These interactions showed clearly the role of natural increase in offsetting past net migration loss, while projections at territorial authority area (TA) level 'extended' the analysis to show that natural decrease will soon become much more widespread, leaving towns and rural centres declining from net migration, increasingly 'unprotected'. That paper also showed that subnational

New Zealand's shift to natural decrease thus far has been more strongly related to the proportion of women aged 15-44 years in each jurisdiction, and thus to net migration loss at those ages, than to the conventional harbinger of natural decrease, very low fertility. The third paper explored the related issue of 'age-selective migration', developing further indices for analysing the extent to which net out-migration at younger ages and net in-migration at older ages are accelerating structural ageing (Jackson & Brabyn forthcoming). Using experimental modelling, the analysis was further able to distinguish between population change

combined with childbearing at younger ages than non-Māori, have resulted in the number of births that are identified as Māori making an ever-increasing contribution to overall birth numbers. With a time-lag, their sequel is increasing numbers in the working age population, which have played an increasing role in ensuring labour supply, most importantly in some low growth regions. Indeed, this contribution differs markedly by region, which in many cases is synonymous with *iwi*. Cochrane and Pool use the Northland and Gisborne-Hawke's Bay regions to illustrate the case. Between 1976 and 1996 the Māori share of the total population

the more youthfully abundant Māori population to disproportionately replace older Pākehā reaching 'retirement age'. The policy implications of this situation are clear. Today's young Māori (and Pasifika) will play an increasing role in determining New Zealand's economic future, and far greater attention to their education, training, health and wellbeing needs is an imperative.

Looking back – migration and the role of amenities
Lars Brabyn's article, '*Declining towns and rapidly growing cities in New Zealand – developing an empirically based model that can inform policy*', returns our focus to the role of migration in determining the relative 'fortunes' of New Zealand's regions, or more specifically of the 275 towns and rural centres referred to above. Linking migration by age data from the Jackson and Brabyn database (above) with a comprehensive time-series database containing social, economic and natural amenity data, Brabyn employs a range of analytical techniques and modelling to explore why some towns grow and others don't. He finds that age is a particularly important factor in determining which variables have the most influence. Younger people, especially around labour market entry age, are moving to more populated places and close to tertiary education facilities and, by implication, to jobs, while people approaching 'retirement age' have a preference for lifestyle drivers, such as warm temperatures and coastal towns, as well as access to international airports and tertiary hospitals. Although some of these drivers have been documented before, much understanding has been based on anecdotal evidence and weighted towards traditional drivers of employment and essential services. Brabyn's research has substantiated this anecdotal evidence, but also demonstrated that lifestyle choice, both nature-based (mountains, climate and water views) and possibly cultural (access to large cities) are just as influential as employment drivers and access to essential services. Importantly for policy purposes, towns close to airports and with natural amenity value are especially favoured by those at labour-market exit age. With population ageing this group's

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'with' and 'without' migration, finding for example, that the vast majority of New Zealand towns, rural centres and territorial authority areas are somewhat older as a result of migration – rather than younger as many would expect. In order to summarise these findings, the article in this issue is structured around a set of ten key observations.

Māori in contemporary and future development
Also drawing attention to the all-important role of natural increase, the article by Bill Cochrane and Ian Pool (*Māori in New Zealand's contemporary development*) focuses attention on the contribution of Māori reproduction to New Zealand's population growth, and to its economic development in terms of subsequent share of the working age, and employed, population. With a substantially younger age structure than that of the total population, especially that of the Pākehā (European-origin) population, the slightly higher fertility rates of Māori,

in each region rose markedly, before stabilizing at around twice the national share. In 2013, Māori in the Northland Region accounted for 55 percent of the region's 0-4 year olds, up from 28 percent in 1976; in the Gisborne-Hawke's Bay region the proportions were 67 and 21 percent respectively. By comparison, the Māori proportion of the 0-4 year-old population at national level increased from just 13 to 27 percent – although in each case this is also somewhat greater than the total Māori share. Similarly, the proportion of Māori in the working age population in both regions increased from around 18 percent in 1986 to close to 30 percent in 2013, by comparison with their national level counterparts increasing from 10 to 13 percent, roughly equal to their population share. Sadly, as Cochrane and Pool show, these substantially greater proportions at working age have not resulted in greater employment rates for Māori, depriving both Māori and all of New Zealand of a potential 'collateral' economic dividend – the potential of

size will increase and there is likely to be increased movement of people to these towns – potentially ameliorating some of the projected declines for those towns. As he argues, knowing what characteristics are favourable, declining towns can examine how they can better capitalise on these factors.

Looking ahead – migration and (un)certainty
Assisting us to look further ahead and to do so with an increased level of confidence, Michael Cameron's article presents key findings from one of New Zealand's first full sets of TA-level stochastic population projections, developed during the course of this project. By comparison with deterministic projections (the classic 'high', 'medium' and 'low' variants that users of population projections are familiar with), the stochastic approach involves running a projection model a large number of times – in this case, 1,000 times. On each run, the fertility, mortality and migration assumptions are randomly applied, in the process generating both future size and accompanying levels of (un)certainty. Cameron's model also uniquely uses a 'gravity' model of migration – one which allows migration flows in each direction to be made explicit, and which will assist end users of these data to understand a little more about where their migrants come from and go to. For this issue, Cameron has used the model to explore the probability of TAs declining across the periods 2023-2033 and 2043-2053 (see also Jackson & Cameron 2017). The progression from growth to decline is clearly charted for a number of TAs (and for a few, continued decline) as time passes, particularly for rural and peripheral areas. Between 2023 and 2033, 20 TAs (30 percent) have a 90 percent or greater chance of declining, increasing to 26 TAs (39 percent) between 2043 and 2053. Less likely to decline, but still having a probability of decline of between 50 and 90 percent, are a further six TAs between 2023 and 2033, increasing to seven between 2043 and 2053. At the lowest end of the scale are five TAs with a probability of decline between 2033 and 2043 of between 5 and 50 percent, increasing to seven TAs between 2043 and 2053. These findings refine, but

generally accord with, the medium variant deterministic projections used by Jackson and Brabyn (this issue) to extend their analysis of towns and rural centres. They also strengthen the proposition that New Zealand is facing a very different set of growth and decline dynamics to those extant in the past.

Looking ahead, looking back – the role of urban influence
Cochrane and Maré's article, '*Population change and urban influence*', concludes the issue by looking at the relationship between the degree of urban influence and population change – and at the possibility that commuting may partially

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resolve some of the issues outlined herein. The article itself sits within the tradition of conceiving of urban-rural relationship in terms of an urban core/rural periphery and seeks to find evidence of backwash (negative) or spread (positive) effects using a descriptive approach based on the Statistics New Zealand experimental urban-rural classification and census data for the 2001 and 2013 census years. This classification schema classifies areas on the basis of their level of urban influence where influence is determined by travel to work commuting. A number of variables are considered: population distribution and growth, age, ethnicity, employment rate, level and growth of skilled employment, and place of residence 5 years ago. Starting with the distribution of the population they confirm that although population is strongly concentrated in urban areas, the most rapidly growing areas are those outside the urban areas which are subject to high levels of urban influence. This relationship between population growth and urban influence attenuates as the level of urban influence declines. Turning to the characteristics of

these high growth/high urban influence areas, in these areas the fastest growing age group is that aged 65 years and over, with the next fastest growing being those aged 45-64 years. A summary measure based on area rankings of Population Growth (2001-2013), Employment Rate (2001), Percent Employed in High Skill Jobs (2001) and Percent Growth in High Skilled Jobs (2001-13) indicates that areas subject to high levels of urban influence are the best performing group, being the highest ranked on three of the outcome variables (population growth, employment rate and growth in high skilled jobs) and second on employment in high skill jobs. Further, for the other non-urban areas performance declines with the degree of urban influence, that is, high > moderate > low > rural/remote corresponding to a clear pattern of level of urban influence equating to the ranking of the area. The overall finding is that, on the basis of the descriptive evidence considered, areas of high urban influence benefit from their close connection with urban areas and that some areas can improve their growth performance by developing or strengthening their ties with urban areas.

What have we learned, what do we need to do?
In this issue we have outlined a selection of the findings from just one project in one small country. We have argued that the ending of population growth and onset of depopulation is 'over the horizon' for New Zealand, at national level. However we have also shown that the majority of New Zealand's subnational areas are ageing at a faster rate than might be otherwise appreciated in a country with a relatively high birth-rates and typically high levels of international migration; and that

migration, international and internal combined, has in many cases caused this accelerated ageing. We have shown that people are moving for different reasons than in the past, and that these movements are highly differentiated by age. Migration has also caused many areas to grow but to be smaller than they would have been in the absence of migration, their growth due to natural increase offsetting underlying net migration loss. We have shown the important role of Māori in contributing to population growth and maintaining natural increase well in excess of their national population share in some areas; but we have also shown that natural increase *per se* is now becoming vulnerable, and projected to become natural decrease in an increasing proportion of TAs (and the towns and rural centres that comprise them), as the increased numbers at older ages result in an increase in the number of deaths, and as fewer people have children. This shift may be especially hastened if industrial closures continue to ravage and displace populations in which Māori are present in disproportionate numbers. We have developed confidence levels around a new set of projections, which confirm that subnational New Zealand will soon see a different set of growth and decline dynamics than in the past. Increasingly, population growth will become concentrated in fewer TAs, towns and rural centres. We have shown that work-related commuting is likely to sustain some areas for longer, particularly those near relatively large centres.

Not included in this collection, our research has also led us to propose that all areas – sub-nationally, nationally, and internationally, face diminishing *replacement capacity*: the capacity of births to offset a) the increased numbers of deaths arising from increased numbers at older ages, and b) any net migration loss, as a result of interactions between the demographic transition and the mobility transition (Jackson & Pool forthcoming). Specifically, we argue that areas losing young migrants simultaneously lose their replacement capacity to areas gaining them, in effect 'watering the neighbour's garden' (Attané & Guimoto 2007) and indicating the need for compensatory-type policy development.

As we note, all of this can occur while population growth continues at national level, and for New Zealand we expect this to be the case until somewhat later this century. At the same time, the subnational ending of growth and likely onset of sustained depopulation has not yet been theorized, and certainly not operationalised, to assist policy responses. As Matanle (2017a, 2017b) proposes, there are many plausible opportunities on offer under the auspices of a 'depopulation dividend', among them new economic innovations, less environmental damage, a renewed sense of community, and greater collaboration. However, similar to its classic 'cousin', the 'demographic dividend' (Bloom, Canning & Sevilla 2003; Pool 2007), the depopulation dividend must be engaged with in a timely manner. With the demographic dividend, there is a short-term window of opportunity during which proactive policies to ensure the health and education of the future labour force must be developed and implemented. With the depopulation dividend, the window of opportunity is also short-term, as, if left to 'the market', depopulating areas will wither and die.

Pre-empting the emergence of such policy development, we supervised, as part of this project, a Masters student to undertake an evaluation of policy responses to depopulation across seven OECD countries (McMillan 2015). Too detailed to cover here, Rachael's invaluable work is summarized in McMillan (2016). In sum, she categorized a vast array of policy responses as either a) 'do nothing' (ignore the problem and let the market decide), b) 'counter' (continue to seek economic and population growth by increasing the competitiveness of regions or key agencies), and c) 'accept and adapt' (continue to seek out opportunities which maximise economic and population growth, while adapting both them and policy development to the acceptance of low/zero/negative population growth). We note that this work has recently been picked up by the Maxim Institute and a set of recommendations developed, prioritizing the 'accept and adapt' model for regions facing the end of growth (Wood 2017: 31). Rather than repeat the exercise we conclude this introduction by endorsing that recommendation, with the added caveat that adaptation involves fully understanding the local dynamics, such as we have outlined in this issue, and orienting solutions towards them.

References

Attané, I & CZ Guilmoto (2007) *Watering the Neighbours' Garden: The Growing Female Demographic Deficit in Asia* Paris: CICRED

Audirac, I (2012) 'Declining suburbs in Europe and Latin America' *International Journal of Urban and Regional Research* pp.226-244

Bedford, R, & I Pool (2001) 'Flirting with Zelinsky in Aotearoa/New Zealand: A M ori mobility transition' pp.44-74, in J Taylor & M Bell (eds) *Population Mobility among Indigenous Peoples in Australasia and North America* London, UK: Routledge

Bloom, D, D Canning & J Sevilla (2003) *The Demographic Dividend: A new perspective on the economic consequences of population change* RAND Corporation

Brabyn, L (2017) 'Declining towns and rapidly growing cities in New Zealand - developing an empirically based model that can inform policy' *Policy Quarterly* Supplementary Issue, pp.37-46

Bucher, H & R Mai (2005) *Depopulation and its Consequences for the Regions of Europe*. Report Prepared for the Council of Europe, Directorate General III–Social Cohesion DG3/CAHP10(2005) 7 final

Cameron, M (2017) 'The relative (un)certainty of population decline' *Policy Quarterly* Supplementary Issue, pp.55-60

Champion, AG (1992) 'Urban and regional demographic trends in the developed world' *Urban Studies* 29, pp.461-484

Chesnais, J-C (1990) 'Demographic transition patterns and their impact on the age structure' *Population and Development Review* 16, pp.327-336

Coale, A (1972) 'How a population ages or grows younger' in R Freedman (ed) *Population: The vital revolution,* pp.47-58, Doubleday-Anchor: New York

Cochrane, W & D Maré (2017) Population change and urban influence *Policy Quarterly* Supplementary Issue, pp.61-71

Cochrane, W & I Pool (2017) 'Māori in New Zealand's contemporary development' *Policy Quarterly* Supplementary Issue, pp.47-54

Cordell, DD, JW Gregory & V Piché (1994) 'African historical demography. The search for a theoretical framework', pp14-32, in DD Cordell & JW Gregory (eds) *African Population and Capitalism. Historical perspectives* 2nd edition, Madison: University of Wisconsin Press

Davis, K (1945) 'The world demographic transition' *The Annals of the American Academy of Political and Social Science* 237, pp.1-11

Demeny, P (2009) 'Depopulation: concept, consequences, and counteractions', paper presented to Session 139, XXVI IUSSP International Population Conference, Marrakech, 22 September-2 October. http://iussp2009.princeton.edu/papers/91784.

Dyson, T (2011) 'The role of the demographic transition in the process of urbanization' *Population and Development Review* 37, pp.34-54

Grimes, A & P Tarrant (2013) 'A New Zealand urban population database' *Motu Working Paper* 13-07 Wellington: Motu Economic and Public Policy Research

Haartsen, T & V Venhorst (2010) 'Planning for decline: anticipating on population decline in the Netherlands' *Tijdschrift voor economische en sociale geografie* 101, pp.218–227 doi: 10.1111/j.1467-9663.2010.00597.x

Jackson, NO (2014) 'Sub-national depopulation in search of a theory – towards a diagnostic framework' *New Zealand Population Review* 40, pp.3-39

Jackson, NO & L Brabyn (2017) 'The mechanisms of subnational population growth and decline in New Zealand 1976-2013' *Policy Quarterly* Supplementary Issue, pp.22-36

Jackson, NO & L Brabyn (forthcoming) 'Population ageing and age-selective migration. Subnational population trends in New Zealand'. Draft available from authors on request.

Jackson, NO, L Brabyn & D Maré (2016) 'New Zealand's towns and rural centres 1976-2013 – experimental components of growth' *Working Paper No. 7.* National Institute of Demographic and Economic Analysis, University of Waikato: Hamilton, New Zealand

Jackson, NO, L Brabyn, DC Maré, MC Cameron & I Pool (forthcoming) 'From ageing-driven growth towards the ending of growth. Subnational population trends in New Zealand' *Under Review*

Jackson, NO & MC Cameron (2017) 'The unavoidable nature of population ageing and the ageing-driven end of growth - an update for New Zealand' *Population Ageing* (tba) 1-26. DOI: 10.1007/s12062-017-9180-8

Jackson, NO & I Pool (forthcoming) *A Theory of Replacement Capacity* manuscript in preparation

Johnson, KM, LM Field and DL Poston Jnr (2015) 'More deaths than births: subnational natural decrease in Europe and the United States' *Population and Development Review* 41(4), pp.651–680

Lutz, W, W Sanderson & S Sherbov (eds) (2004) *The End of World Population Growth in the 21st Century: New challenges for human capital formation and sustainable development* London & Sterling VA: International Institute for Applied Systems Analysis/Earthscan

Martinez-Fernandez, C, N Kubo, A Noya & T Weyman (2012) Demographic change and local development: shrinkage, regeneration and social dynamics *OECD/LEED Working Paper Series*

Matanle, P (2014) 'Ageing and depopulation in Japan. Understanding the consequences for East and Southeast Asia in the 21st Century', in H Dobson (ed) *East Asia in 2013: A region in transition*, pp.30-35 White Rose East Asia Centre and Foreign and Commonwealth Office Briefing Papers, Sheffield: WREAC

Matanle, P (2017a) 'Towards an Asia-Pacific depopulation dividend in the 21st Century. Regional growth and shrinkage in Japan and New Zealand' *The Asia-Pacific Journal* 15(6), p.5

Matanle, P (2017b) 'Understanding the dynamics of regional growth and shrinkage in 21st Century Japan: Towards the achievement of an Asia-Pacific 'Depopulation Dividend'', in D Chiavacci & C Hommerich (eds.) *Social Inequality in Post-Growth Japan: Transformation during economic and demographic stagnation*, pp.213-230 London: Routledge

Matanle, P & A Rausch with the Shrinking Regions Group (2011) *Japan's Shrinking Regions in the 21st Century: Contemporary responses to depopulation and socioeconomic decline* Amherst, NY: Cambria Press

Matanle, P & Y Sato (2010) 'Coming soon to a city near you! Learning to live 'beyond growth' in Japan's shrinking regions' *Social Science Japan Journal* 13(2), pp.187-210

McMillan, R (2015) 'Anticipating subnational depopulation. Policy responses and strategic interventions to regional decline', Masters Thesis, University of Waikato

McMillan, R (2016) 'The shrinkage pathway: managing regional depopulation', in P Spoonley (ed) *Rebooting the Regions: How low or zero growth needn't mean the end of prosperity* pp.213-237, Albany: Massey University Press

Notestein, FW (1945) 'Population: The long view' in TW Shultz (ed) *Food for the World* pp.36-67, Chicago: University of Chicago Press

Pool, I (2007) 'Demographic dividends. Determinants of development or merely windows of opportunity?' *Ageing Horizons,* 7, pp.28-35

Pool I (2017) New Zealand's population and development path: the 'when', 'how' and 'why' of New Zealand's population and development path' *Policy Quarterly* Supplementary Issue, pp.10-21

Reher DS (2011) 'Economic and social Implications of the demographic transition' *Population and Development Review,* 37, pp.11-33

Rogers A, & J Raymer (2003) 'Immigration and regional demographics of the elderly population of the United States' *Journal of Gerontology* 56B (1), pp.S44-S45

Skeldon, R (1997) *Migration and Development. A Global Perspective* London: Addison Wesley Longman

Statistics New Zealand (2017) Subnational population projections by age and sex 2013(base) – 2043 Update

Wood, J (2017) 'Growing beyond growth. Re-thinking the goals of regional development in New Zealand' Maxim Institute Discussion Paper Auckland: Maxim Institute

World Bank (2009) *Reshaping Economic Geography* chapter 3, Washington DC: World Bank

Zelinsky, W (1971) 'The hypothesis of the mobility transition' *Geographical Review* 61, pp.219-249

Ian Pool

New Zealand's population and development path
Unravelling the 'when' 'how' and 'why'

Demographic regimes and national identity

New Zealand's demographic regime, moderate to high population growth for most of the last 170+ years, has shaped 'nation building', especially self-identity (Pool 2016). Increasing population numbers, the quantum of demography, is the value 'writ large' in our consciousness, as an immigrant country with one of the highest rates of natural increase (births minus deaths) among western developed countries (WDCs)[1]. Yet, the spectre of slower or negative demographic rates has now appeared for some regions, and even nationally (Jackson and Cameron 2017), invoked popularly by the application to various districts of the inexact and pejorative term 'zombie towns'. Changes to places

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and people occur typically because of complex forces of population and development, or natural events, outside local control. The trends in the different factors producing sub-national demographic changes have been identified and parsed in other articles in this issue (Jackson and Brabyn, *infra*; Cameron *infra*).

Slower growth and even population decline are not new in Aotearoa's history, as nineteenth century Māori, and Pākehā in the 1930s depression show. But, with the significant exception of Victorian era Māori, this was transitory. The Marsden programme, to which this article contributes, asks: is New Zealand at an inflection point of a continuing and deeper decline, with a new mix of factors, with subnational decreases a key

component that might be an 'early warning' sign of negative national growth? The question here is whether the population dynamics and structures unfolding since 1970/1980 simply represent continuities (or accelerations) of on-going past trends, or whether instead they are far more profound – a multi-factorial rupture, across major segments of the demographic system and its development co-variates? Or, more sceptically, are they simply an artefact of the first-time availability of digitalised, anonymised, but individual level data sets that give an appearance of real change?

The key question is whether or not Aotearoa has passed a genuine inflection point, which would signal a deterministic spiral towards eventual widespread sub-national, and, ultimately, national decline. Alternatively, if the inflection point is more apparent than real, then could we expect to go back – *grosso modo* – to what we were before 1980/1970, when growth was higher, but the population overwhelmingly Māori or Pākehā[2]. This second scenario seems unrealistic because of the diversified 'peopling' streams since 1980, carrying different normative systems from those operating between contact (1769) and then. Prognosis is difficult because there are no national precedents in our history since Pākehā dominated the country's demographic regime – from circa 1860. Nevertheless, we are not alone in this recent transition – Australia, Canada and the United States face similar situations, although we are closer to Canada and Australia than the United States in terms of proportions of foreign-born and Asian, and well above European comparators. We have the additional factor of a large Pasifika population.

This article argues that the trends seen since the 1970s are period-bound – unique to this one era in New Zealand's history, particularly for national material factors, demographic, economic and social systems. Yet, perhaps counterbalancing these are some enduring factors, especially values, and related material factors. The latter are easier to identify and study, and even measure, but values and norms are by their very nature difficult to delineate and document

empirically. Nevertheless, as Prue Hyman (2014: 90) argues, 'Values and norms underlie all economic and social systems…',[3] and this is certainly true for the demographic system as well, because population change is very much a function of both individual and collective ideas. For norms, it is useful to distinguish between what people do – norms as 'modal' behaviours, which can be analysed, particularly by looking at demographic trends, which are simply the sum of what groups are doing in their daily lives – and norms as 'model' behaviours, the explanatory variables for much of sociology and anthropology, which cannot be quite so easily observed. This is not just a handicap for sociology/anthropology: the dominant explanatory variables for economists, 'market forces', are equally as nebulous, so that even the great Adam Smith had to refer to the 'Invisible hand, the unobservable market force that helps the demand and supply of goods in a free market to reach equilibrium automatically' (www.dictionary.com/browse/invisible-hand).

When analysing the recent decades, a simplistic, oft-cited explanation of the observable changes is that they are economically determined, by (i) globalisation and financialisation[4], or (ii) some recent, seminal exogenous political-economic event (e.g. Britain entering the European Union, or now its manoeuvring to 'Brexit'). The causes and effects of these are often measured by changing patterns of employment and shifts in the industrial sectoral labour force, say the explosion of the Finance, Insurance, Real-Estate (FIRE) sector. This article questions this explanation, showing that population changes, which, to reiterate, are shifts in modal social behaviours, preceded economic, recently, post-1970, and historically. This sequencing implies causality, but being deterministic is

reductionist as the drivers of change are complex and interrelated rendering it impossible to disentangle them; this is not to eschew 'causality' when explaining 'variance' as, for example, in regression analyses for narrowly defined situations, but such narrow applications do not unravel complex interactions. If there were an overriding determinant, it might be the values-system, but as noted, norms are unobservable.

Population change is interrelated with development in all its dimensions – cultural, economic, health and social. A model, 'Total Social Production', outlined below, provides a wider understanding of these interlocking transitions, and was elaborated to analyse African development. Operationalised for New Zealand by Jackson (1998) to study ethnic stratification, it has many attributes

> Population change is interrelated with development in all its dimensions – cultural, economic, health and social.

essential for the explanation of population change in relation to development and covers most factors of production and reproduction. Jackson's 'acclimatisation' of the model is opportunistic, avoiding the need to test its applicability, particularly apposite when reviewing Aotearoa's temporal sequencing of multi-factorial changes.

The prime role of this paper is to outline history – how we got to where we are: prognosis is left to other essays in this issue. Since contact in 1769, Aotearoa has passed through three eras, the transformations between which have followed a sort of sequence, with demographic changes preceding economic. Fundamental changes have come from a fuzzy mix of demographic, economic, social and technological shifts, some of which have been 'game-changers', as against shocks with short-run effects. The most recent era is covered by this Marsden Programme, which plays a seminal role in documenting and theorising about what is unfolding as a major question globally.

At present neither a more comprehensive meta-synthesis of findings exists, nor a sustainable theory on its 'how' and 'why'; the 'when' seem more concrete – since the 1960s-1980s seems to be a common experience across the WDCs – but that belies real momenta, which may stretch back to roots that are earlier (e.g. Merlin 1971, 2009; Johnson et al 2015; Pace and Mignolli 2016).

Towards an analytical framework: 'Total Social Production'

No systematic corpus of theory exists on sub-national declines, although observations of particular factors and situation-specific interpretations show that this is an important issue across

although health development is valorised. Unfortunately, neo-liberal development economics downplayed 'health development' as a vexing demand-side, fiscal burden, best privatised. Recently, however, mainstream economics sees health as essential for productivity (World Bank 1993, 2007; Stiglitz, 2008; Deaton 2013: Chapt 1).

Integrating demographic factors into development requires models that recognise that 'neither production [and thus the remainder of the economy] nor reproduction [and the rest of demography] can take place in the absence of the other…' (Jackson 1998: 30, drawing on Cordell, Gregory & Piché (1994), in African population studies, and saw

of economic primacy reflects a general failure to adequately conceptualise and integrate the generational replacement of labour power'. This also applies to 'the genesis of the consumer population, without which capitalist production would have rapidly ceased, and capitalism with it' (Jackson 1998: 30-31). Her arguments point to the impacts of momentum effects, of cohort flows, frequently analysed in mortality, fertility and numeric ageing. But, momenta also have wider roles: they constitute the fundamental structural factors of population and development. Such trends are not like those, say, of stock-markets or 24-hour news cycles, both of which fluctuate dramatically, almost minute by minute; instead, structural forces generate momenta that endure and are irreversible. For example, a seminal action of South Africa's apartheid was coercively to block 'urban influxes' of Blacks, assigning them to non-metropolitan 'Bantustans'. Even so, the regime failed to combat natural forces, and, since apartheid ended, agglomeration has accelerated, with 'townships', such as those neighbouring Cape Town, growing rapidly (Pool 2014). Yet, change can be sudden, even unforeseen; the decision by an absentee corporation to close a plant may affect regional development (Cochrane & Pool *infra*). Similarly, migratory 'churning' in New Zealand's migration patterns in the 2010s, has an impact culturally, socially and economically (Pool 2015a, 2016).

'Social organization' depends on both production and social reproduction, which includes fertility and child survivorship.

WDCs. Moreover, conventional models in population and development have limited utility, as they are factor-specific, deterministic and uni-directional. For example, Frank Notestein's (1945) demographic transition, really natural increase, excludes long-term natural decrease or migration, both pertinent to sub-national declines (Casterline 2003; see also epidemiological transition, Omran 1982; industrial sector transformation, Chenery & Syrquin 1975; and Maddison 1982). The mobility transition model is not merely deterministic, but confounds migration with population redistribution (e.g. urbanisation). Focusing on internal migration makes the model less applicable to the effects of international movements (Bedford & Pool 2004)[5]. The World Bank (2009), extolled agglomerations, downplayed the inverse, regional declines, and simplistically attributed causation to 'market forces'. Richard Nelson's (1956) powerful model on 'low level equilibrium traps in underdeveloped economies' may have application to marginalised regions[6] but it does not cover demographic change,

'reproduction of the labour force', often forced or indentured, as vital for labour-intensive colonial production – mining, plantations, public infrastructure). Jackson focused on Aotearoa's ethnic stratification, constructing a model sufficiently complex to cover most of the issues being dealt with here. But, it needs 'tweaking' at its edges – for example, adding child survivorship and seeing migration as merely one process producing geographic re-distribution. Equally, recognition must be given to structural economic factors. It already covers economic factors – employment, the labour force, consumption – but macro-economic drivers provide the underlying momenta of sub-national changes.

Total social production, with its roots grounded in social theory, implicitly underpins the classical population and development literature. Above all, 'economic production and demographic reproduction are both material processes, and that neither dimension can be subordinated to the other… [T]he problem

To operationalise the total social production model, it is necessary to recognise the recent dominance and expansion of the U.S. FIRE-sector (see former Republican strategist, Phillips, 2006; Aotearoa, Kelsey 2015). Its financial sub-sector oils development, while real-estate facilitates residential development. But, often the FIRE-sector diverts investment from productive activities, has a major role in agglomeration, positive or negative, and is an engine of sub-national decline. It also drives consumption, yet may be negative: Auckland's housing for example.

Jackson, drawing on Cordell et al, identifies the following traits of total social production (paraphrasing Jackson 1998: 31-32)[7]. 'Social organization' depends on both production and social

reproduction, which includes fertility and child survivorship. In low mortality populations, fertility drives levels of natural increase, but, recently, where regional age-structures are disproportionately older, natural decrease from old-age mortality is seen (US, Europe: Johnson et al 2015; NZ: Jackson & Brabyn *infra*). Presaging the more recent literature on 'demographic dividends', Jackson identifies the importance of the labour force age-group, responsible for production, and also for childbearing and childrearing. A demographic dividend occurs when the costs of social support decline because of fertility decreases occurring before ageing sets in, and the resultant dividend is invested in productive sectors. This requires pro-active policies and efficient management, whereas diverting economic and social investment into some rentier activities will dissipate dividends. In the period from 1970s-2010s Māori and Pākehā age-momentum effects provided a 'Window of Opportunity' for such dividends, but Aotearoa squandered this (Pool 2016). High Māori (and Pasifika) fertility rates in the 1970s have produced momentum effects; at first, high child dependency, constraining household savings. But declining natality since then could generate new dividends through national and sub-national labour markets, but only if pro-active education, work-training and labour market policies were implemented (Jackson 2012, 2016).

The two functions of production and reproduction typically result in sexual divisions of labour. Gender still affects remuneration, status within occupations and choice of job (Hyman 2014). Age also has classificatory effects: in WDCs retirement affects employment levels. '[R]eproduction of the labour force,' is merely one aspect of its renewal. Others are: 'replacement of older workers to respond to new demands [up-skilling], and to offset death and emigration'; maintenance of good health; social support systems for non-workers. In-migration affects replacement, so population geography is critical.

Finally, the family represents the main locus for production, plus the reproduction of the labour force. With

today's dominant workplace-home separation, this should apply less than when households were central to production and reproduction (e.g. Aotearoa's family owner-operated dairy farms). But overseas, National Transfer Accounts (NTA) exercises show that the family still remains critical, even in formal economies with wide workplace-home gaps[8].

Jackson also introduces 'the concept of lag time, first as it pertains to the period between first births and their eventual arrival at the labour market, and second as it pertains to the childbearing patterns of subsequent generations'; momentum effects are correlates of this. Because of lags and momenta nation-states continue to grow even when reproduction levels

transition from the second to the third, but some important values and tangible determinants of development were laid down in the first era, and so it must be briefly discussed.

have dropped to below replacement. Other non-demographic phenomena, such as infrastructure projects, are subject to lag time, even when completed according to plan. Other examples are the installation of new plant; delays between workforce planning, recruiting and new employee(s) being at their workplace(s).

The discussion above covers natural increase, labour markets, population redistribution, shifts in age-structures and cohort momentum effects, all of which have longer-term provenances. There are still survivors of early 20th century birth cohorts; the 1930s cohorts were born closer to the New Zealand Wars (1860s) than the Global Financial Crisis (2000s).

The total social production model directly addresses economic changes through its emphasis on labour and production, although less directly on consumption. But this belies more fundamental questions about the drivers of sub-national change and differentials, a problem exacerbated by the tendency to carry out short-term analyses. In reality the population-economic drivers of

change have their own momenta and enduring effects whose roots often go back very far. Some roots may lie less in population-economic factors *per se* than the broader political economy, the wider society and pervasive ideational constructs. Thus, the question of whether or not recent decades are unique in the history of New Zealand's political economy is not at all academic.

Aotearoa's population and development: Historical eras

Over its post-1769 history, New Zealand went through three major eras[9]: a Turbulent period, 1769-1880s/1890s; 'Recolonisation', 1880s/1890s-1970s; and the current Neo-turbulent period starting in the 1970s. The interest here is the

> Growing competition from settler-owned extensive grain farms in the 1860s' wars was reinforced by the destruction of Māori horticulture.

Turbulent Era, 1769-1880s/1890s
First came a Turbulent period, for much of which time – to ca.1850 – the country was virtually mono-cultural, Māori. By 1901, however, Māori were only 5 percent of the total in what was then bi-cultural, with very small numbers of Chinese and others. Māori passed 10 percent of the total only in the final decades of the 20th century. A list of key events for Māori in the Turbulent era would include contact; the inter-tribal 'Musket Wars'; the far more significant impacts on Māori of introduced diseases to which they had no immunity; the very successful Māori enterprises, both domestic and international, in an epoch of paleo-globalisation; colonial annexation; two major colonial wars, the second of which (1860s) lasted 12 years, was highly asymmetric, had very high fatality rates (for Māori) and at peak

involved 29 percent of all imperial troops, worldwide outside Britain and India. Growing competition from settler-owned extensive grain farms in the 1860s' wars was reinforced by the destruction of Māori horticulture. The cardinal factor, from the 1840s into the 20th century, was the loss of most of their land and other resources – thus their capital (so defined, Piketty 2014: 46-48, 213). This loss came from a mix of warfare, invasion (O'Malley 2016) and frequently dubious legal means (Pool 2015a; *Parliamentary Commission Report*, Rees & Carroll 1891). For Māori, land loss is a source of enduring bitterness, only mitigated since the 1970s by the Waitangi Tribunal/Office of Treaty Settlements processes. They restore some of the

Pākehā population growth came more from natural increase than migration, as settler fertility levels neared biological maxima (1870s) and child survivorship the most favoured anywhere. This trend and its underlying pro-natalism were to be reprised in the Baby Boom but at a lower level (births per woman 1870s, 7.0; 1960, 4.0). Such values may persist in residual form in the maintenance since the 1970s of exact replacement, a high level for WDCs today. Finally, Pākehā redistributed geographically. In a seminal study Miles Fairburn, referring to 'bondlessness', showed that they were highly mobile residentially, more so than North Americans (Fairburn 1989; Nolan 2009; Pool et al 2007). In 1840, three-

South Africa and the United States, Native-Americans were enslaved (Resendez 2017: chapters 10 and 11) and others imported (e.g. Africans to the Americas; Malays to the Cape)[11]. The evangelical ethos transmitted itself to the post-war Welfare State, via preferred settler-recruitment systems (Vogel's *Immigration and Public Works Act, 1870*), the Liberal Government's policy 'experiments' (Sinclair 1959: Part Two, chapter II), the *Social Security Act, 1938*, and since then by the *Accident Compensation Act, 1972*, the *Superannuation Act, 1974*, aborted by Robert Muldoon, *the Treaty of Waitangi Act, 1975* and *the New Zealand Superannuation and Retirement Act 2001*.

The most persistent and consistent example of a values system and related material development, has been the Pākehā obsession with pastoralism, driven by 'land-abundance' myths – sheep 'ranching' started immediately (1843) after annexation. 'Grasslands' farming has been essential to nation-building, economically, in moulding its demography, social structures social organisation and political dynamics. But, to put it in context, it was part of a land-grab of immense proportions, encompassing the Americas, southern Africa, Siberia and Australasia (Weaver 2006), and even in the metropole itself – Highland and Irish 'clearances', Anglo-Welsh 'enclosures (Pool 2015a: passim). Everywhere, this required the displacement of the native owners, whose mixed land-uses were to yield to beef and sheep ranching, and sometimes extensive grain farming. In Aotearoa, Māori, like Irish or Scottish peasants/crofters, were forced onto small lots or displaced into other regions, to eke out their living, highly dependent on potatoes, subject to episodes of blight.

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capital essential for development, until then reliant on earned income (Cochrane & Pool *infra*). Conversely, Pākehā gained that capital and much of New Zealand's development relied on its exploitation; many Pākehā refuse to acknowledge this 'ghost at the party'.

For Pākehā, this era was also turbulent. There were numerous commodity 'booms', from extractive industries; Michael King says, 'It is difficult to see how New Zealand could have survived as a viable country had it continued to rely solely on wool and grain and extractive commodities for its national income' (King 2003: 237). Pākehā fought wars and skirmished with Māori. Booms attracted major inflows of gold-diggers; settler-colonists gained from the dispossession of Māori from their land; and wars engaged military and militia-migrants. Net immigration was heavily concentrated into just two quinquennia, 1861-65 and 1871-75, then after this slowed, with brief outflows (Pool 2015b). Rapid Victorian

quarters were in what became Auckland Province, going down to 47 percent (1857/58), but still with 74 percent in the North Island. But, by 1874, goldrushes, 'ranching'[10], grain booms, 'bondlessness' plus the northern war saw 55 percent in the South, with Dunedin briefly being Aotearoa's prime settlement. By 1896, however, the North Island once again outnumbered the South, and by 1901 Auckland was the leading city, with growing ascendancy, accelerating in the Baby Boom, and since 1970.

From contact, various nation-building values and determinants of development have been inherited and perpetuated, more or less, until the present. For example, Aotearoa's delayed annexation, compared to Australia, although Cook 'discovered' both in 1769-70, plus the power of evangelicals in Whitehall ca.1840, focused on 'Aboriginal protection', ensured that Aotearoa was never a slave or convict colony – nor used indenturing. In other settler-colonies as in

Recolonisation, 1880s/1890s – 1970s

James Belich argues, convincingly, that New Zealand then went through a century of 'Recolonisation', 'a renewal and reshaping of the links between colony and metropolis after an earlier period of colonisation'. In this era, 'New Zealand became the town-supply district of London. London became the cultural

capital of New Zealand' (Belich 2001: 29-30). This was a period of relative stability demographically and economically, sustained by a values-system that went through only gradual transitions, underpinned by the production and export of pastoral products.

The game-changers shifting Aotearoa from turbulence seem to have been provoked by three demographic changes among Pākehā, now enjoying demographic and political hegemony. First (late 1870s), radical volume declines in immigration occurred, even a brief loss, presaging several other modest outflows – 1926, mid-1930s, late-1960s – in an era when net immigration generally remained steady but not spectacular (Farmer 1985: Fig 14). Secondly, and simultaneously (1870s-1901), 'family values' shifted from a colonial reproductive regime (early, almost universal, marriage; high fertility rates) to that prevalent in Britain – not achieved through contraception, which, anyway, was still very primitive technologically. There were marked increases in the age at first marriage and in female celibacy (Pool et al 2007: chapters 3 and 4). This reprise of British patterns of nuptiality coincided with other values-shifts (Belich 2001: 30): '[R]obust and ruthless town- and camp-led progress was written out, steady and farm-led progress was written in… relations with Britain became more deferential … sub-nationalist … [a] permanently junior partnership…' Thirdly, inter-provincial migration had been high in 1891-96, when the redistributions northwards and through pastoral intensification reached high levels. Tellingly, however, the mobility declined, and never reached early 'Recolonisation' levels again until 1991-96 (Brosnan 1989; updated by me).

New technologies (1880s) facilitating 'Recolonisation' are often cited as overriding determinants, yet, coterminous timing with massive demographic shifts suggest that causal pathways are more diffused. Indeed, two decades ensued before most farmers had adopted technologies, a process reinforced by land reforms (1891-1911) (McAloon 2008: 5), a product of values-systems favouring property rights, yet guaranteeing access to

comfortable living-standards for the average family. Paradoxically, the Liberal Party's tenurial reform architect, Gaelic-speaking John McKenzie who had witnessed highland clearances, saw little dissonance in displacing Māori from their lands (Brooking n.d.).

Recolonisation was underpinned economically by pastoralism: New Zealand, the 'dairy farm of the Empire' (King 2003: 237). David Greasley and Les Oxley show that grasslands farming intensified from the 1880s, a shift made possible through freezing, dairy processing and milking machine technologies, plus legislation that 'dismantled the large estates', thereby definitively precluding plantation agriculture. Together, these factors created New Zealand's iconic regime of family-owned and operated farms, for eight decades providing most farmers with satisfactory living-standards in a country with the highest GDP globally – at least as late as 1938. Moreover, this affected the population geography, leading to high levels of urbanisation early in the 20th century (Greasley & Oxley 2005, 2009). However, this was an urban system underpinned not by heavy or textile manufacturing, but linked to the processing and export of pastoral produce, and the import of manufactured goods from the 'mother country'. Coastal secondary cities, Gisborne, Timaru, Whanganui, Invercargill, Napier and New Plymouth, exported directly to Britain. During the Baby Boom, some grew at rates above New Zealand's as a whole, but from 1976 their growth dropped. The largest urban areas, Auckland, Wellington, Christchurch, Dunedin and Napier-Hastings consistently retained this ranking from 1936 to 1976, after which Hamilton (4th) and Napier-Hastings (5th)

passed Dunedin (6th), recently outdone by Tauranga, a small centre (3,000) in 1936.

Envisaging 'Recolonisation' as a period of stability seems unrealistic given two World Wars and others, depressions (1880s; 1930s), the 'Baby Boom', Korean War Wool Boom (1950-51), 'Great/Long Boom' (1935-66, Easton 2010) and the rapid Māori rural exodus. Nevertheless, for dominant Pākehā, loyal subjects of 'England', norms and values remained relatively stable, adhering to mores and ideas they believed characterised the 'mother country'. The last Dominion to ratify the Statute of Westminster (1931), Parliament passed the *New Zealand Constitution (Request and Consent) Act* in 1947, over strong opposition from the

> Even after World War II … economically (trade), culturally and socially, and demographically, through British migration preferences – New Zealand remained closely linked to 'Home'.

opposition which viewed the bill as disloyal.

During 'Recolonisation', Aotearoa's strategic directions were really dictated by the concerns of the Pākehā majority. Even after World War II, in a *de facto* sense – economically (trade), culturally and socially, and demographically, through British migration preferences – New Zealand remained closely linked to 'Home'. In fact, Aotearoa's metropole-dependent mentality persisted until the 1960s/1970s: the British flag flew, alongside its own, 'God Save the King/ Queen' was played before shows, with the audience expected to stand. Britain's decision to join the European Union in 1973, although previewed and with diversification underway from the 1960s (Easton 2010: 10), was an emotional shock. Gary Hawke (1985) devotes a chapter to the significance of 1967-68.

Two very important demographic events occurred after World War II: Māori urbanisation and the eponymous Baby Boom. Other demographic changes were

Table 1: Per annum Growth (%), Major Urban Areas Combined, New Zealand Regions

Regions	AKL	RNI	SI	NZ
1936-76	3.0	2.0	1.7	2.3
1976-96	2.0	0.3	0.2	1.1

AKL = Former Auckland Province; RNI = Rest of North I; SI = South I

unfolding (see below), but cumulatively more muted, typically continuities of trends seen historically.

Starting in the 1940s, but accelerating in the 1950s, Māori urbanised very rapidly – pre-1970, the highest among people anywhere (Pool 1991: 152-55, citing University of California, Berkeley, study). Until then, Māori had been largely 'out of sight, out of mind', residing in hilly, marginal regions of the North Island, or in hamlets on tiny pockets of land, for e.g. the Waikato. Urbanisation was initiated and executed by Māori themselves, although the welfare-state gave housing, job-training, welfare and health. The introduction of a new armoury of chemotherapeutics, and equal access to social welfare and health systems, produced a diminution, but not an elimination, of health gaps between with Pākehā. Māori fertility rates remained high until the 1970s (Pool 1991: 152-59).

Meanwhile, Pākehā entered the longest, highest, most intense (timing and spacing) Baby Boom in the WDCs. Its duration exceeded the American by almost a decade, and other attributes were more extreme. First births were early, even younger than in the colonial hyper-fertility period (1870s), and intervals between births short (Morgan et al 2001; Pool 2007). These dynamics have long-term consequences for New Zealand – the simple fact of a second peak ca.1970 affects all superannuation metrics – yet New Zealand commentators uncritically cite American perspectives rather than our own. At the time, moreover, fertility was not just the driver of growth, but also of its fluctuations – disordered cohort flows, a less tumultuous oscillatory factor than migration became in the post-1970 era (Pool 2003).

The Baby Boom remains enigmatic, a deviation from long-term fertility declines starting c.1880, and still evident (2010s). Despite its iconic status, the Baby Boom lasted merely 22 percent of the period since 1880: 60 years of fertility decline

until 1945; the Boom, 30 years; then fertility fluttering around replacement for 40 years since. Most WDCs, including Pākehā (ca.1936) reached replacement fertility in some interwar periods, but there were also marked rural-urban differentials: in 1921, rural Pākehā birth-rates per 100 women, 15-44 years, were almost twice as high as urban (Tiong 1988: 163-64).

The Baby Boom was a 'fad' that gripped all the WDCs simultaneously after World War II, less in Europe, more in Neo-Europes, intensively but quickly curtailed in Japan. The mechanics of what happened are reasonably clear, pointing to period-specific proximate determinants, rather than cohort-effects, but the underlying causes have not been satisfactorily documented. Andrew Cherlin's comparison of America's Baby Boom and Baby Bust (see below) dynamics still does not elucidate for us whether it was a new trend, or was a reprise of tradition harking back to late Victorian New Zealand family building, as if the WDCs wanted a 'last fling' before entering subsequent transitions to sub-replacement fertility (Cherlin cited in Morgan 2003; Pool 2007)[12]. While Pākehā fertility increased, differentials (rural-urban, class and religious) decreased, except ethnically: Māori (high) – Pākehā (medium)[13]. There were, however, significant intra-urban differentials, mainly because of neo-local patterns of family building that clustered young parents into suburbs, in 'state-house rentals', or State Advances' financed owned dwellings. Inflows of young Māori couples into these suburbs intensified intra-urban differentials. Nevertheless, reproductive capacities were still weighted towards rural Pākehā New Zealand. In 1966, in an era when the force of childbearing was at young ages, there were 154 young rural adults (15-34 years) for every 100 older (35-64 years); in metropolitan New Zealand the ratio was 89. In the Neo-Turbulent period (see

below), a shift-share in the composition of the adult populations occurred, affecting the nation's reproductive capacities. By 2001, the ratio was 51 rural, 86 metropoli. Young adults were now city-dwellers, but, because of career pressures and work-family life imbalances, urban Total Fertility Rates (TFRs) had dropped, and levels of childlessness had increased. This was notable in central Auckland and Wellington, where Māori also followed these trends (Pool et al 2007: Fig 4.2, 186-88; Pool et al 2005a: 8-20). By 2001, non-metropolitan regions also had TFRs approximating national levels, except for peripheral North Island areas where Māori were heavily represented.

Across WDCs, higher rural fertility spawned rural exoduses, yet ensured productive and reproductive capacities sustaining country life-ways. But when rural fertility transitions approach urban, trends in natural increase – 'natural decrease' – exceed out-migration rates, as in France, and elsewhere in Europe and the United States (Merlin 2009: 13; Johnson et al 2015). The Baby Boom may thus have dampened down rural-urban differences in intended and actual family sizes, but eventually generated non-metropolitan fertility declines.

With the exceptions of the Baby Boom and Māori urbanisation, gradualism characterised New Zealand's post-war demography, especially its spatial dimensions. Trends producing shifts from Turbulent to 'Recolonial' continued, sometimes accelerating: urbanisation, metropolitanisation, and two waves of suburbanisation. The first depended on public transport limits (interwar years) and then post-war extensions became possible because of automobiles. Aotearoa's population gradually redistributed northward during 'Recolonisation', so, for example during 1936-1976 the Auckland Province's share increased, especially larger urban centres (Table 1). North Island growth was rapid 1936-1976, but in 1976-1996, after 'Recolonisation', nationally New Zealand grew slowly, but differences between Auckland and the other regions increased – relatively and absolutely. While most 'Auckland Provincial' cities – Auckland, Hamilton and Tauranga – grew rapidly and Whangarei emerged,

Gisborne's increases were like the Rest of the North Island.

In the last years of 'Recolonisation', complex sets of changes were underway that would accelerate in the Neo-Turbulent period. The Baby Boom ended not 'with a whimper but a bang': the 'Baby Bust'. The farming sector was becoming more efficient so the rural workforce gradually decreased; conversely the secondary sector grew slowly, peaking in the early 1970s, while the tertiary sector grew gradually.

Neo-Turbulent Period, 1970s to the Present
The 'Neo-turbulent Era'[14] has erupted since the early 1970s. 'Recolonisation' has been supplanted by numerous shocks and game-changers to the demographic and economic system.

This era commenced in the 1970s with demographic changes of lasting significance. First came 'Baby Busts' for both Māori – the most rapid on record anywhere (Pool 1991: 166-75) – and for Pākehā. Both reflected values changes: for Māori, limitation of family sizes; Pākehā a shift from early to older childbearing. Both demanded resort to effective contraception: the 'Pill', which had been rapidly adopted by Pākehā married women in the 1960s, expanding in the 1970s for timing, spacing and limitation; sterilisation, limitation; modern condoms, timing; and the IUD (Pool et al 1999). Moreover, this occurred with little resort to induced abortion, despite a moral panic and controversy (1970s), mainly imported from the United States (the Supreme Court case, *Roe vs Wade*, 1973). The abortion debate is a good example of an accelerating pattern: the speed of diffusion of values that can become distorted in transit (Sceats 1988: chapters 4 and 6). Since then fertility has fluttered around replacement, a little higher for Māori, counteracting the instability migration has inflicted on the demographic system. Contextually, there was a radical shift from marriage as the preferred form of first union to cohabitation (Pool et al 2007: Figs 6.1, 6.2). There were other values-shifts in the 1970s, such as religious affiliation and rapid secularisation (Young 1997: chapter 9).

Secondly, after net-emigration (late 1960s), the largest wave of net-immigration

since 1871-75 hit exactly a century later, but was followed over the next quinquennium by net-emigration – an inter-quinquennial, intra-decennial pattern that continued at least until 2010. These migratory oscillations have buffeted the entire demographic system since then, a common factor across the WDCs. Moreover, churning – by age, occupation, national origin and ethnicity between inflows and outflows and between adjacent calendar years – has added to this instability. Yet, over the long term, migration has barely affected the net stock of population, by comparison with natural increase: from 1976 to 2010, its contribution was one

percent, despite historically high inflows 2001-05; it contributed merely 20 percent of growth, 2010-14; but exciting commentators with short memory-spans, it was a massive contributor over the last two years (Pool 2015b)[15].

In the 1980s, game-changers switched from population to the economic system. The main features of the neo-liberal revolution, passing through 'Rogernomics', 'Ruthenasia' and their successors is well documented, so needs no elaboration here. Over recent decades, micro-economic values – 'Homo economicus, a calculating subject…' (Mishra, 2017), 'individualism and self-actualization…' (Morgan 2003) – and their macro-level analogues, financialisation and marketisation, have dominated development paradigms, a significant effect of which has been increased social and regional inequality (Rashbrooke 2013; Boston & Chapple 2014; Cochrane and Pool *infra*; Pool et al 2005b). First, the industrial sectoral structure of the workforce underwent radical changes in

this period. The primary sector gradually declined (1951-91) from 19% to 11% of the workforce, then withered (2006, 7%). The secondary sector remained steady around 34 percent into the 1970s, then plummeted, manufacturing alone dropping 1986-2006 from 20% to 12%. The tertiary sector grew gradually 1951-86 (< 10 percentage points), ballooning thereafter by almost 20 points. Decreases in manufacturing were offset by expansion of tertiary's FIRE sub-sector, doubling to 16 percent, 1986-2006. This is strongly reflected in the national accounts: 14 percent of GDP was transacted in the FIRE sector in 1986, reaching 25 percent

Functionally, pastoralism continues to hold a highly significant place in New Zealand's economy, despite employing but a minute proportion of the labour force and being a minor component of GDP …

in 2006; the community, social and personal services sector, including health and education rose from 4% to 12% of GDP, 1986-2006.

Functionally, pastoralism continues to hold a highly significant place in New Zealand's economy, despite employing but a minute proportion of the labour force and being a minor component of GDP (8 percent). Quantitatively, however, grasslands' products play a major role in trade, a direct hangover of 'Recolonisation', which still accords pastoralism a high status among attributes that dictate national identity. Primary-sector exports (pastoral, horticultural, fish, wood and other minor items) constitute 62 percent of the total.

Pastoralism has gone through major mutations over recent decades, mainly further intensification: a growing emphasis on dairying alone, reflected in the heavy dependence of dairy products, at the expense of meat and wool, in export incomes. There is increasing reliance on, and heavy usage of, artificial fertilisers,

tenurial changes from family farms to agri-business, often combining multiple former family farms, a waged farm workforce, and increased herd sizes, whether per dairying enterprise, or cows handled per milking-unit (Jackson unpublished). Additionally, 'land-abundance' myths have been stoked by converting other land into dairying (for example, sheep farms; exotic pine plantations; ranched tussock-grass inland basins). Accompanying this has been a population-geographic shift: dairy farming is still dominant in humid western regions of the country, but it has now become significant for less humid eastern regions, requiring major use of river- and aquifer-sourced irrigation.

Finally, New Zealand seems to have followed international trends in peri-urbanisation and also rurbanisation. Pierre Merlin (2009) points out that, not only are French metropolitan-dwellers suburban, but peri-urban – expanding dormitory zones have triggered an 'exode urbaine'. This is reinforced by the functional metropolitanisation of previously small towns with limited services: Tauranga is New Zealand's prototype. Furthermore, Aotearoa also seems to have adopted other WDC-wide patterns. Already, one-quarter of territorial local authorities have more than 20 percent of their population aged 65+ years, one-third saw declines in population numbers 1996-2013, and by

Projections suggest, moreover, that a point of 'no return', of unstoppable decline, has been reached for some sub-national areas of New Zealand. These parameters, indicate complex interrelations between population and development (Jackson & Cameron 2017; Jackson & Brabyn *infra*).

Three questions were set at this article's start, two partially answered. First, for the hegemonic Pākehā, 'when' the shift from 'Recolonisation' definitively commenced, was the 1970s/1980s, depending on the variable. 'How' such seminal changes in trajectories occurred has also been identified. Demographic changes initiated the start both of 'Recolonisation' and the 'Neo-Turbulent' period, but were co-terminous with other 'game-changing' events – freezing technologies (1880s) and Britain's entering the EEC (1970s). Furthermore, both emergent regimes correlated temporally with fundamental values-shifts, affecting, in both cases, social organisation's plinth, the family, as shown in radical fertility declines. In both cases, socio-cultural values-shifts preceded, and possibly opened the road for, major legislature-driven restructuring. The Liberal Party's tenurial reforms reinforced technology, producing rural intensification, and other effects; legislatively-imposed financialisation and globalisation of the 1980s/1990s established the development agenda of the neo-Turbulent period.

Nevertheless, 'why' remains unanswered. The demographic, social and economic interactions, historically or today, seem beyond unbundling: demography is not destiny, nor are the economy, society or ecology overriding determinants. The Total Social Production (TSP) framework proposed here identifies critical parameters: reproduction, and replacement, plus 'production', which increasingly also involves consumption of goods and services, confounded by the domination of the FIRE-sector by its contribution to GDP. Whether it contributes to national wealth, as against product, is a moot question.

To add to the complexities, some sub-national areas seem to be in spatio-demographic-developmental decline. As Richard Nelson (1956) showed, this could

> Nationally, Pasifika levels are well above replacement; Māori above but declining, with age-patterns of childbearing converging towards Pākehā, who are slightly below replacement; and Asians well below.

From 1980 New Zealand became a highly diversified multi-cultural society, in part because of Māori (15 percent of the total), but also Asian, Pasifika and other migrant waves. In 1981, New Zealand was bi-cultural: 87 percent were Māori or Pākehā. For 2013, it is difficult to estimate ethnicity because of 'total response' coding routines by Statistics New Zealand, but probably 25 percent are neither Māori nor Pākehā. Overall, nearly 40 percent of New Zealanders are of non-European descent – far higher levels than those stoking xenophobic fires in Britain. Without minimising Aotearoa's social tensions, like Canada we seem to have avoided extreme ideological divisions. In the 1960s, both countries chose policies of 'integration' (which assumes that cultures all have equal worth) over 'assimilation' (which assumes that the culture being assimilated is gaining a superior culture) (Hunn 1960[16]: clause 9; Royal Commission, Canada, 1969).

2033 a shift will occur between the 'old' form of population decline (migration) to the 'new' (natural decrease) (Jackson and Cameron 2017).

From old to new regimes: unravelling 'when', 'how' and 'why'

From 1980 New Zealand dramatically changed the general path of population and development followed from the 1880, 'Recolonisation', itself a radical change from the 'Turbulence' that marked Aotearoa's 110-year passage from contact between Māori and Pākehā. 'Recolonisation' was a period of relative stability built around metropole-periphery exchanges, particularly commodities exchanged for manufactures, and an imbibing of the culture and even political direction (for example, military command, World War I) of 'Mother England'. But, starting in 1970, Aotearoa entered another 'Turbulent' era, radically different from 'Recolonisation' as much as it differed from the 1769-1880s.

become a 'low-level equilibrium trap', a notion applying to nineteenth century Māori (Pool 2015b: Fig 1.1). This situation could also occur, extend and deepen sub-nationally through declining natural increase due to age-compositional differentials at reproductive ages (Jackson and Brabyn 2017). 'Reproduction' in the TSP could also enter a 'low fertility trap' (Lutz 2007) for diametrically contradictory reasons: (i) rural areas have older age-structures, fewer young parents and thus fewer children, (ii) 'rurban' settlements have structures that are weighted towards retirees, who bear smaller birth cohorts. Yet (iii), metropoli disproportionately house young adults, potential parents, who, paradoxically, produce low birth numbers because of family-building constraints due to prolonged education, subsequent career-development and work-family life imbalances. Offsetting these are the effects of intra-urban ethnic differences. Nationally, Pasifika levels are well above replacement; Māori above but declining, with age-patterns of childbearing converging towards Pākehā, who are slightly below replacement; and Asians well below. These can translate into geographic variance. In 2001, central Auckland had a TFR of 1.7, 1.4 in central Wellington, but 2.5 in Southern Auckland Urban Area and Porirua, where Māori and Pasifika are clustered (Pool et al 2007: chapters 6-9, Tables 8.4, 8.5).

If low-level equilibria are to be averted, material interventions must be effective (McMillan 2016). Most problematically,

because it depends on values-systems and population structures, fertility cannot be freed from traps. Perhaps the most emblematic attempt to turn around underdevelopment was in southern Italy in the postwar period, *La Cassa per il Mezzogiorno*, developed in part by the World Bank, driven by passionate anti-communist Walt Rostow, fearing that Italy would become a Soviet satellite. He believed that the 'traditional', enduring ideas, should be destroyed and replaced by the far superior modern values (Rostow 1960: chapter 2; Lepore 2013). While the Mezzogiorno programmes had some success (Franklin, Harvey 1969: chapter 4), much of this came, paradoxically, through development based on the enduring ideas and customs - Rostow's anathema, often agro-turismo ventures (e.g. in Puglia). Fertility levels (TFR, 2013 = 1.31) are now the lowest in Italy, and at an historic low (Pace and Mignolli 2016: Table 7.3). Positive trends for Total social production have not been regained.

1   Anglo-America, Australasia, north-western Europe, Greece, Iberian Peninsula, Italy, Malta and Japan.
2   I summarise a longer paper (Pool forthcoming, a).
3   She is particularly concerned about gender issues and inequalities that I do not address here except in passing.
4   Globalisation is hardly new. Soon after contact Māori had successfully globalised their extensive, domestic networks, both through their own commodity trading enterprises, and in extractive industry 'joint ventures' (Pool 2015a: chapters 6-9).
5   If one takes Māori until 1900 one can show that the demographic and epidemiological transition models cannot be applied to much of colonial history – (Pool 2015b: especially 312-14). Since then, these models and those on labour force transformation have accurately described the Maori experience (Pool 1991: especially Fig 9.1).
6   I drew on his ideas in positing that, by the 1890s, Māori were in an 'underdevelopment trap' (Pool 2015b: Fig 1.1; his modelling requires data not available for 19th century Māori).
7   Most of the others relate to issues of relationships of power,

and any resulting competition and conflict that are indirectly of relevance to *Tai Timu Tangata*.
8   'Intra-family', or private, transfers include material and non-material supports: e.g. cash gifts and loans to family members; gifts of property and goods; cash inputs assisting public 'free' services such as schooling (e.g. payment of stationery) and health; etc. The 'public', comprise benefits and other forms of social-security from agencies, including housing, health, education, income-support, unemployment relief/payments. Few NTA exercises have looked at non-monetised transfers (e.g. after-school supervision of children whose parent(s) work(s) by grandparents (Lee and Mason 2014; United Nations 2013).
9   This postulate comes from a partially-written book by me on New Zealand's population and development, 1769-2010. Ideas for it were generated by the Marsden Programme, plus numerous books, monographs and papers on Aotearoa's demography. I also commissioned and locally edited ESCAP (1985).
10 I use the more widely understood term ranching for extensive grazing, even though in Australasia these farms are called 'stations', or 'properties'.
11 In inter-tribal wars Māori enslaved the losers, but this ceased after colonization, with the sole exception of the Moriori enslaved by Ngati Mutunga, which, contrary to an empire-wide abolition, continued after the Chathams were annexed in 1843.
12 In different circumstances increases in fertility are seen in developing countries before a decline, (Dyson and Murphy 1985), and applies to Māori (Pool 1991: 113).
13 Total fertility rates, per woman, Maori 6.0+, Pakeha 4.0+
14 See note ii.
15 I want to stress that I am very much in favour of immigration, as it enriches New Zealand's social fabric and ensures that some services can actually be provided. But, I am very concerned about the way it is managed. Because of the flows of New Zealand residents, strict control is impossible, but the inflows of the last few years have been partially due to arrivals on study visas being counted as long-term and permanent arrivals.
16 Hunn's language, which today seems quaint, even ambiguous in places, belies the significance of his advocating integration over assimilation, segregation – still legal and enforced in the United States, South Africa and Australia – and symbiosis (which he dismisses). The Canadian Commission's findings (and implementation) show how strategic this direction was there, and for New Zealand; the *Treaty of Waitangi Act, 1975*, made this strategy more concrete.

References

Bedford R & I Pool (2001) 'Flirting with Zelinsky in Aotearoa/New Zealand: A Maori Mobility Transition' in J Taylor & M Bell (eds) *Population Mobility among Indigenous Peoples in Australasia and North America* London: Routledge

Belich, J (2001) *Paradise Reforged: A History of the New Zealanders from the 1880s to Year 2000,* Auckland: Allen Lane Penguin

Boston, J & S Chapple (2014) *Child Poverty in New Zealand,* Wellington: Bridget Williams Books

Brooking, T (n.d.) 'McKenzie, John' *Dictionary of New Zealand Biography, Te Ara – The Encyclopedia of New Zealand* http://www.TeAra.govt.nz/en/biographies/2m17/mckenzie-john (First published in *NZ Dictionary of Biography* 1993)

Brosnan, P (1986) 'Net Interprovincial Migration, 1886-1966', *New Zealand Population Review* 12(3), pp.185-204

Cameron, M (2017) The relative (un)certainty of subnational population decline *Policy Quarterly* Supplementary Issue, pp.55-60

Casterline, J (2003) 'Demographic transition', in P Demeny & G McNicoll (eds) *Encyclopedia of Population* vol 1, pp.210-162, New York: Macmillan Reference

Chenery, H & M Syrquin (1975) *Patterns of Development, 1950-70* Oxford: Oxford University Press

Cochrane, W & D Maré (2017) 'Population change and urban influence', *Policy Quarterly* Supplementary Issue, pp.61-71

Cochrane, W & I Pool (2017) 'Māori in New Zealand's contemporary development', *Policy Quarterly* Supplementary Issue, pp.47-54

Cordell, DD, JW Gregory & V Piché (1994) 'African historical demography. The search for a theoretical framework' pp.14-32, in DD Cordell & JW Gregory (eds) *African Population and Capitalism. Historical*

perspectives 2nd edition, Madison: University of Wisconsin Press

Deaton, A (2013) *The Great Escape: Health, Wealth and the Origins of Inequality* Princeton: Princeton University Press

Dyson, T & M Murphy (1985) 'The Onset of Fertility Transition', *Population and Development Review* 11(3), pp.399-440

Easton, B (2010) 'Economic history' *Te Ara - the Encyclopedia of New Zealand*, http://www.TeAra.govt.nz/en/economic-history/.

ESCAP (Economic and Social Commission for Asia and the Pacific) Population Division (1985) *The Population of New Zealand: Country Monograph Series # 12*, 2 vols, Bangkok & NY: United Nations

Fairburn, M (1989) *The Ideal Society and its Enemies* Auckland: University Press

Farmer, R (1985) 'International Migration', in Population Division, Economic and Social Commission for Asia and the Pacific (ESCAP) *The Population of New Zealand: Country Monograph Series,* No. 12, 2 vols, Bangkok & NY: United Nations, v.1, pp.54-89

Franklin, S Harvey (1969) *The European Peasantry: The Final Phase,* London: Methuen

Greasley, D & L Oxley (2005) 'Refrigeration and distribution: New Zealand land prices and real wages, 1873-1939' *Australian Economic History Review* 45(1), pp.23-44

Greasley, D & L Oxley (2009) 'The pastoral boom, the rural land market, and long swings in New Zealand economic growth, 1873-1939', *Economic History Review* 62(2), pp.324-49

Hawke, G (1985) *The Making of New Zealand,* Cambridge: Cambridge University Press

Hunn, J (1960) *Report on Department of Māori Affairs,* Wellington: Govt Printer

Hyman, P (2014) 'Unplugging the machine', in G Bertram *et al The Piketty Phenomenon: New Zealand Perspectives,* Wellington Bridget Williams Books

Jackson, N (2013) 'Ageing in the Dairying Industry', LIC Interim Report Commissioned by The Livestock Improvement Corporation Hamilton: National Institute of Demographic and Economic Analysis, University of Waikato

Jackson, N (2016) 'The potential collateral demographic dividend', in R Pace & R Ham-Chande (eds) *Demographic Dividends: Emerging Challenges and Policy Implications* pp.135-73, Cham, Switzerland: Springer

Jackson, N (unpublished mss) 'The social structure of New Zealand's dairy farming industry from a demographic perspective: challenges for self-sustainability'

Jackson, NO (1998) 'Ethnic stratification in New Zealand. A total social production perspective', PhD Thesis, Australian National University, Canberra

Jackson, NO (2012) 'Māori and the [potential] demographic dividend' *New Zealand Population Review* 37, pp.65-88

Jackson, N & L Brabyn (2017) 'The mechanisms of subnational population growth and decline in New Zealand, 1976-2013', *Policy Quarterly* Supplementary Issue, pp.22-36

Jackson, N & L Brabyn (forthcoming) 'Population ageing and age-selective migration. Subnational population trends in New Zealand'. Draft available from authors.

Jackson, NO & MC Cameron (2017) 'The unavoidable nature of population ageing and the ageing-driven end of growth - an update for New Zealand', *Population Ageing:* (tba) 1-26. DOI: 10.1007/s12062-017-9180-8

Johnson, KM, LM Field & DL Poston Jnr (2015) 'More deaths than births: subnational natural decrease in Europe and the United States', *Population and Development Review* 41(4) pp.651-680

Kelsey, J (2015) *The 'FIRE' Economy: New Zealand's Reckoning* Wellington: Bridget Williams Books

King, Michael (2003) *The Penguin History of New Zealand* Auckland: Penguin

Lee, R & A Mason (2014) 'An Overview', *Policy Focus* 30, New York: UNDP

Lepore, A (2013) *La Cassa per il Mezzogiorno e la Banca mondiale, Un modelloe per lo sviluppo economico italiano,* Soveria Mannelii (Calabria) Rubbettion for SVIMEZ (republished Yale University Press)

Lutz, W (2007) 'The Future of human reproduction: Will birth rates recover or continue to fall', *Ageing Horizons* 7, pp.15-21

Maddison, A (1982) *Phases of Capitalist Development* Oxford: Oxford University Press

McAloon, J (2008) 'Land ownership – The Liberals and land policy', *Te Ara – The Encyclopedia of New Zeala*nd http://www.TeAra.govt.nz/en/land-ownership/page-5

McMillan, R (2016) 'The shrinkage pathway: managing regional depopulation', in P Spoonley (ed) *Rebooting the Regions: How low or zero growth needn't mean the end of prosperity,* pp.213-237, Albany: Massey University Press

Merlin, P (1971) *L'Exode Rural* Travaux et Documents Cahier #59 Paris: INED/PUF

Merlin, P (2009) *L'Exode Urbain* Paris: La Documentation Francaise

Mishra, Pankaj (2017) 'Welcome to the age of anger', *Guardian Weekly* 13 Jan, pp.26-29

Morgan, SP (2003) 'Baby boom, post-World War II' in P Demeny & G McNicoll (eds) *Encyclopedia of Population* vol 1, pp.73-77, New York: Macmillan Reference.

Morgan, SP, I Pool, J Sceats & A Dharmalingam (2001) 'The link of early childbearing to marriage and subsequent fertility in New Zealand', *New Zealand Population Review* 27, pp.49-76

Nelson, R (1956) 'A theory of the low-level equilibrium trap in underdeveloped economies', *American Economic Review* 46(5), pp.894-908

Nolan, M (2009) 'Constantly on the move, but going nowhere? Work, community and social mobility', in G Byrnes (ed) *The New Oxford History of New Zealand,* chapter 15, Melbourne: OUP

Notestein, Frank (1945) Notestein, FW (1945) 'Population: The long view', in TW Shultz (ed) *Food for the World* Chicago, University of Chicago Press.

O'Malley, V (2016) *The Great War for New Zealand: Waikato 1800-2000*, Wellington, Bridget Williams Books

Omran, A (1982) 'Epidemiologic transition', in J, Ross (ed-in-chief) *International Encyclopedia of Population* vol 1, pp.172-175, New York: Free Press

Pace, R & N Mignolli (2016) 'The impact of sub-national demographic transitions on demographic dividends in Italy', in R Pace & R Ham-Chande (eds) *Demographic Dividends: Emerging Challenges and Policy Implications,* pp.135-174, Cham, Switzerland: Springer

Phillips, K (2006) *American Theocracy: The Peril and Politics of Radical Religion, Oil and Borrowed Money in the 21st Century*, New York, Penguin

Piketty, T, (2014) *Capitalism in the 21st Century,* Cambridge MA: Belknap Press

Pool, I (1991) *Te Iwi Māori*, Auckland: Auckland University Press

Pool, I (2003) Ageing, population waves, disordered cohorts and policy', *New Zealand Population Review (Population and Policy: Special Issue)* 29(1), pp.19-39

Pool, I (2007) 'The baby boom in New Zealand and other WDCs', *Journal of Population Research* 24(2), pp.141-61

Pool, I (2014) 'Field report number one: Comparative case-study, Republic of South Africa', Unpublished Report, Marsden Programme: Tai Timu Tangata –Taihoa e?

Pool, I (2015a) *Colonisation and Development, New Zealand 1769-1900: The Seeds of Rangiatea,* Cham, Switzerland: Springer

Pool, I (2015b) 'The demographic implications of immigration', *New Zealand Population Review (Festschrift to Richard Bedford)* 41, pp.45-68

Pool, I (2016) 'Population replacement, nation-building, population policy', *New Zealand Population Review* 42, pp.43-64

Pool, I (forthcoming, a) 'Aotearoa's new demographic regime', *Discussion Paper* National Institute for Demographic and Economic Analysis, Hamilton: University of Waikato.

Pool, I (forthcoming, b) 'Six analysts in search of a Theory: New Zealand's sub-national population declines and differentials', *Discussion Paper* National Institute of Demographic and Economic Analysis, Hamilton: University of Waikato

Pool, I S Baxendine, W Cochrane & J Lindop (2005a) 'New Zealand Regions, 1986-2001: Population Dynamics', *Discussion Papers* 52 Hamilton: University of Waikato, Population Studies Centre

Pool, I, S Baxendine, W Cochrane & J Lindop (2005b) 'New Zealand Regions, 1986-2001: Incomes', *Discussion Papers* 58 Hamilton: University of Waikato, Population Studies Centre

Pool, I, A Dharmalingam & J Sceats (2007) The New Zealand Family From 1769: *A Demographic. History* Auckland: University Press

Pool, I, J Dickson, A Dharmalingam, S Hillcoat-Nalletamby, K Johnstone, & H Roberts (1999) *New Zealand's Contraceptive Revolutions*, Social Science Monograph Series, Hamilton: University of Waikato, Population Studies Centre

Rashbrooke, M (ed) (2013) *Inequality: A New Zealand Crisis* Wellington: Bridget Williams Books

Rees W, J Carroll (& T Mackay who died before it was tabled) (1891) 'Report of the Commission appointed to look at the Subject of Native Land Laws' *AJHR (Appendices to the Journal of the House of Representatives*) G-1, Session II

Resendez, A (2017) *The Other Slavery: The Uncovered Story of Indian Enslavement in America* New York: Houghton, Mifflin, Harcourt

Rostow, W (1960) *The Stages of Economic Growth: A Non-Communist Manifesto* Cambridge: Cambridge University Press

Royal Commission on Bi-culturalism (later expanded to Multi-culturalism) and Bi-lingualism (1969) Ottawa: Government of Canada

Sceats, J (1988) *Induced abortion in a low fertility country: New Zealand a case-study* PhD Thesis, London: University of London (London School of Hygiene and Tropical Medicine)

Sinclair, K (1959) *A History of New Zealand* London: Penguin

Stiglitz, J (2008) 'Development Theory and Policy' in S Yusuf (ed) *Development Economics through the Decades: A critical look at the World Development Report* pp.139-151, Washington DC: World Bank

Tiong, F (1998) 'Towards a better measurement of 19th Century non-Maori fertility trends and differentials, 1878-1921' *MSocSci Thesis* Hamilton: University of Waikato

United Nations (2013) *National Transfer Accounts Manual: Measuring and Analysing the Generational Economy* New York: Department of Economic and Social Affairs

Weaver, J (2006) *The Great Land Rush and the Making of the Modern World* Montreal: McGill-Queen's University Press

World Bank (1993) *World Development Report: Investing in Health* New York: Oxford University Press

World Bank (2009) *Reshaping Economic Geography*, Washington DC: Author, chapter 3, chapter 5 and Part 3.

Young, J (1997) 'Religious Change in New Zealand: A Population Perspective', MSocSci Thesis, Hamilton, University of Waikato

Natalie Jackson and Lars Brabyn

The mechanisms of subnational population growth and decline in New Zealand 1976-2013

Introduction:

This article summarises key findings from the strand of the *Tai Timu Tangata. Taihoa e?* project that examined the mechanisms of subnational population change in New Zealand for 143 towns, 132 rural centres and 66 territorial authority areas (hereafter TAs), for the 37-year period 1976-2013. Because of space constraints we present the information as a set of 10 summary observations. For the underlying analyses please refer to Jackson, Brabyn and Maré (2016); Jackson and Cameron (2017), Jackson, Brabyn, Maré, Cameron and Pool (forthcoming); and Jackson and Brabyn (forthcoming).

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The broader rationale for the *Tai Timu Tangata* project is outlined by Jackson (*infra*). Essentially, current New Zealand has a relatively young and rapidly growing population. However, widespread *subnational* depopulation between 1996 and 2013 saw one-third of the nation's TAs decline in size; Auckland and 12 TAs shared 90 percent of growth, while the remaining 10 percent of growth was spread very thinly across 32 TAs. The situation has led to some towns being disparagingly labelled as 'zombie towns' (NBR 2014), and contrasted against their more successful growing counterparts.

With two large cities among those declining (Dunedin and Invercargill), and structural ageing known to drive a reduction in natural increase (the difference between births and deaths), we wished to better understand why some areas are growing and others not. Specifically, we wished to know whether parts of subnational New Zealand might be following their international counterparts in declining from what is proposed as a 'new' and increasingly

intractable form of population decline (where net migration loss is accompanied by natural decrease), as opposed to the 'old' form, where natural increase is positive but fails to offset net migration loss (Bucher & Mai 2005, cited in Matanle & Rausch 2011: 19-20, 46-47).

The question was not merely academic. Globally, population growth is theorized to end around the end of the present century, but much sooner across the developed world (Lutz, Sanderson & Sherbov 2004; Davoudi, Wishardt & Strange 2010; Reher 2007, 2011, Lee & Reher 2011). Reports from newly depopulating countries such as Japan are largely negative, indicating reduced investment in local infrastructure, widespread abandonment of schools, homes and business, and general social, economic and environmental damage outside of the main cities; at the same time, opportunities arising from a potential 'depopulation dividend' (Matanle 2017) need to be engaged with in a timely manner, long before local councils and similar agencies are overwhelmed with sustained depopulation that they have not been anticipating (Matanle & Sato 2010; Audirac 2012; Martinez-Fernandez, Kubo, Noya & Weyman 2012; McMillan 2016).

Indeed, if subnational New Zealand is following its international counterparts while at the same time being relatively youthful and growing strongly at national level, we asked if there could be broader theoretical implications that would contribute to a theory of depopulation, and thereby support councils and other agencies to plan for this eventuality in a more positive way (McMillan 2016).

Because the data we needed for the exercise were not available for many subnational jurisdictions, or for the period required, or on consistent geographical boundaries, we had to first extract them via statistical means. The methodology for creating this unique database is briefly described in the attached Appendix, with more detail available in Jackson et al., (2016). Key methodological points are that 'usually resident population' data for all census years 1976-2013 were aggregated to 2013 geographic boundaries based on Statistics

Figure 1: Percentage of Territorial Authority Area, Town and Rural Centre Populations experiencing net migration gain or loss, 1976-2013
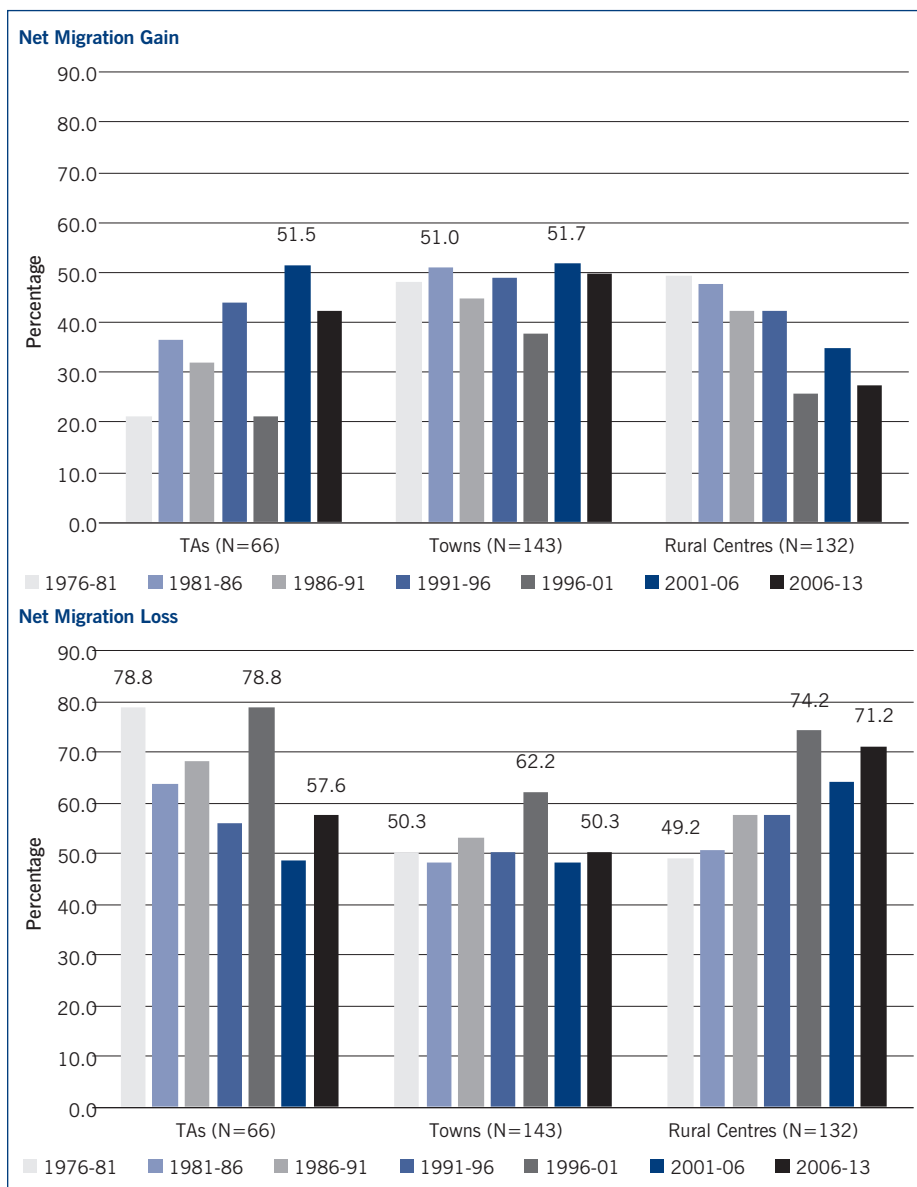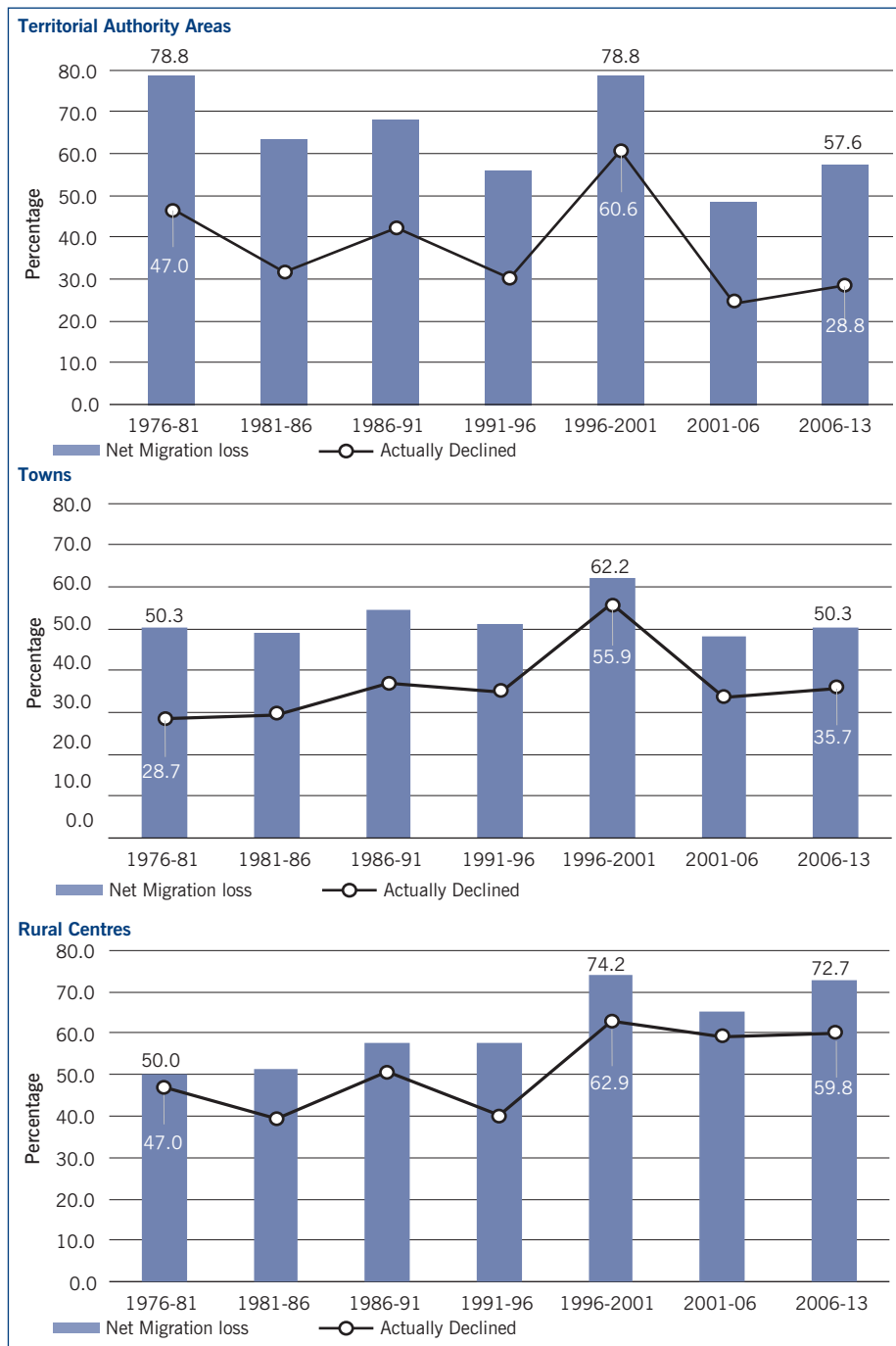

Source: Jackson and Brabyn (forthcoming).
Notes: These data were first published in Jackson et al. 2016. Proportions here differ slightly, due to database revisions.

New Zealand's coding. The demographic components of change (births, deaths, natural increase) for each area were then retrospectively modelled using TA-level fertility and survivorship rates. An estimate of net migration (total and by age) was then extracted via the conventional residual method (net change minus natural increase = net migration). The exercise permitted us to develop births, deaths, natural increase and population by age data, both with and without migration. Although the baseline data and all rates for modelling have been sourced from statistics New Zealand, the resulting output has been developed for the purposes of this project, and should not be seen as official statistics.

Our 143 towns and 132 rural centres conform to Statistics New Zealand's 'urban areas'. This means that our 'towns' range in size from major (>30,000 people) to minor (1,000 – 9,999 people) urban areas, and our 'rural centres', from 300 to 999 people, *in terms of their size in 1976*. Under these arrangements, Auckland is divided into four zones, while data for rural districts is excluded. The latter was an unfortunate necessity, reflecting the large number of small units that would have needed to be analysed; however, where possible we note trends for the aggregate rural district population.

Methodologically it should also be noted that each data point carries equal

Figure 2: Percentage of TAs, Towns and Rural Centres experiencing net migration loss, and actually declining, 1976-2013

Source: Jackson and Brabyn (forthcoming)

and deaths, while mobility theories by definition deal with 'open' populations affected by migration, and are applied subnationally, nationally and globally. To avoid getting tangled in theoretical constructs (but see but see Pool, *infra*; Jackson and Pool, forthcoming), we proceed here on the basis that the New Zealand population is in fact both 'open' as in mobility theories, and is ageing structurally, as theorised in demographic transition (following Dyson 2011).

Following are ten key observations drawn from the project. These are necessarily brief, but, as noted, more formally elaborated in the referenced papers. We conclude the article with a short summary and consideration of related policy implications.

Observation 1: The majority of areas experience net migration loss rather than gain

Figure 1 compares the percentage of TAs, towns, and rural centres experiencing net migration gain or loss from 1976-2013. The majority of TAs and rural centres experienced somewhat greater net migration loss than gain at most observations. For towns the split was typically close to 50:50, although net loss was somewhat greater than gain between 1986 and 1991, and 1996 and 2001. Recalling that rural district data were not analysed in detail for this project, their aggregate suggests a slightly different story, with slightly more years of gains than losses, and those gains being sustained since 2001.

Observation 2: Net migration loss does not always result in population decline

Figure 2 shows the percentage of TAs, towns and rural centres experiencing net migration loss from 1976 to 2013, and the percentage actually declining. The difference between the two measures is accounted for by natural increase (births minus deaths), discussed further below. On average 59 percent of TAs experiencing net migration loss actually declined; for towns and rural centres the proportions were 70 and 84 percent respectively. These data indicate that TAs and towns have been more able than rural centres to cover their net migration loss with natural increase, and conversely, that

weight, irrespective of size. This was a deliberate choice, in that our research is concerned with the extent to which individual jurisdictions – all of which have implications for such things as rates and resources – are affected, rather than what proportion of the total New Zealand population is affected (Jackson & Cameron 2017). For example, TA level patterns and trends are of interest to TA councils, while those for towns and rural centres are of interest to local councils, and their respective planners and

communities. The exclusion of rural districts from our detailed analyses means that such communities have only broad trends on which to deliberate.

One major theoretical conundrum also needs to be acknowledged. As outlined in the introduction to this Issue, the project has been informed by both demographic and mobility transition theories. Demographic transition theory (Davis 1945) is a 'global and national' level theory that essentially treats populations as 'closed', that is, changing only due to births

net migration loss is a stronger predictor of net decline for rural centres than towns and TAs.

Observation 3: The majority of areas are smaller with, than without, migration

In total, 62 percent of TAs, 66 percent of towns and 50 percent of rural centres were larger in 2013 than in 1976. However, because net migration was often negative, a proportion of those growing across the period was smaller with migration than they would have been without. By 'with migration' we mean population change due to both migration and natural increase; by 'without migration' we mean population change due to natural increase only (see Appendix). Thus, those growing, but smaller than they would have been without migration, owe much of their growth to natural increase. We elaborate on these interactions further below.

The exercise generated three groups of interest (Figure 3):

Group 1: Areas that grew between 1976 and 2013 and were larger with migration than without. This situation pertained to 26 percent of TAs, 39 percent of towns, and 33 percent of rural centres.

Group 2: Areas that grew between 1976 and 2013, but were smaller in 2013 with migration than without. These areas experienced periods of net migration loss, but it was either partially or fully offset by natural increase. This situation pertained to 36 percent of TAs, 27 percent of towns, and 17 percent of rural centres. In the aggregate it also pertained to rural districts, the total population of which was larger in 2013 (513,951) than in 1976 (398,436), but smaller than it would have been in the absence of migration (599,218).

Group 3: Areas that declined in size between 1976 and 2013, all of which were also smaller in 2013 with migration than without. In most cases these areas experienced natural increase, but it was completely offset by net migration loss. This situation pertained to 38 percent of TAs, 44 percent of towns, and 39 percent of rural centres.

Figure 3: Percentage of Territorial Authority Area, Town and Rural Centre Populations Growing/Declining 1976-2013 by impact of migration on size
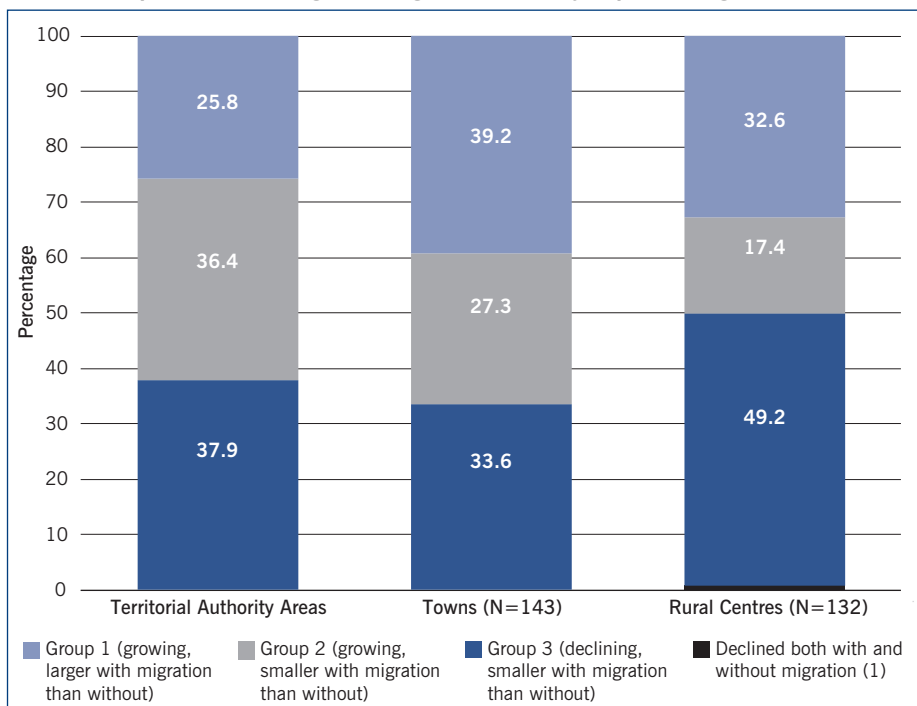
Source: Jackson and Brabyn (forthcoming).
Notes: (1) refers to one rural centre (Waitati) which declined both with and without migration, but slightly less 'with'

Figure 4: Percentage of Territorial Authority Area, Town and Rural Centre Populations experiencing natural increase or natural decrease, 1976-2013, and projected for TAs to 2043
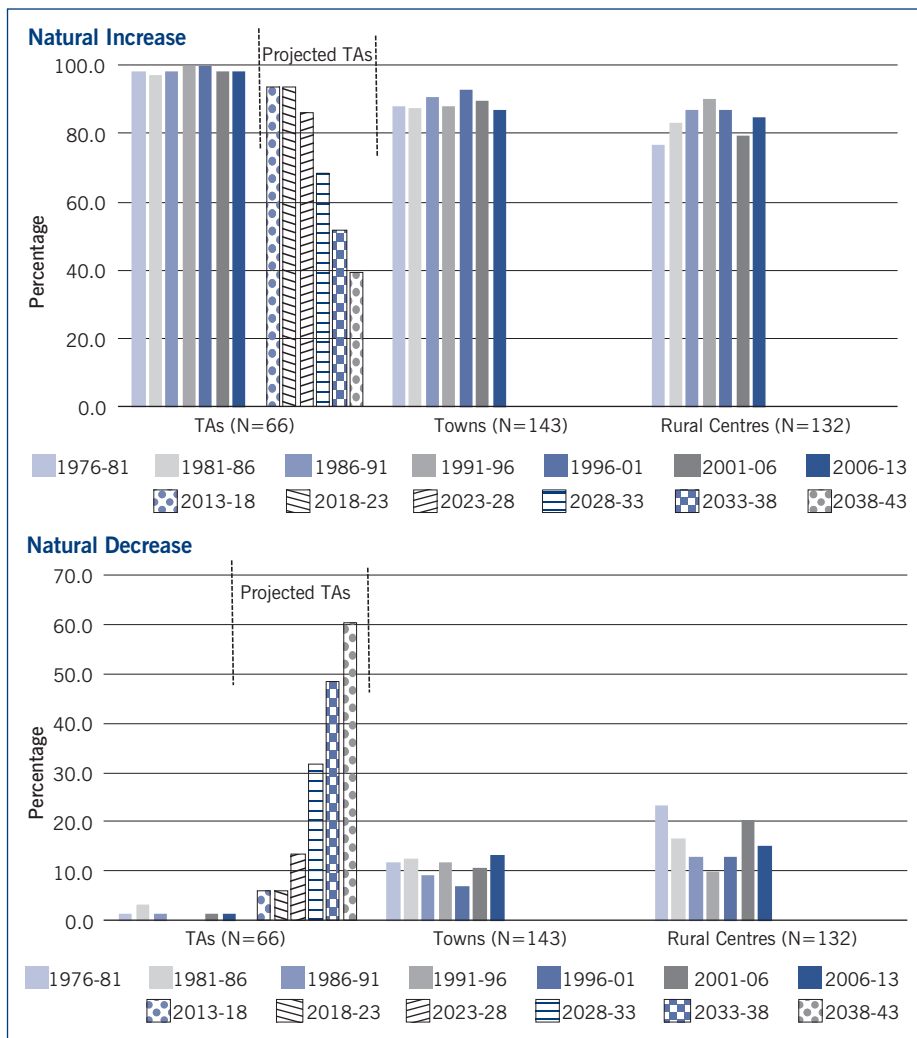
Table 1: Combination of components of change that deliver net growth or net decline

Outcome	Combination of Components
GROWTH	A: Natural Increase and Net Migration are both positive
	B: Natural Increase offsets Net Migration Loss
	C: Net Migration Gain offsets Natural Decrease
DECLINE	D: Net Migration Gain fails to offset Natural Decrease
	E: Natural Increase fails to offset Net Migration Loss
	F: Natural Decrease and Net Migration Loss
ZERO GROWTH	G: Natural Increase = Net Migration Loss
	H: Natural Decrease = Net Migration Gain

Source: Jackson, Cameron and Pool (2015). Notes: By 'offset' we mean to 'completely conceal'

In sum, migration is not a panacea for growth, while growth *per se* may not reflect net migration gain, but rather, be the result of natural increase offsetting underlying net migration loss.

Observation 4: The majority of areas experience natural increase – but this will soon change, with profound implications

During the period 1976-2013 the vast majority of TAs, towns and rural centres experienced natural increase, with levels in 2013 slightly higher for towns than rural centres (Figure 4, left panel). In the aggregate, rural districts also experienced natural increase across each five-year period. Natural *decrease* thus remains relatively low (right panel). However, supporting the main tenets of demographic transition theory, which

hold that the emergence of natural decrease is initially 'incipient' (intermittent onset), 47 towns and rural centres (17 percent) experienced natural decrease across more than one five-year period between 1976 and 2013, and 22 (8 percent) experienced it across five or more periods. In 2013, 19 towns (13 percent) and 20 rural centres (15 percent) were regularly experiencing natural decrease; for towns this had increased slightly, and for rural centres, reduced. These findings reflect those for the counties of the United States and Europe (Johnson, Field & Poston 2015), and confirm that New Zealand is following its older counterparts, but is as yet at a much earlier stage.

Attempting to extend the analysis forward, we drew on projections at TA level.[1] These data show that while natural

decrease is as yet barely evident at TA level, the projections (medium variant) indicate that it will be the experience of the majority (61 percent) of TAs by 2043, and thus of many of the towns and rural centres which comprise them (see also Jackson & Cameron 2017, and Cameron *infra*).

Observation 5: There are complex interactions between net migration and natural increase/decrease

Net migration and natural increase or natural decrease interact in several different ways to generate three different outcomes: growth, decline, and zero growth. Our project has identified three combinations that generate growth, three that result in decline, and two that result in zero growth (Jackson, Cameron & Pool 2015). We refer to these as Types A-C growth, Types D-F decline, and Types G and H zero growth (Table 1, and Figures 5 and 6).

For the policy community the typology is important because it provides 'advance warnindding end notdg' of the permanent ending of growth (see also Jackson 2014). Type A growth, where both elements are positive, is more robust than either Type B or C growth, where one or other element is negative, and is likely to be sustained for much longer. In particular, areas growing

Figure 5: Percentage of Territorial Authority Areas by Cause of Growth and Decline, 1976-2013, and Projected 2013-2043 (Medium Variant)
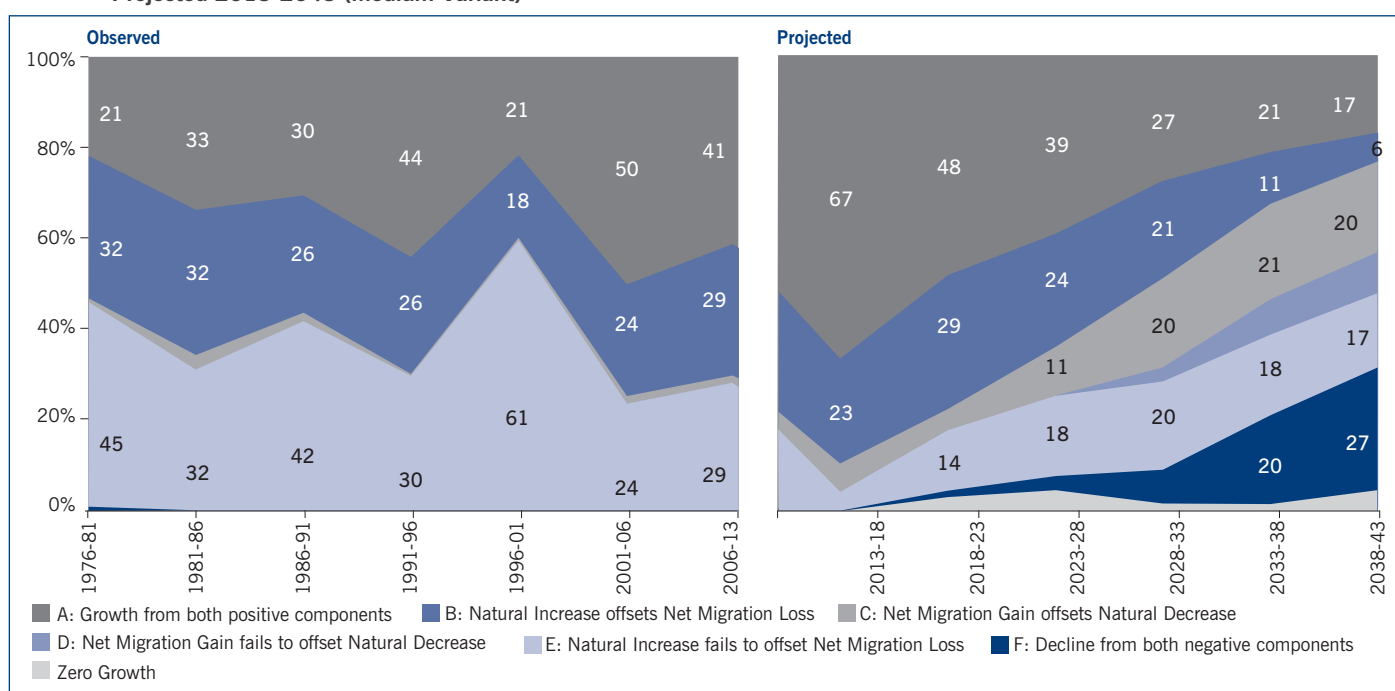

Source: Jackson and Brabyn (forthcoming).

because of Type B growth, where natural increase is completely concealing net migration loss, are highly vulnerable to decline as natural decrease emerges, and their growth should not be seen in the same light as Type A. Type D decline (where net migration gain fails to offset natural decrease) is more 'preferable' to Type E or F decline, in that the former has a good chance of reverting to population growth, at least in the short-term. By contrast, Type E decline typically indicates that natural increase is becoming very low, while Type F decline, the 'new' form of population decline, foreshadows a self-reinforcing and increasingly intractable type of depopulation. In order to 'extend' the period covered in our 1976-2013 analysis to indicate what will unfold for towns and rural centres, we include TA level projections to 2043 (medium variant).

Type A Growth: Across the period 1976-2013 the majority of TAs and towns grew from 'Type A' growth, where both net migration and natural increase were positive, although there was an anomalous period, nationally, between 1996 and 2001, when this cause of growth was overwhelmed by Type E decline (see below). The percentage of TAs growing from Type A growth increased overall across the period, from 21 to 41 percent (Figure 5). For towns, Type A growth remained relatively stable, at 38 percent of towns in 1976 and 37 percent in 2013; for rural centres, Type A growth declined across the period, from 30 to just 17 percent of rural centres (Figure 6). In the aggregate, rural districts also grew from Type A growth between 1991 and 1996, and 2001-2013. The TA level projections in Figure 5 show this form of growth increasing until 2018, then steadily diminishing across the period, pertaining to just 17 percent in 2043.

Type B Growth (where natural increase completely conceals net migration loss) declined across the period for TAs and towns but increased for rural centres. For TAs it pertained to 32 percent in 1976 and 29 percent in 2013; for towns, 22 and 17.5 percent

Figure 6: Percentage of Towns and Rural Centres by Cause of Growth and Decline, 1976-2013

Source: Jackson et al. (forthcoming)
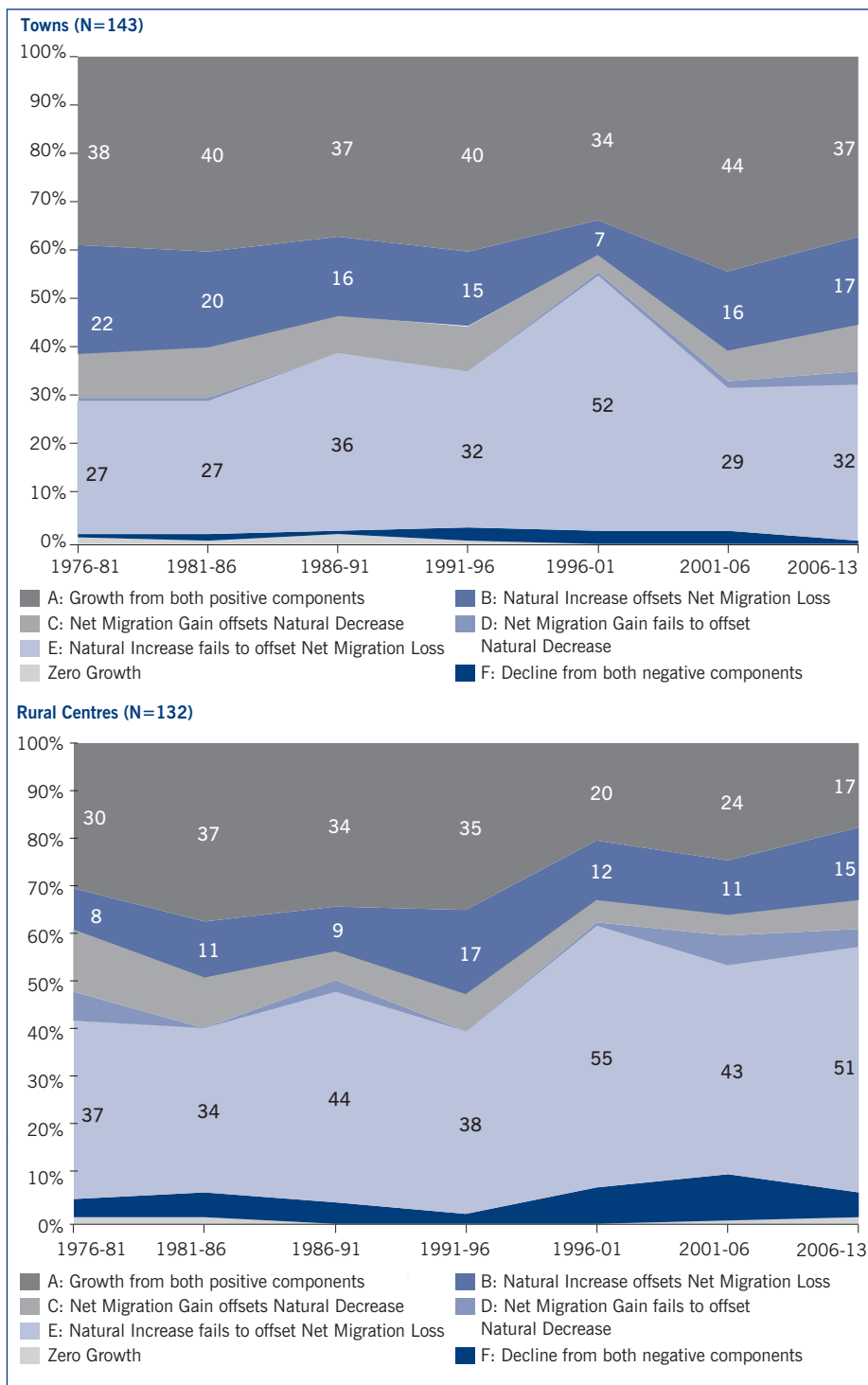
respectively. For rural centres the proportions were 8.3 and 15 percent. In the aggregate, rural districts experienced this type of growth between 1981 and 1991, and 1991-1996. This type of growth places affected areas in a somewhat more vulnerable position than Type A growth, because as indicated above, natural increase is trending

downwards, and over the next few decades will increasingly leave areas experiencing net migration loss, 'unprotected'. TA projections indicate that this form of growth will diminish as the proportion experiencing natural decrease grows, with Type B growth accounting for as few as 6 percent of TAs in 2043.

Figure 7: Percentage of Territorial Authority Area, Town and Rural Centre Populations by impact of migration on structural ageing (as indicated by percentage aged 65+ years, with and without migration)
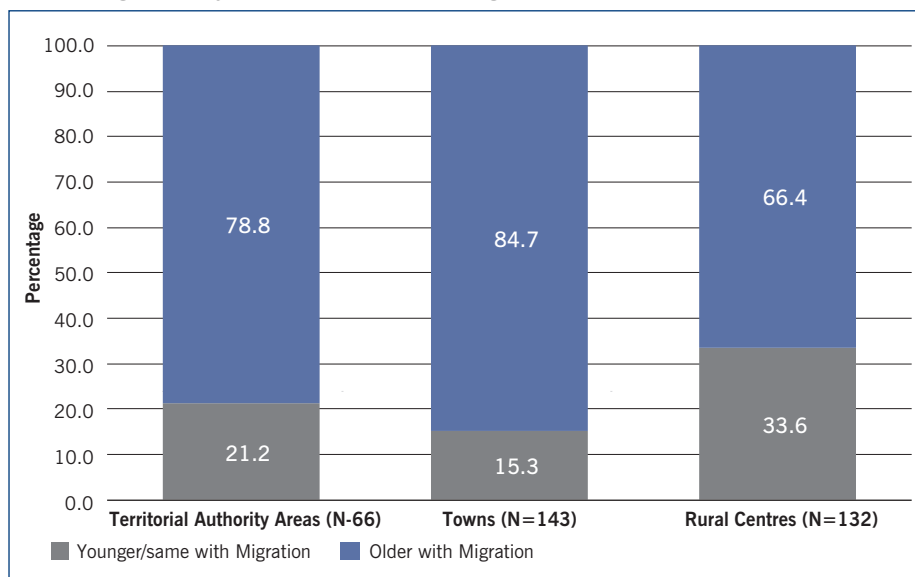
Source: Jackson and Brabyn (forthcoming).

Type C Growth (where net migration gain offsets natural decrease) has as yet been the experience of relatively few areas, because natural decrease itself is as yet not widespread. However, TA level projections indicate that Type C growth will now become more prominent, pertaining to around 20 percent by 2043, and becoming the largest driver of growth and the second-largest driver of population change. Type C growth may be a more robust driver of growth than Type B, at least in the short-term, because while migration remains positive it has a good chance of offsetting underlying natural decrease.

Type D Decline (where net migration gain fails to offset natural decrease) is as yet similarly uncommon, not yet experienced at TA level and pertaining to less than 3 percent of towns and 4 percent of rural centres in 2013. TA projections indicate that this form of decline will become noticeable from around 2028 and pertain to around 6 percent of TAs in 2043.

Type E Decline (where natural increase fails to offset net migration loss), has, by contrast, been very common across New Zealand's TAs, towns and rural centres, although diminishing for the former and increasing for the latter. For TAs, the proportion fell from 45 to 29 percent; and for towns and rural centres, increased from 27 to 32 percent, and 47 to 60 percent, respectively. Aggregate data for rural districts suggests they experienced this combination between 1976 and 1981 only. TA projections indicate this form of decline will remain a common experience for the towns and rural centres which comprise them, although will diminish over time as it gives way to Type F decline (see below). This is the shift from the 'old' form of depopulation referred to by Bucher and Mai (2005) to the 'new' form, where both elements are negative.

Type F Decline (where both elements are negative) has so far played a minor role in New Zealand's subnational population change, albeit more evident for rural centres than towns. At TA level the combination has not yet been experienced. However, projections indicate that it will become notable at TA level from the early 2030s, become the major driver of decline, and be the main cause of population change *per se*, by 2043 – when it will account for around 27 percent of TAs.

Zero Growth: No cases of zero growth were observed at TA level during 1976 to 2013, although a few came very close. It was also a minor cause of population change for either towns or rural centres. Instead, the long-theorized arrival of zero growth as the 'end point' of demographic transition has been shown in our project – as it has internationally – to be a transitional stage through which most areas pass on their journey from growth to decline, and in a few temporary cases, *vice versa*.

In sum, the TA level projections provide advance warning of the ongoing impact of structural ageing, with both Type A and B growth steadily diminishing and Type C growth (net migration gain offsetting natural decrease) ultimately taking over as the main cause of growth. Type D, E, and F decline each grow, with Type F decline (both components negative) taking over as the main cause of decline around the mid-2030s, and of population change *per se* in 2043 (Jackson et al., 2016).

Observation 6: The vast majority of TAs, towns and rural centres are older as a result of migration

Across the period 1976-2013, migration caused the majority of TA, town and rural centre populations to have older age structures than would have been the case in the absence of migration (Figure 7). That is, migration either removed young people and/or added older people, causing the proportion aged 65+ years to be greater than it would have been without migration.[2]

This is known as 'age-selective' migration (see below), which has also been shown internationally to accelerate structural ageing as much as the conventional driver, low fertility rates (Johnson et al., 2015).

The greatest 'juvenescent' (youth-imparting) impact was for towns, only 15 percent of which had populations younger with, than without, migration. The same situation pertained to one-fifth of TAs and one-third of rural centres. This means that, by contrast, 79, 85, and 66 percent of TAs, towns, and rural centres respectively were older with, than without, migration. Notably this was not the case for New Zealand's rural districts, which, in the aggregate, had an almost identical percentage aged 65 and older in 2013 both

with and without migration (13.0 and 13.1 percent respectively).

Only a minority of TAs, towns and rural centres have thus become more youthful as the result of migration, a finding which, at least in terms of international migration, runs counter to many governmental pronouncements on the issue (see McDonald & Kippen 1999 and Kippen & McDonald 2000 for a refutation of this perception for Australia; and Jackson & Cameron 2017 for New Zealand).

Moreover, many jurisdictions are decidedly older as a result of migration (Figure 8). At TA level, 36 percent had populations that were between 20 and 50 percent older because of migration, and 31 percent, between 50 and 100 per cent older. By contrast, just one was more than 50 percent younger (Wellington City). Almost 30 percent of New Zealand towns had populations between 20 and 50 percent older as the result of migration; 36 percent, between 50 and 100 percent older; and 10 percent, more than 100 percent older. Rural centres had larger proportions than towns that were both more than 100 percent older (13.6 percent) and more than 50 percent younger (4 percent compared with 3 percent for towns), as the result of migration. Rural centres also had greater proportions in each of the 'younger with migration' groups.

Observation 7: Towns are more likely than rural centres to have more than 20 percent aged 65+ years

The finding of greater proportions of rural centres than towns being younger as a consequence of net migration is one of the more surprising findings of this project. We had theorised that rural centres would be more affected by the loss of young adults and have greater levels 'ageing-in-place', and this combination would have caused those areas to age faster. The explanation is that while the populations of rural centres are, *on average*, older than those of towns (in 2013, 17 and 14 percent aged 65+ years respectively), there is a greater proportion of towns with more than 20 percent aged 65 years (Jackson et al., forthcoming, Tables 3 and 4).[3] In 2013, 41 percent of towns compared with 29

Figure 8: Percentage of Territorial Authority Area, Town and Rural Centre Populations by extent of impact of migration on structural ageing (as indicated by reduction or increase in percentage aged 65+ years, with and without migration)
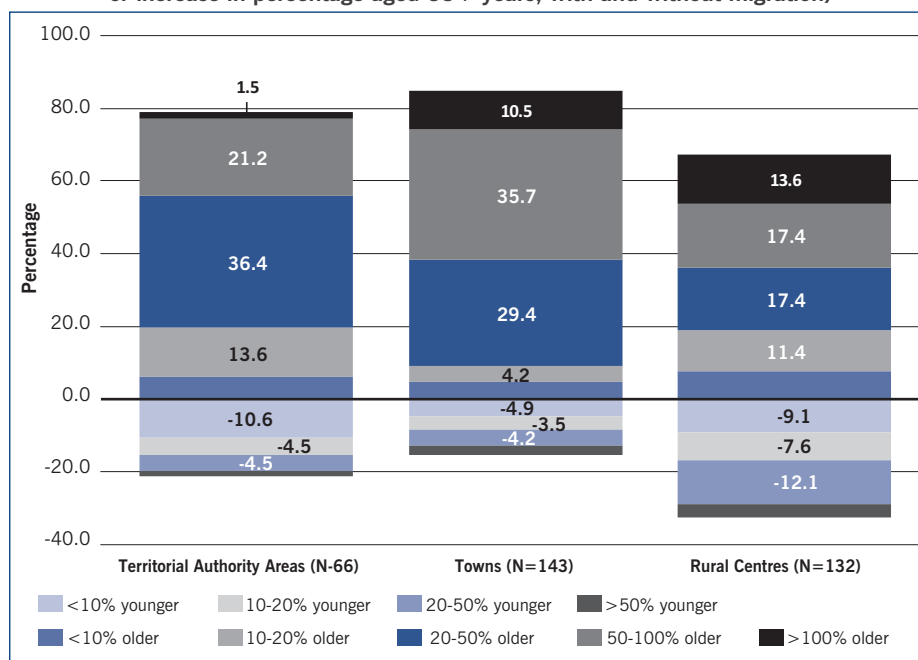
Source: Jackson and Brabyn (forthcoming).

percent of rural centres (and 15 percent of TAs) had greater than 20 percent of their respective populations aged 65+ years. As a result, towns are on the one hand currently less likely than rural centres to be experiencing natural decrease (as noted above, in 2013, 13 and 15 percent respectively), but on the other, seeing a more rapid shift to that situation. As both Pool and Brabyn (this issue) propose, tertiary education and jobs are attracting young people to the larger cities, while lifestyle and amenity factors are attracting older people from both the rural centres and the larger towns to the smaller towns.

Observation 8: Age-selective migration is accelerating structural population ageing in most areas

Figure 9 shows the age distribution of migration for the five towns experiencing the greatest juvenescent impact of migration (left figures) and the five towns experiencing the greatest ageing impact (right figures). The respective left- and right-hand skews clearly illustrate the difference in impact. Queenstown, Rolleston, Wellington, Arrowtown and Central Auckland all gain a disproportion of migrants at the younger ages, albeit Rolleston and Arrowtown experience minor net loss at 20-24 and 15-19 years respectively, but this is offset by substantial

gains of those of parenting age and thus also their children – and reinforced by loss at the oldest ages. By contrast, the towns experiencing the greatest ageing effect from migration all see net losses at 15-19 or 20-24 years, and make their gains at the older ages, particularly 'early retiree' age. The reverse effect from age 75 is also very clear, reflecting the classic move many older people make 'back' towards health services and/or family.

Although not studied in detail, aggregate data for rural districts suggests an age migration profile that falls between the two extremes. On the one hand the data show consistent net loss at 15-19 and 20-24 years, but on the other, in most years, net gains at the main parental and child ages, offset by net loss at age 65 and above. Similar to Rolleston and Arrowtown, this combination leads to a relatively low percentage aged 65+ years, and further indicates that the structural ageing of rural districts is primarily due to ageing-in-place, albeit in some cases the ageing of past migrants, but not direct in-migration at older ages.

As also proposed, these migration age profiles are typically altered by natural increase, both the net difference between births and deaths, and change in the size of individual cohorts as they age. That is, when larger cohorts take the place of

Figure 9: Net migration age distribution (percentage of migrants at each age) for the five towns experiencing the greatest youthful impact and the five towns experiencing the greatest ageing impact from net migration, 1976-2013
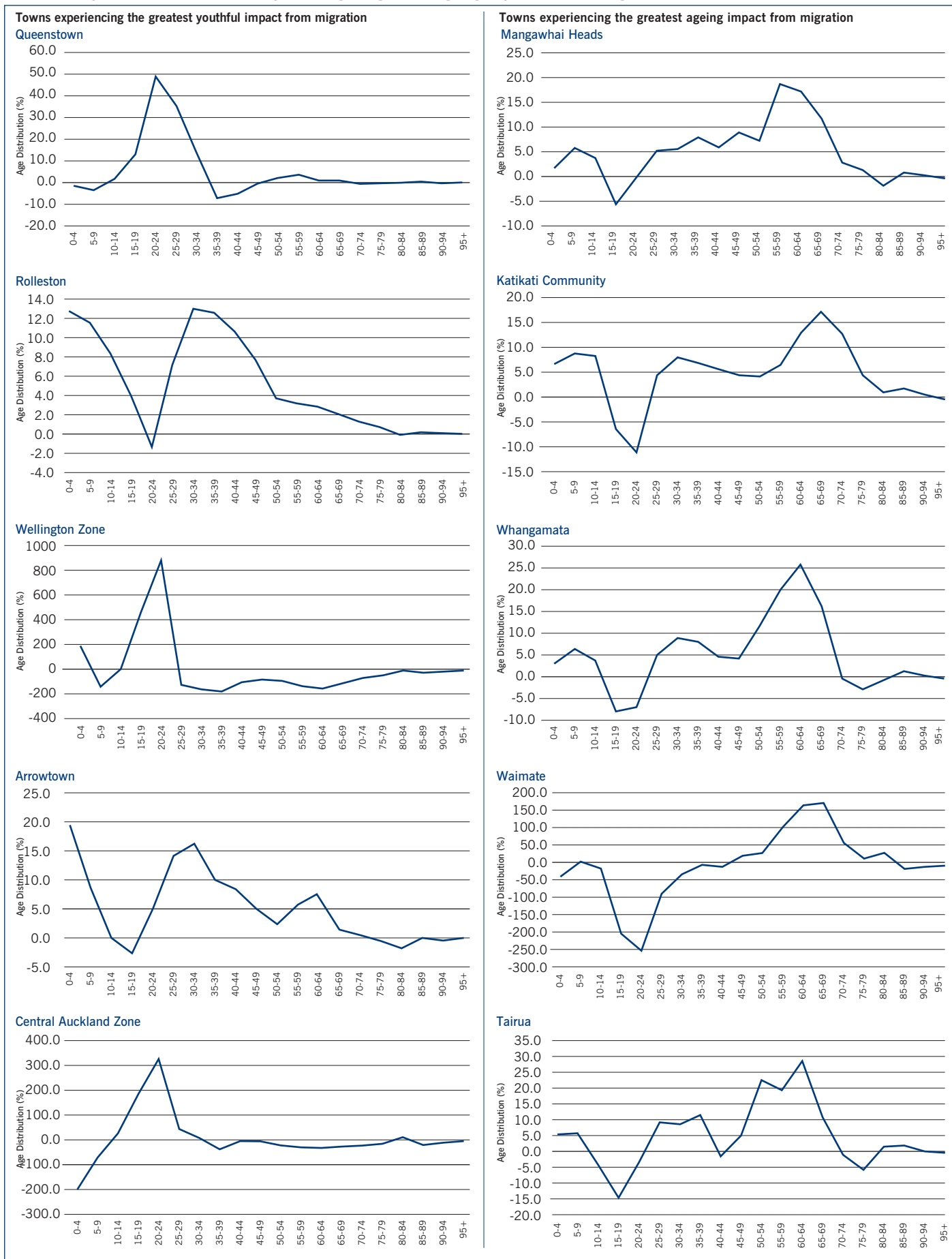
Notes: Different scales on Y-axis

smaller ones, and vice-versa, the net change for those age groups may be less or greater than indicated by migration alone. However for the most part, it is the concentration of migration at either younger or older ages, and particularly the level of net out-migration around age 15-24 years, and/or in-migration at 50+ years, that determines the 'speed' of structural ageing.

Observation 9: The proportion of women aged 15-44 is a stronger driver of natural increase or decrease than the total fertility rate

Conventionally, the shift from natural increase to natural decrease is associated with a total fertility rate (TFR)[4] of less than 2.1 births per woman, for around a generation (c. 25 years). New Zealand's TFR is still around 2 births per woman, although at TA level it ranges from 1.5 for Queenstown-Lakes District to 3.3 for Opotiki District (Statistics New Zealand 2016). However, reflecting the age-selective migration patterns above, we found a much stronger relationship[5] between natural increase and the percentage of women aged 15-44 years[6], than with the TFR (Jackson et al., forthcoming). Although we have reliable subnational TFR data for only three observations, our findings concur with Johnson et al., (2015: 667-669), whose study on the counties of the United States and Europe showed that the higher/lower the proportion of women at the main childbearing ages, the more/less likely it is for them to sustain the natural increase required to offset migration loss.

Also important is our finding that the national percentage of women aged 15-44 years (for New Zealand) peaked in 1991 at 46.6 percent and has since fallen to 39.8 percent, the latter almost identical to that for the USA and Europe. Unless fertility rates rise substantially, diminishing proportions of women at reproductive age mean diminishing birth numbers. The proportion of towns with lower than the national proportion of women in these childbearing age groups increased from 77 percent in 1976 to 87 percent in 2013 (+14 percent). For rural centres the proportion (lower than the national average) has increased from 70 to 90

percent, accelerating since 2001 (+29 percent). Rural centres are thus more vulnerable than towns to the loss of natural increase via decreased births, while towns are becoming more vulnerable to it from increased deaths.

Mirroring the trends at 15-44 years is the equally strong but negative correlation between the percentage aged 65+ years and natural increase[7], indicating that the higher the percentage aged 65+ years, the lower the natural increase. Although to some extent auto-correlated with the proportion of women aged 15-44 years, this relationship was similarly found for the United States and European counties by Johnson et al., (2015: 665-666). The relationship is somewhat stronger for

> What has been missing from the debate is an understanding of the widespread nature of decline across the country, and in particular, an understanding that it is not limited to small rural towns.

New Zealand's towns than rural centres, reflecting the finding that many towns have relatively old age structures, with proportions at older ages presumably increasing the number of deaths. While a greater proportion of towns than rural centres have been experiencing natural increase, the proportion is falling at a faster rate than for rural centres.

Observation 10: Net migration explains most of the variance in net change, but natural increase determines whether the outcome is positive or negative

We found that net migration explains around 95 percent of the variance in the net population change of towns and rural centres across the period 1976-2013. This is because natural increase is somewhat more even across these jurisdictions, and is mostly positive. At the same time, we found that natural increase has a relatively weak relationship with net change. For

towns the relationship is negative (the higher the natural increase, the lower the net change, and vice-versa), but it is not statistically significant after 1996. For rural centres the relationship is significant at only three observations, and it is positive (the higher the natural increase, the higher the net gain).

By contrast, the correlation between net growth and net migration gain is both very strong and positive, and never below +0.92 (p=0.01 for all observations, for both towns and rural centres). Thus, areas with higher net migration gain have higher growth – and vice-versa.

The analysis confirms that net migration is the stronger 'predictor' of net change; however, the foregoing analyses demand that a caveat be added: only when migration is examined as a discrete variable.

Moreover, another important finding from the correlation analysis is that net migration and natural increase are negatively correlated. That is, the higher the net migration gain, the lower the natural increase, and vice-versa. For towns the correlation is statistically significant (p=0.01) at all but one observation. Although more modest for rural centres, and statistically significant at just three observations (p=0.01), the negative correlation is a salutary finding, as it appears that migration does not necessarily mean 'more births', as is often believed. Rather, it may reflect recent trends in the composition of migrants, from primarily families, to primarily non-family workers (students and others on temporary visas and/or early retirees moving for lifestyle reasons). That is, not

only is migration not a panacea for growth, but it may further hasten the end of natural increase, a finding also noted for the United States and Europe by Johnson et al., (2015) and for Europe over a very long period by Murphy (2016: 239).

Summary and discussion

Over the past few years, population change in New Zealand has attracted much media and political attention. Areas experiencing rapid growth have been contrasted with so-called 'zombie towns' (NBR 2014), the latter usually singling out a few rural towns that have experienced precipitous decline. What has been missing from the debate is an understanding of the

> … the question as to whether the ending of population growth and onset of depopulation will be 'good' or 'bad' has as yet been subjected to very little serious research – or theoretical development …

widespread nature of decline across the country, and in particular, an understanding that it is not limited to small rural towns. Both Dunedin and Invercargill cities, for example, are smaller now than they were in 1976, despite their annual gains of many of the nation's tertiary education students. Also missing from the commentary is that in many cases, growing towns and rural centres are growing only, or largely, because of natural increase – the difference between births and deaths; this component is regularly rendered invisible. Even Auckland's growth has been primarily the result of natural increase, accounting for 58 percent of the region's growth over the past 25 years (Jackson 2016).

The widespread perception of migration as the primary driver of growth and decline has diverted attention away from the all-important population replenishing role of natural increase (see also Cochrane & Pool, *infra*, on the critical role of Māori), a deficit that will become

glaringly evident over the next few decades, as natural increase gives way to ageing-driven natural decrease. As Brabyn (*infra*) argues, the contribution of natural increase to population change has thus far been relatively even across New Zealand, with the result that migration accounts for 95 percent of variation. However, as we show in this article, the actual level of growth or decline is heavily dependent on whether natural increase augments or offsets that net migration gain or loss.

We have shown here that there are several combinations of natural increase and net migration, three of which deliver growth, three decline, and two, zero growth. The distinction between the growth and decline types is important for policy purposes. Type A growth, where both elements are positive, is somewhat more robust than Type B growth, where natural increase conceals net migration loss, and the two should not be conflated. As natural decrease unfolds, areas currently growing from Type B growth will become increasingly vulnerable to overall decline. Type E decline, on the other hand, where natural increase fails to conceal net migration loss (the widely experienced, 'old' type of decline), has the potential to revert to Type B growth, if migration in those areas turns positive. Type E decline is also less perverse than the 'new' type of depopulation, Type F decline, where there is both net migration loss and natural decrease. *Answering our main research question, we found that this new, 'dual' form of depopulation is as yet affecting a relatively small number of New Zealand's towns and rural centres (13-15 percent), and is not yet evident at TA level.* However, it is emerging intermittently,

and projections at TA level indicate that it will become increasingly prevalent from 2028. By 2043 it is projected to affect around 27 percent of TAs, and to be the largest cause of depopulation and the single largest cause of population change *per se*. Type A growth will by then have diminished to around 17 percent of TAs.

Answering our second research question, the various combinations delivering population growth and decline also do more than simply affect population size; they also have a profound effect on the age structure of each population. Net loss at younger ages typically makes age structures older, and net gain, younger. Net in-migration at older ages further accelerates – or, where negative, slows – structural ageing. This 'age-selective' migration has resulted in just 15 percent of New Zealand towns having populations in 2013 that were younger as the result of migration across the period 1976-2013; conversely, 85 percent of towns were older. The latter situation also pertains to two-thirds of rural centres and four-fifth of TAs. Only a minority of our study areas have thus become more youthful as the result of migration, a finding which, at least in terms of international migration, runs counter to many pronouncements on the topic. Moreover, in many cases areas are substantially older (or, in fewer cases, substantially younger).

Again, these effects have policy implications, as areas gaining young adults (especially from internal migration) are at the same time playing a role in the ageing of the towns and rural centres they have left. Akin to 'watering the neighbour's garden' (Attané & Guilmoto 2007), future policy may need to consider having younger/growing areas compensate their ageing/declining counterparts. This proposition is strongly supported by correlations that show the relative size of the population of women aged 15-44 years is a critical factor in sustaining natural increase. Second only to the strong positive correlation between net migration and net change, the correlation for women aged 15-44 years and natural increase shows that the higher the former, the higher the latter. Conversely, the lower the percentage of women at these ages, the lower the natural increase. This very

strong correlation, which concurs with that found for the United States and Europe (Johnson et al., 2016), has also strengthened over time, and more so for rural centres, where the loss of women aged 15-44 years is greater than for towns.

Moreover, the correlation between women aged 15-44 years and natural increase is also substantially stronger than that between natural increase and the total fertility rate, for both towns and rural centres – although we have only three observations on which to base this proposition. While also positive, indicating that the higher/lower the TFR, the higher/lower the natural increase, the relatively weak correlation values indicate that there is as yet very little relationship between the two. Accordingly, we can at least tentatively conclude that age-selective migration is *the* major driver of New Zealand's current shift to natural decrease, rather than the conventional driver, low fertility.

This finding is further supported in another, even more surprising finding, which shows that net migration and natural increase are negatively correlated. Although the correlations are relatively weak, they are consistently negative and indicate that the higher the net migration, the lower the natural increase, and vice-versa – a finding also reported for the USA and Europe (Johnson et al., 2015; Murphy 2016). Migration may thus not be the 'bringer of babies' that many believe.

These findings are important from a migration policy perspective, not least because they have implications for the ideal composition of international migrants; that is, perhaps low growth/ declining areas need more who are likely to have families, and fewer merely to 'work', especially in rural centres.

Similarly, where areas are gaining older people, either through migration or ageing-in-place, or alternatively are losing them to other areas, there are social policy implications in terms of the type of resources and services that are needed; one-size-fits-all policies are to be avoided. The same point pertains to areas gaining or losing families and children; their needs are very different.

In terms of policy development regarding structural ageing *per se*, New Zealand's relatively high birth rates and currently very high per capita levels of net international migration may suggest to some that the ageing-driven ending of population growth is 'over the horizon', and thus may be paid less attention in the short term. We emphasise that this is not the case at the subnational level (see also Matanle 2017, which compares New Zealand with Japan). Although the decline experienced across the period 1976-2013 was disproportionately the result of net migration loss, that loss and its age-selective nature has greatly accelerated the structural ageing of affected areas. These areas will struggle to return to long-term population growth, as the increased proportions at older ages and decreased proportions at reproductive age afford little chance of resurrecting the natural increase they once enjoyed. As natural increase diminishes, more and more migrants will be required simply to maintain each population at the same size. This may happen for popular retirement towns, but not most towns. Ageing and declining areas thus require regionally-specific migration policies that give primacy to local, rather than national, demographics.

Finally, the question as to whether the ending of population growth and onset of depopulation will be 'good' or 'bad' has as yet been subjected to very little serious research – or theoretical development (see Matanle, *infra*). The end of population growth is likely to have both positive and negative outcomes – positive, for example, in terms of fewer people to consume resources and damage the environment, and potentially the development of a greater sense of community. However, its negative outcomes will include the loss of many economies of scale that have been enjoyed in the growth phase, and plausibly the loss of value of many assets, such as housing. In New Zealand it will have major implications for the way in which rate revenue has historically been gathered by local government councils (Jackson 2004; Jackson & Cameron 2017). Ultimately the ending of growth and onset of depopulation is expected to be the dominant situation across most countries of the developed world by mid-century; prior to that our populations will age considerably (Atoh 2000; Lutz, Sanderson & Sherbov 2004; Reher 2007, 2011; World Bank 2009; Haartsen & Venhorst 2009; Audirac 2010; Lee & Reher 2011; Matanle and Rausch 2011; Martinez-Fernandez et al., 2012, among many others). In many cases there is the potential for a 'depopulation dividend', if the situation is accepted and engaged with positively and in a timely manner (Matanle 2017). Accordingly, it is time for our policy makers to begin revisiting our policies and the (growth) principles on which most are based (United Nations 2000:4).

References

Atoh, M (2000) 'The coming of the hyper-aged and depopulating society and population policies: the case of Japan', Conference Proceedings New York: Department of Economic and Social Affairs

Attané, I & CZ Guilmoto (2007) *Watering the Neighbours Garden: The growing female demographic deficit in Asia.* Paris: CICRED

Audirac, I (2012) 'Declining suburbs in Europe and Latin America', *International Journal of Urban and Regional Research*, pp.226-244

Bucher, H & R Mai (2005) Depopulation and its Consequences for the Regions of Europe. Report Prepared for the Council of Europe, Directorate General III–Social Cohesion DG3/CAHP10(2005) 7 final

Cameron, M (2017) ''The relative (un)certainty of subnational population decline' *Policy Quarterly*, Supplementary Issue, pp.55-60

Davis, K (1945) 'The world demographic transition', *The Annals of the American Academy of Political and Social Science* 237, pp.1-11

Davoudi, S, M Wishardt & I Strange (2010) 'The ageing of Europe: demographic scenarios of Europe's futures', *Futures* 42, pp.794-803

Dyson, T (2011) 'The role of the demographic transition in the process of urbanization', *Population and Development Review* 37, pp.34-54

Haartsen, T & V Venhorst (2009) 'Planning for decline: anticipating on population decline in the Netherlands' *Econom. en Social Geography* 101(2), pp.218-227

Jackson, NO (2014) 'Sub-national depopulation in search of a theory – towards a diagnostic framework', *New Zealand Population Review* 40, pp.3-39

Jackson, NO (2016) 'Irresistible forces: facing up to demographic change', In P Spoonley (ed) *Rebooting the Regions. Why low or zero growth needn't mean the end of prosperity* pp.47-77, Auckland: Massey University Press

Jackson, NO & L Brabyn (forthcoming) 'Population ageing and age-selective migration. Subnational population trends in New Zealand'. Draft available from authors on request

Jackson, NO, L Brabyn & D Maré (2016) 'New Zealand's towns and rural centres 1976-2013 – experimental components of growth' *Working Paper* 7. National Institute of Demographic and Economic Analysis, University of Waikato, Hamilton, New Zealand

Jackson, NO, L Brabyn, DC Maré, MC Cameron & I Pool (forthcoming, under review) 'From ageing-driven growth towards the ending of growth. Subnational population trends in New Zealand'

Jackson, NO & MC Cameron (2017) 'The unavoidable nature of population ageing and the ageing-driven end of growth - an update for New Zealand' Population Ageing: (tba), 1-26. DOI: 10.1007/s12062-017-9180-8

Jackson, NO, MC Cameron & I Pool (2015) The mechanisms of subnational depopulation – towards a typology Presentation to 'Our People, Our Places' Population Association of New Zealand Biennial Conference, Hamilton June 29-30

Jackson, NO & I Pool (forthcoming) *A Theory of Replacement Capacity*

Johnson, KM, LM Field & DL Poston Jnr (2015) 'More deaths than births: subnational natural decrease in Europe and the United States', *Population and Development Review* 41(4) pp.651-680

Kippen, R & P McDonald (2000) 'Australia's population in 2000: the way we are and the ways we might have been' *People and Place* 8(3), pp.10-17

Lee, RD & DS Reher (2011) 'Introduction: the landscape of the demographic transition and its aftermath', *Population and Development Review* 37(1), 1-7

Lutz, W, W Sanderson & S Sherbov (eds) (2004) *The End of World Population Growth in the 21st Century: New challenges for human capital formation and sustainable development* London & Sterling VA: International Institute for Applied Systems Analysis/Earthscan

Martinez-Fernandez, C, N Kubo, A Noya & T Weyman (2012) Demographic change and local development: shrinkage, regeneration and social dynamics, OECD/LEED Working Paper Series.

Matanle, P (2017) 'Towards an Asia-Pacific depopulation dividend in the 21st Century. Regional growth and shrinkage in Japan and New Zealand', *The Asia-Pacific Journal* 15(6), p.5

Matanle, P & A Rausch with the Shrinking Regions Group (2011) *Japan's Shrinking Regions in the 21st Century: Contemporary responses to depopulation and socioeconomic decline* Amherst, NY: Cambria Press

Matanle P & Y Sato (2010) 'Coming soon to a city near you! Learning to live 'beyond growth' in Japan's shrinking regions', *Social Science Japan Journal* 13(2), pp.187-210

McDonald, P & R Kippen (1999) *The impact of immigration on the ageing of Australia's population* Canberra: Department of Immigration and Multicultural Affairs

McMillan, R (2016) 'The shrinkage pathway: managing regional depopulation', in P Spoonley (ed) *Rebooting the Regions: How low or zero growth needn't mean the end of prosperity* pp.213-237, Albany, NZ: Massey University Press

Murphy, M (2016) 'The impact of migration on long-term European population trends, 1850 to present', *Population and Development Review* 42(2), pp.225-244

National Business Review [NBR] (2014, 12 July) 'NZ has zombie towns that need to close — economist', (retrieved 26 March 2017 from: https://www.nbr.co.nz/article/nz-has-zombie-towns-need-close-%E2%80%94-economist-ns-159124)

Reher DS (2007) 'Towards long-term population decline: A discussion of relevant issues', *European Journal of Population* 23, pp.189-207

Reher DS (2011) 'Economic and social Implications of the demographic transition', *Population and Development Review* 37, pp.11-33

Rowland, DT (2003) *Demographic Methods and Concepts* Oxford: Oxford University Press.

Statistics New Zealand (2015a) Life Table functions 2005-07 and 2012-14 by territorial authority area, age and sex

Statistics New Zealand (2015b) Subnational population by age and sex, June 1996, 2001, 2006, 2013

Statistics New Zealand (2015c) Live births per 1,000 women by age, Māori and Total, Table DFM019AA

Statistics New Zealand (2015d) Number of births, Māori and Total, by territorial authority area, Table VSB011AA

Statistics New Zealand (2015e). Subnational population projections by age and sex, 2013(base)–2043

Statistics New Zealand (2016) Customised database. Estimated birth occurrence at 30 June 1997-2013 by age of mother and territorial authority area of usual residence based on 2013 boundaries.

United Nations (2000) *Replacement migration. Is it a solution to declining or ageing populations?* UN Secretariat, Department of Economic and Social Affairs

World Bank (2009) *Reshaping Economic Geography* chapter 3, Washington DC: World Bank

Appendix

Data Sources and Methodology:

Population data: Mesh-block level counts of the usually resident population by 5-year age group (to 80+ years) and sex for all census years 1976-2013 were aggregated to the 2013 geographic area boundaries at urban area (UA) and territorial authority area (TA) level[8]. The allocation to 2013 geographic areas was based on a 'user-derived correspondence'. <u>The counts are not official statistics but should be understood as experimental estimates intended for use in this research</u>.[9] This exercise resulted in data for 143 urban areas, 132 rural centres, and 66 TAs (The Chatham Islands were excluded from the TA level analysis because of small cell sizes).

Birth and survivorship rates for all years for which these data were required are not available at urban or rural centre level, and were instead constructed using indirect standardisation. In order to construct birth rates, we purchased a customised dataset from Statistics New Zealand (2016) covering births by 5-year age group of mother for the period 1997-2013 (June years) at territorial authority area (TA) level and 2013 geographic boundaries. Survivorship (Lx) rates by age and sex for each TA were accessed for the years 2005-07 and 2012-14 (Statistics New Zealand 2015a).

Calculating missing birth rates via indirect standardisation was done in two main steps. First, age-specific fertility rates were constructed for each of New Zealand's 66 TAs for the June years 1996-97, 2001-02, and 2006-2013, using number of births by age of mother as sourced above, and female estimated resident population counts for corresponding 5-year age groups 15-49 years sourced from Statistics New Zealand (2015b). The age-specific fertility rates for 1996 and 2001 were then summed and averaged (for each age group and each TA), and their ratio to the equivalent rates for total New Zealand constructed (drawing on Statistics New Zealand 2015c). These relative age-specific fertility ratios for each TA were then held constant and multiplied by the equivalent rates for total New Zealand for the missing years, 1976, 1981, 1986, and 1991. That is, the national values were retrospectively inflated or deflated by the relevant ratio, for each of the four observations 1976-1991, to generate approximate TA level age-specific rates for those years.

The second step involved constructing age-specific fertility rates for each town and rural centre, by applying the age-specific rates for the TA in which each is located to the number of women in each 5-year age group 15-49 years, in each town and rural centre.

The resulting birth rates and numbers at TA level differ slightly from those published by Statistics New Zealand (2015d) because they are constructed experimentally using both the 'estimated resident population count' (ERP) which includes adjustments for births, deaths and migration occurring between March and the ERP date (typically June or December), and the 'usually resident population count' (URP) at each five-yearly census (which is taken in March). As with the underlying population counts, the fertility data should be thought of as best approximations extracted for these research purposes.

Calculating missing survivorship rates via indirect standardisation was similarly done in two steps. First, Lx values (the average number alive in each age group) by 5-year age group and sex for each TA for two Life-Table periods, 2005-07 and 2012-14, were compared to the average number alive in the preceding 5-year age group. This process produced sex- and age-specific survivorship ratios for each five-year age group to 95+ years, for these two observations (for the purposes of this exercise, considered to be 2006 and 2013). The 2006 ratios were then compared with their national equivalents, to generate relative survivorship ratios for each TA for the missing years: 1976, 1981, 1986, 1991, 1996, and 2001. That is, for each of those observations, the national values were retrospectively inflated or deflated by the relevant sex- and age-specific survivorship ratios for each TA in 2005-2007, to generate approximate TA level rates.

The second step involved constructing sex- and age-specific survivorship rates for each town and rural centre, by applying the rates for the TA in which each is located, to the number of males and females in each five-year age group, in each town and rural centre. In order to survive age groups above 80 years, the 80+ year age group was prorated to 80-84, 85-89, 90-94 and 95+ years according to the New Zealand distribution (by sex) at those ages. Again, the resulting data are 'best approximations' based on calendar year survivorship ratios and census usually resident population counts.

When the resulting data are compared with published birth and death numbers for each TA, which are available for all years 1992-2013, there is strong correspondence, and the model is thus considered sufficiently robust to use for our purposes of calculating the components of change for towns and rural centres. This is done using cohort component analysis and the 'residual' method for separating net migration from net change (Rowland 2003 Chapter 12).

Calculating components of change by the residual method: The resulting fertility and survivorship rates were used in a conventional cohort component analysis to separate out the contributing effects of both net migration and natural increase. First, survivorship rates for each age group were applied to the baseline usually resident population numbers for each individual observation (separately by sex), and fertility rates applied to survived women aged 15-49 years. The resulting births were summed and apportioned male/female according to the standard sex ratio for New Zealand (105 males per 100 females). Births were entered at age 0-4 years, and all other age groups 'aged' by five years. The resulting 'expected' population by age and sex was then

compared to the actual population at the relevant observation (for example, the survived and 'reproduced' population from 1976 was compared to the actual population for 1981), and the difference at each age (five-year age group) taken to be a residual measure of net migration by age across the five-year period. Subtracting total estimated migration from net change in population size between the two observations in turn generates the natural increase component, which in turn is disaggregated into its births and deaths components by summing each individual component generated at each step.

With and Without Migration

To generate the 'without migration' data used in our analyses we used a standard cohort component projection method, with the exception of excluding an assumption for migration. We applied period-based age-specific fertility and survivorship rates to the 1976 population by 5-year age group, separately by sex, adding in the resulting births at age 0-4 and subtracting deaths, then ageing the population by 5 years. We repeated the process for each census year to 2013. These data were then compared with those which had been developed similarly, but included migration.

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Lars Brabyn

Declining Towns and Rapidly Growing Cities in New Zealand
developing an empirically-based model that can inform policy

Introduction

Understanding and predicting spatial patterns in population change has significant implications for infrastructure, property investments, and national spatial planning. It is also at the core of understanding what motivates people to move to different places, and the underlying geographical conditions that are important to people. During recent times, the population growth of large cities in New Zealand (particularly Auckland, but Tauranga has had faster growth) has resulted in severe social and infrastructural problems, such as sky-rocketing house prices, homelessness, and congestion of roads. At the same time, many small towns have had significant population decline, with no proposed solutions apart from acceptance or undertaking so-called "managed decline" (McMillan 2016; Wood 2017). As will

be described in this article, net migration has been a significant component of the spatial variation in population change, while natural change does not have a significant spatial variation and has been generally positive for all urban places. A policy response to the spatial variation of net migration needs to be based on an empirically based understanding of what drives net migration.

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The drivers of net migration are fundamental topics of Human Geography, Regional Economics, and Human Ecology. As a consequence there has been a considerable amount written on this topic (e.g. Lee 1966; Glaeser 2011; and Castles et al 2014), which is beyond the scope of this article to review. Historically the main drivers of net migration have been understood to be economic drivers such as resources and markets for industry and associated employment (Poot 1986; Barreira et al 2017). However, a range of surveys have shown that employment is often not the main motivation for migration (Morrison & Clark 2011). There is increasing interest in the role lifestyle has on migration (McGranaham 2008). Although this is often associated with lifestyle blocks (Andrew & Dymond 2013) and rural living, many small urban towns also provide a rural setting. Lifestyle is often

geographically models net migration in New Zealand, using the substantial amount of information on urban places which has been collected over decades, including both population counts and their environmental and social context. In New Zealand, the quantitative modelling of population change and mobility has been initiated by Grimes and Tarrant (2013) and Grimes et al (2016), which involved developing a data set of population change for 60 towns over the last 80 years. Other studies include Kerr et al (2004), who identified population density and education as pull factors. Our research builds on this research by focusing on the last 40 years, using a substantially greater number of places and more detailed data sets. In particular, net migration (rather than population change) is used as the dependant variable.

Zealand (2017), as the unit of spatial analysis. Urban areas include main urban areas, satellite urban communities, and independent urban communities. The rural centres had a baseline (1976) population between 300 and 999 in a 'reasonably compact area'. For this article, these urban areas and rural centres are all referred to as 'urban places'. In total, Statistics New Zealand identifies 276 urban places, but Waiouru and Burwood were removed from the dataset because they are military bases, and Pegasus was removed because of difficulty in determining early population counts. The choice of spatial units is an important decision in spatial modelling. Results are influenced by the unit of analysis, which is known as the modifiable area unit problem (Gehlke & Biehl 1934). Also, spatial units can have considerable internal heterogeneity, leading to the ecological fallacy (Robinson 1950). The benefit of urban places as spatial units is that they form natural units of analysis that are not biased by processes used to create artificial zones such as Territorial Authority Areas (TAs) or Census Area Units (CAUs). The extent of urban places is based on their natural growth, and they have a relatively consistent population density compared to many other larger units. Most importantly, they are also units that have meaning to people as they are associated with place-names and used in everyday conversations. The disadvantage is that each urban area is treated as one record even though the population count of urban areas can vary significantly. In 2013 the highest count was Central Auckland, with a population of 427,063, and the lowest count was Ohura with 126. Each urban place, regardless of size is a statistical record, and is treated equally. We do this deliberately, as our interest is in what attracts people to both large and small places.

This article statistically and geographically models net migration in New Zealand, using the substantial amount of information on urban places which has been collected over decades …

linked to landscape setting – Vukomanovic & Orr (2014) have shown that rugged terrain, visual complexity and naturalness are drivers of 'amenity migration'.

Although qualitative surveys, such as used by Sloan and Morrison (2016), provide a picture of the drivers of net migration in New Zealand, it is important that understanding is substantiated through a range of approaches and methods. It is through triangulation of many studies and a range of methods that knowledge is generated. With the availability of geographic information system (GIS) data that describe places, both now and in the past (and combined with population census data that show where people live), it is timely to investigate how well changes in population distribution can be modelled with this data. This paper statistically and

By using just net migration, the model excludes natural change (births and deaths) which has different determinants. This should, in theory, result in a cleaner model. A machine learning technique, as opposed to an Ordinary Least Squared (OLS) regression model, became the statistical modelling technique of choice.

The main motivation of this research was to understand spatial differences in net migration, and to determine the relative influences of the different drivers and how these vary by age. Some drivers of net migration, such as employment, are well known, but others, such as lifestyle, are less well substantiated.

Urban Places Data and the Components of Population Change

This research used urban areas and rural centres, as defined by Statistics New

The development of the New Zealand urban places population data set, which contains natural change and net migration, is described in detail in the Appendix of Jackson & Brabyn (infra). Figure 1 compares natural change, net migration, and total change in population between 1976 and 2013 for the 273 urban places. Although natural change accounts for a substantial proportion of population growth in many places, and all of growth in

Figure 1: Components of population change (number and percentage contribution to change) between 1976 and 2013.
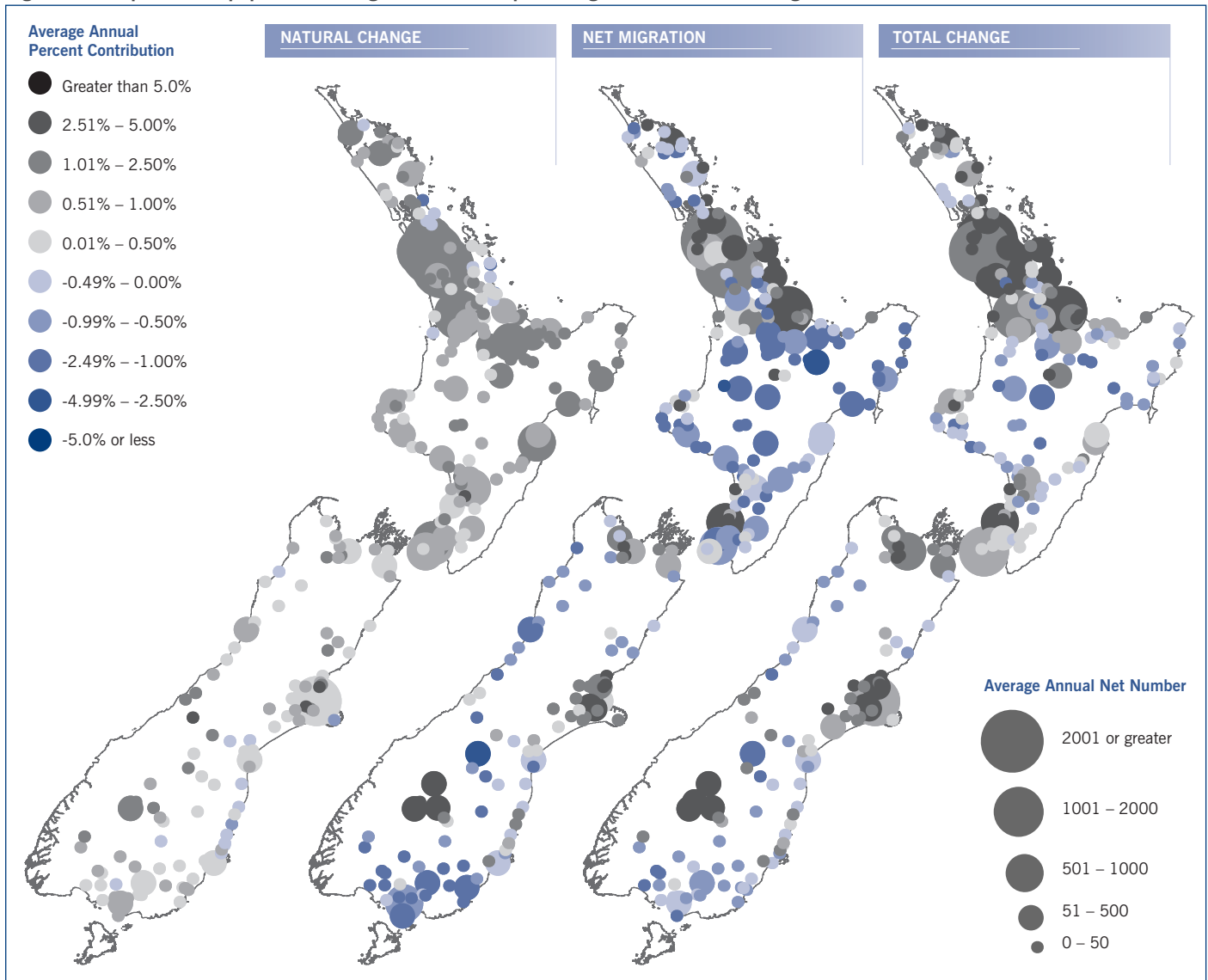
places experiencing severe net migration loss (see Jackson & Brabyn *infra*), this component, as a percentage, is relatively even across all towns. By contrast, net migration has considerable spatial variation, and accounts for over 95 percent of the variation in net population change. Separating natural change and net migration from net population change means that the analysis of drivers can focus entirely on net migration, and is not complicated by the need to consider the determinants of natural change, which include population age structure, and other determinants of birth and survivorship.

What Drives Net Migration? – The Conceptual Model

Table 1 summarizes the conceptual drivers of net migration that were used in

this research. In summary, these drivers are based around employment, natural and cultural lifestyle opportunities, access to essential services (hospitals and education facilities), and demographic age (technically this is a factor rather than a driver). Table 1 also includes general information how these drivers are represented by indices. The following section describes how these indices are represented using GIS and available data sets, but for now this section will focus on justifying these conceptual drivers. The drivers used in this study are conventional. For example, Chi and Ventura (2011) use similar categories, but there are some considerations that need further explanation.

The model used in this research uses 'ultimate' (that is, remote) drivers rather than proximate drivers, where possible.

Although the distinction of ultimate and proximate is open to interpretation, these are useful for looking at employment drivers. In this research, the key components of industry are used to represent employment, rather than the number of jobs or the presence of particular industries. The key components of industry are resources, which are linked to access to land-use and population size (and associated agglomeration theory), as well as access to markets, both domestic (large population centres), and international (ports and airports).

The conceptual model shown in Table 1 is based on the New Zealand context. New Zealand has not experienced, during the period being analysed, regional warfare or successive massive natural hazards that have resulted in large scale migration. The only exceptions are the

Table 1: Conceptual model of the drivers of net migration, and the indices that describe these drivers

Main Driver	Sub-driver	General Indices
Economic / Employment / Industry	Productive land-use in surrounding region	% in productive and non-productive land
	International transport hubs	Travel time to ports and airports
	Domestic markets	Travel time to different size population centres
	Critical population size – access to skills	Travel time to different size population centres
Lifestyle - Culture and Nature	Friends and family living close by	Travel time to different size population centres
	Cultural and social entertainment opportunities	Travel time to different size population centres
	Climate – sunny and not too wet	Annual sunshine hours and rainfall
	Aesthetic landscape setting / outdoor recreation	% of land in mountains and nature. Water views and coastal
Essential Services	Healthcare	Travel time to closest hospital
	Education	Travel time to education centres
	Transport, particularly airports	Travel time to airports
Demographic	Age classes	% population in different labour market age groups

Canterbury earthquake events in 2010/11, but to model the influence of earthquakes would require many more records that included other places. New Zealand has experienced many localized floods, but in general these have been ameliorated through flood barriers, or have a long enough reoccurrence interval to not induce significant net migration loss.

The importance of lifestyle does have a specific New Zealand context since it is linked to culture and local environment. Lifestyle choices for New Zealand will be different from other countries and cultures. Lifestyle as a determinant of migration is not as well developed and analysed, compared to the more traditional determinants such as employment and essential services. New Zealand is known for its scenic mountainous areas and coastal landscapes, which is the basis of its tourism industry; this industry also requires servicing, so tourist areas also attract people seeking employment. Anecdotally it is clear that scenic destinations such as Queenstown, and coastal sunny settlements around Nelson, the Coromandel, Bay of Plenty and northern New Zealand are popular places for tourists as well as places to

retire. Many landscape studies show that people have a preference for natural, mountainous and coastal landscapes (Swaffield & Foster 2000; Brown & Brabyn 2012). In contrast, people also enjoy the cultural opportunities and diversity provided by large cities. Access to entertainment, such as large concerts, movie theatres, sports clubs and societies, is an important part of people's lifestyle choices. Large cities are also more likely to be where friends and family live, as well as culture peer groups for new immigrants.

Linked to the desirability of cities is improved access to essential services such as hospitals and large tertiary education institutes. Many of these services benefit from economies of scale, as they offer expensive technologies. Over the last 30 years in New Zealand there has been extensive change and consolidation of essential services, driven by the need to rationalize resources and reduce costs, but also by the difficulty of recruiting experts in small provincial towns. International airports are also considered an essential service for many, who want to take advantage of cheaper or more readily accessible international travel. Again, economies of scale are a key determinant

of the number and location of international airports in New Zealand, especially given that New Zealand's population is only 4.7 million.

Compounding the complexity of different drivers of migration is age. People's wants and needs change with age. In this research four broad age groups are considered, each based on their labour market roles – labour market entry-age (15-24 years), prime working-age (24-54 years), labour market 'exit-age' (55-64 years), and retirement (65+ years)[1]. The labour market entry-age group may be keen to move away from home, may want to study at a tertiary institution, or move for work reasons and/or start a career. The prime working-age group is primarily focused on work and stable income for raising a family, while the labour market exit-age group (i.e., those in the 'retirement zone' and beginning to leave the labour market) may have considerable savings and be thinking about more desirable lifestyles. The retirement age group may begin with a focus on lifestyle but are more likely to be forced to move closer to tertiary hospitals as they age further.

Spatial Data Representation
This section outlines how the conceptual model described previously is represented and operationalized through spatial data sets collected from archives and derived from GIS analysis. Table 2 shows how the concepts that form the drivers are represented by 29 variables, and what datasets and GIS analysis functions were used to derive these variables. Key references and web links associated with these layers are also provided. The abbreviated titles of the variables are provided because these are used to present the results. The main driver type that each variable is represented is also listed, and it should be noted that some variables represent more than one driver type. The expected direction of influence for each variable is also provided, which is useful for checking that the statistical models being developed make sense. It is important to note that the travel time variables to essential services and infrastructure all have expected negative influence on net migration. This is because people want or need to be close to

Table 2: Description of independent variables used to model net migration

Abbreviated Variable Title	Full Variable Description	Main Driver Type	Expected Influence of Net Migration	Data Source	Analysis	Reference and Notes
Population size	Population count - all ages	Economic, Lifestyle Cultural	Positive	Statistics NZ Census	Sums	Statistics NZ
Entry-age 15-24	Percent labour market entry age 15-24 yrs	Demographic	Unknown	Statistics NZ Census	Sums	Statistics NZ
Working-age 20-64	Percent prime working-age 55-64 yrs	Demographic	Unknown	Statistics NZ Census	Sums	Statistics NZ
Exit-age 55-64	Percent labour market exit-age 55-64 yrs	Demographic	Unknown	Statistics NZ Census	Sums	Statistics NZ
Retire age 65 +	Percent retirement age 65+ yrs	Demographic	Unknown	Statistics NZ Census	Sums	Statistics NZ
Pop. > 20k	Travel (hrs) to the closest place with a pop. > 20K	Economic, Lifestyle Cultural	Negative	Statistics NZ Census	LCPA *	Statistics NZ
Pop. > 50k	Travel (hrs) to the closest place with a pop. > 50K	Economic, Lifestyle Cultural	Negative	Statistics NZ Census	LCPA	Statistics NZ
Pop. > 100k	Travel (hrs) to the closest place with a pop. > 100K	Economic, Lifestyle Cultural	Negative	Statistics NZ Census	LCPA	Statistics NZ
Pop. > 200k	Travel (hrs) to the closest place with a pop. > 200K	Economic, Lifestyle Cultural	Negative	Statistics NZ Census	LCPA	Statistics NZ
Large port	Travel (hrs) to the closest large container port	Economic	Negative	Prepared for project	LCPA	> 200k containers / yr.
Port	Travel (hrs) to the closest small or large port	Economic	Negative	Prepared for project	LCPA	Container port
Int'l. airport	Travel (hrs) to the closest international airport	Economic, Essential Services	Negative	Prepared for project	LCPA	Just international airports
Airport	Travel (hrs) to the closest airport	Economic, Essential Services	Negative	Prepared for project	LCPA	Regional and international
High producing	Hectares of high producing land-cover within 50km of the centre – dairy and horticulture	Economic	Positive	Land-cover database	Buffer	Newsome, 1987
Low producing	Hectares of low producing land-cover within 50km of the centre – sheep farming and forestry	Economic	Negative	Land-cover database	Buffer	Newsome, 1987
Urban	Hectares of urban land-cover within 50km of the centre	Economic	Positive	Land-cover database	Buffer	Newsome, 1987
Natural	Hectares of natural land-cover within 50km of the centre	Lifestyle Natural	Positive	NZ Landscape Classification	Buffer	Brabyn, 2009
Solar radiation	Solar radiation	Lifestyle Natural	Positive	LENZ dataset	Zonal	Leathwick et al 2002
Temperature	Mean annual temperature	Lifestyle Natural	Positive	LENZ dataset	Zonal	Leathwick et al 2002
Wind	Average wind speed	Lifestyle Natural	Negative	LENZ dataset	Zonal	Leathwick et al 2002
Rainfall	Average rainfall	Lifestyle Natural	Negative	LENZ dataset	Zonal	Leathwick et al 2002
Water view	Percent of urban area that has a water view (lake or sea)	Lifestyle Natural	Positive	NZ Landscape Classification	Sums	Brabyn, 2009

Abbreviated Variable Title	Full Variable Description	Main Driver Type	Expected Influence of Net Migration	Data Source	Analysis	Reference and Notes
Coastline	Total length of coastline within 50km of the centre	Lifestyle Natural	Positive	LINZ topog'l. data	Buffer	Land Information NZ
Mountains	Hectares of mountains within 50km of the centre	Lifestyle Natural	Positive	NZ landscape classification	Buffer	Brabyn, 2009
Hills	Hectares of hills within 50km of the centre	Economic	Negative	NZ Landscape Classification	Buffer	Brabyn, 2009
Major hospital	Travel (hrs) to the closest tertiary hospital	Essential Services	Negative	Prepared for project	LCPA	Tertiary
Hospital	Travel (hrs) to the closest hospital	Essential Services	Negative	Prepared for project	LCPA	Secondary + tertiary
University	Travel (hrs) to the closest university	Essential Services	Negative	Prepared for project	LCPA	Just universities
Tertiary education	Travel (hrs) to the closest tertiary institution	Essential Services	Negative	Prepared for project	LCPA	University, polytechnic or wananga

these services, so a reduced travel time is expected to be more desirable.

The sources of the data sets are also listed as well as the GIS analysis functions applied to these data sets and associated references for more information. The GIS analysis used are generally routine functions. Buffer (also known as proximity analysis) measures a set distance from a point or object. Zonal functions calculate the mean value for a region, and Least Cost Path Analysis (LCPA) calculates the shortest path via a network. The LINZ topographic road layer was used for the road network and the shortage path was based on time rather than distance – see Brabyn and Skelly (2002) for an example of how this is calculated.

Where applicable and available, the values for each variable were derived for the base year of each period. For example, the 1981 (Newsome, 1987) landcover layer was used to determine the extent of productive, natural, and urban land uses. Some variables like climate do not change significantly and 2002 data was used. The location of essential services and infrastructure (hospitals, tertiary education, ports and airports) does change over time and compiling this information was a major task. Archived information available on the internet was often the best source of this information. Hospitals reduced in number over the analysis period, primarily due to costs and government restructuring. Tertiary institutions combined but created many

learning outposts in smaller centres – primarily due to costs and government policy to upskill the population. Airports fluctuated from national carrier to regional carriers and vice versa – primarily due to demand and costs. Ports increased the volume of cargo moving through their facilities over the period - due to increased trade and population demand.

Statistical modelling
Ideally, a statistical model will explain all the variation in net migration and provide the relative importance that each variable makes to the model. For example, if a new hospital was built in a town, the perfect model would be able to predict the net migration resulting from this change. Ordinary Least Squared (OLS) regression models provide coefficient values that give an exact break down of what each variable contributes to the model; however there are significant stability issues when the variables are not independent (have collinearity). This is a problem with the variables in this study as well as other studies (see Grimes et al 2016), and is to be expected given that airports, universities and hospitals are often located in major cities, so the travel time to these services will often be similar for different urban places. When two or more variables correlate, it is impossible to know which variable is the actual driver. The other concern with regressions is that outliers often have a significant weighting on coefficient values, and

the removal of one or two records can have a huge change to the coefficient value. This research investigated the use of stepwise OLS regression with standardized variables, but soon realized that the significant coefficient values were meaningless, as they change dramatically when one variable is dropped or added. The use of Principle Component Analysis was also used to reduce the number of variables and collinearity, but it became impossible to interpret the results and what each component actually meant. The significant coefficients were also highly unstable.

Random Forest (RF) is a machine learning technique that resolves many of the instability problems with regression models (Rodriguez-Galiano et al 2012), and was one of the adopted methods used in the analysis – the other method was Pearson's 'r'[2]. The output from a Random Forest model is an assessment of the variation in the dependant variable that the model can explain, as well as a set of importance values associated with each variable. By comparing the importance values for each variable, the relative importance (RI) of each variable is determined. Random Forest uses decision trees to produce a model. The variables used at each branch in a tree are selected randomly based on a set number of variables specified by the user (set to 4 for this study), and the number of branches used is determined by the number of variables (Breiman 2001). The random

Table 3: Net migration by different age groups - model description and performance

Dependent Variables % Net Migration	All Ages Combined		Entry Age Group (15-24 years)		Prime Age Group (25-54 years)		Exit Age Group (55-64 years)		Retirement Age Group (65+ years)	
	RI	ρ	RI	ρ	RI	ρ	RI	ρ	RI	ρ
Top 10 Explanatory Variables Listed by Order of Importance	Entry-age 15-24 1.00	-0.35	Population size 1	0.313	Population size 1.00	-0.05	Population size 1.00	-0.11	Population size 1.00	0.017
	Exit-age 55-64 0.99	0.46	Temperature 0.92	-0.36	Water view 0.53	0.402	Water view 0.86	0.375	Int'l airport 0.69	-0.25
	Mountains 0.65	0.04	Pop. > 50k 0.92	0.051	Hills 0.36	-0.31	Hills 0.53	-0.19	Population > 200k 0.56	-0.24
	Population size 0.62	-0.03	Natural 0.89	0.251	Mountains 0.30	0.054	Solar radiation 0.52	0.156	Low producing 0.45	-0.15
	Retire age 65+ 0.57	0.36	Hospital 0.88	0.048	Solar radiation 0.27	0.191	Temperature 0.49	0.158	Temperature 0.40	0.196
	Hills 0.43	-0.32	Hills 0.89	-0.2	Coastline 0.25	0.304	Int'l airport 0.49	-0.21	Coastline 0.38	0.203
	Working-age 20-64 0.37	0.27	Rainfall 0.88	0.103	Natural 0.21	-0.03	Low producing 0.48	-0.03	Major hospital 0.37	-0.2
	Coastline 0.33	0.32	University 0.87	-0.04	Temperature 0.20	0.168	Rainfall 0.48	-0.1	Large port 0.32	-0.08
	Solar radiation 0.31	0.20	Population > 20k 0.73	0.133	Hospital 0.20	0.13	Hospital 0.39	0.127	Hills 0.30	-0.11
	Int'l airport 0.28	-0.31	Tertiary education 0.6	-0.03	Low producing 0.18	-0.04	Mountains 0.39	0.049	Airport 0.30	-0.15
Variability Explained	0.47		0.43		0.41		0.24		0.08	

decision tree is repeated several hundred times (set to 500 for this study) to produce a 'random forest'. Generally, after 100 repeats, the results are consistent. The data records were divided into a bootstrap sample ('in bag' data) and 'out-of-bag' (OOB) data using a split of 2/3 and 1/3 respectively (Rodriguez-Galiano et al 2012). The OOB data are used to calculate a prediction error by comparing the predictions from the in-bag data with the OOB data. The OOB samples are also used to calculate the variable importance (the prediction strength of each variable) by changing randomly the values of a given variable in the OOB samples. The increase of OOB error from these changes are averaged over all trees and is a measure of the importance of the variable.

As noted previously, when several hundred random trees are used, the relative importance of each variable becomes stable, but the value is relevant only to that particular model and is useful only as a relative measure. For this reason it is not valid to compare the magnitude of the importance value of a variable with another model generated with different data, such as another year; however, it is valid to compare the relative position of the importance value of a variable across different models. The importance values provide an estimate of the significance the variable has to the model. The lower ranked variables generally make only a small contribution to the model. In order to determine the relative importance (RI) of each variable the importance values were normalised based on their position relative to the maximum and minimum values ((value – min)/(max-min)).

The advantage of RF is that it is non-parametric, is relatively quick at processing large data sets with many variables, and is relatively stable with outliers and collinearity. The disadvantage with RF is that it needs many records, and provides no indication on the direction (positive or negative) of the relationship between the dependent and independent variables. For example, if mean annual temperature of a town is identified as an important variable, it is not known from RF whether there is a positive or negative influence on net migration. To get around this, Pearson's r correlation was used in conjunction with Random Forest to provide an indication of the direction.

RF was used to model net migration between 1976 and 2013. When all age groups were combined the 29 variables listed in Table 2 were used. When the net migration of each individual age group was modelled, all four age variables were not used, so the model was based on 25 variables.

Results

Table 3 shows the results in terms of percent net migration for the different age groups. This table lists the top ten variables in order of their importance values for the different periods. Each variable contains the relative importance values (normalised) as well as its Pearson's r (ρ) value to show the direction of the influence. In general, the directions of influence are consistent with the expected directions. As previously stated, travel time to essential services is negative because increased travel time is not favoured by people. Interpretation of the magnitude of the Pearson's r values requires care because of the collinearity between values, but it still provides additional information. Pearson's r (ρ) values between -0.1 and +0.1 were not significant at p < 0.10, since

n=273. This table also shows how much of the variation is explained by the RF models.

Observation 1: Overall model performance is good.

The best RF model explains 47 percent of the variation in net migration. Although this can be considered low, it is common in predictive spatial modelling at an ecological level for model performance to be around 20-30 percent (Jansen, Judas & Saborowski 2002). Given the complex nature of the human world and the diverse range of values among people, a model that predicts 47 percent of the spatial variability is a good achievement. However, this model performance is less than that achieved by Grimes et al (2016), which was close to 60 percent. An explanation for this result could be because

Although the determinants of net migration are highly complex, this research has produced models of net migration that explain close to 50 percent of the variation across 273 urban places.

our study used 273 towns compared to 56 towns for the study by Grimes et al. These 274 towns included many small rural centres, and as a consequence there would be greater diversity in characteristics, making it more difficult to model. Small towns also have greater data variability for percent net migration because of the smaller denominator values.

The performance of the individual RF models for the different labour market age groups is less than when all age groups are combined. This is surprising because it was expected that there would be less variation within an age group and therefore be easier to model. The age variables were not included in these models, which reduced the model performance. Age variables do not have a logical explanation for improving the model. In general, one age group will not

have an influence on the net migration of another group. The exception is children moving with their parents, but children were not analysed separately in this study.

Observation 2: Age is a significant factor that determines net migration.

The results show that labour market age groups are a significant factor that determines net migration. The results for all ages combined show that the labour market entry-age group (%15-24) years and the labour market exit-age group (%55-64) were the top two most important variables. The Pearson's r shows a significant positive correlation for the exit-age group and a significant negative correlation for the entry-age. The positive correlation for the exit age group implies that places with high percentages of labour market exit-age

people had high levels of net migration gain, and the negative correlation for the entry-age group implies that places with high percentages of entry age people had net migration loss. The likely explanation for this is that many retirement (lifestyle) destinations had a high percentage of older people and these places have high positive net migration, which is likely to be more retirees seeking a retirement destination. Many small farming towns had a high percentage of young people and these towns have net migration loss. This is likely to be the result of young people moving from these small towns to cities, and retirees moving to retirement destinations. The importance of age prompted separate modelling of each age group.

Observation 3: Population size is important but varies with age group.

The high RI value for population size for all age groups implies that the population size of the urban place had an influence, but the Pearson's r does not show a clear direction. It was expected that many small towns would have had net migration loss, which is the case, but there are also many that have had a gain for lifestyle reasons. To understand the influence of population size, it is necessary to examine this by the different labour market age groups. For the labour market entry-age group, the Pearson's r is positive and significant, indicating that the entry-age group is moving from small towns to large cities. With the prime working-age, population size is important but the direction is not clear because the Pearson's r value is not significant. The exit-age group has a significant negative correlation with population size, indicating a move from large urban places to small urban places. This is consistent with the idea that people close to retirement are seeking places with high natural lifestyle values, which, judging by the high RI values for water views, appears to be small coastal and lakeside towns. The retirement-zone age group has a significant positive correlation with population size, indicating that this group has a preference for larger cities, where hospital care is available. Related to population size is distance to different size cities. People may seek the benefits of a large population centre, but choose to live in satellite towns. These variables do appear in the list of top ten variables but do not have particularly high RI values compared to population size. Distance to cities with a population greater than 200,000 is significant for the retirement group. The correlation is negative indicating this groups prefers being close to large cities, rather than in them.

Observation 4: Economic and lifestyle are both important drivers.

As discussed previously, lifestyle drivers such as water views are important, but variables associated with employment and the economy are also consistently important. Surrounding mountains and natural land-cover are important variables, but the correlation is not

consistently significant. This could reflect the boom in tourism during these years, and many 'alpine' towns such as Queenstown, Wanaka, and Fox Glacier had high net migration gains. Being close to international airports also had a highly-ranked RI value. This is consistent with lifestyle values, since airports give access to international travel; however, it could also be interpreted as an employment driver as airports provide access to international markets and this helps businesses. Surrounding hills had a negative influence on net migration and this is linked to employment. In the New Zealand context, hill country is associated with sheep farming, which has been in decline, resulting in towns servicing these regions having net migration loss.

Observation 5. Access to essential services is important but not highly ranked.

There is a general trend of health services being consolidated in the larger cities, and this is an important consideration for many people. The variable, 'travel time to a hospital' appears relatively frequently in the top 10 list, but is mainly ranked as a mid-range variable. The other hospital variable 'travel time to a tertiary hospital' only appears for the 65+ age group (we might expect this to be higher again at 75+ years). Tertiary education appears to be important for the labour market entry-age group only, which is to be expected.

Conclusion

Although the determinants of net migration are highly complex, this research has produced models of net migration that explain close to 50 percent of the variation across 273 urban places. The models that have been developed show that the determinants of net migration are considerably influenced by age. Labour market entry and exit ages are primary factors that had a strong influence on net migration. Further analysis of these groups showed that labour market entry-age people are moving to the more populated places with access to tertiary education and different types of work, while the labour market exit-age group is moving to places with high natural lifestyle value - water views, mountains, and warm temperatures. The retirement-zone age group was also an influential group, and there appears to be a movement away from small farming towns to slightly larger towns, with access to international airports and warmer temperatures.

Although the drivers of net migration are reasonably well understood, much of this understanding has been based on traditional drivers of employment and essential services. This research has substantiated this evidence but also modelled the importance of lifestyle drivers, which are increasingly being recognised. Lifestyle choice, both nature based (mountains, climate and water views) and, possibly, cultural (access to large cities) are just as influential as employment drivers and access to essential services. This research, however, has not used indices that distinguish cultural lifestyle drivers from economic drivers, as both are based on access to large cities. It was therefore inconclusive whether cultural lifestyle is important, although anecdotal evidence would suggest it is.

In New Zealand there is general concern over the future of many towns that are consistently declining in population due to net migration loss. A policy suggestion for these towns has been 'managed decline' (McMillan 2016; Wood 2017); however this research indicates that towns close to airports and with natural amenity value are especially favoured by the labour market exit age group. With population ageing this group's size will increase and there will be increased movement of people to such towns. New Zealand has many towns with high natural amenity value that are close to the coast and/or among the mountains. Rather than having a 'managed decline' policy response to many towns in decline, this research has shown that a potential policy response is to make such towns more attractive to people nearing retirement, especially towns with regional airports and access to medical facilities. This research has also emphasised the importance of having quality empirical data and analysis when developing policy responses to net migration within New Zealand.

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1   New Zealand does not have a formal retirement age. These groupings reflect observed labour force movements by age, with male full-time employment at the 2013 Census dropping from 65 per cent at 60-64 years to just on 18 per cent at 65+ years, and for females, from 39 per cent to 7 per cent. In 2013, 11 per cent of males and 10 per cent of females aged 65+ years were also employed part-time; for males this was similar to levels at 60-64 years of age, while for females the level had halved (Statistics New Zealand 2015).

2   The Pearson product moment correlation coefficient 'r' measures the linear strength of the relationship between two variables, with +1 meaning that both variables increase and there is a perfect positive correlation, 0 meaning there is no linear relationship, and -1 meaning there is a perfect negative correlation (one variable increases while the other decreases).

References

Andrew, R & J Dymond (2013) 'Expansion of lifestyle blocks and urban areas onto high-class land: an update for planning and policy' *Journal of the Royal Society of New Zealand* 43(3), pp.128-140

Barreira, AP, S Ramalho, JJ Panagopoulos & MH Guimarães (2017) 'Factors driving the population growth and decline of Portuguese cities' *Growth and change* doi:10.1111/grow.12205

Brabyn, L (2009) 'Classifying landscape character' *Landscape Research* 34(3), pp.299-321

Brabyn, L & C Skelly (2002) 'Modeling population access to New Zealand public hospitals' *International Journal of Health Geographics* 1(3) DOI: 10.1186/1476-072X-1-3

Breiman, L (2001) 'Random forests' *Machine Learning* 45(1), pp.5-32

Brown, G & L Brabyn (2012) 'An analysis of the relationships between multiple values and physical landscapes at a regional scale using public participation GIS and landscape character classification' *Landscape and Urban Planning* 107(3), pp.317-331

Castles, S, de Haas H & M J Miller (2014) *The Age of Migration: International Population Movements in the Modern World* (5th ed.) London: Palgrave Macmillan

Chi, G & SJ Ventura (2011) 'An Integrated Framework of Population Change: Influential Factors, Spatial Dynamics, and Temporal Variation' *Growth and Change – A journal of Urban and Regional Policy* 42(4), pp.549-570

Gehlke, CE & K Biehl (1934) 'Certain effects of grouping upon the size of the correlation coefficient in census tract material' *Journal of the American Statistical Association* 29(185A), pp.169–170

Glaeser, E (2011) *Triumph of the city: how our greatest invention makes us richer, smarter, greener, healthier, and happier* New York: Penguin Press

Grimes, A & N Tarrant (2013) 'A New Zealand urban population database' *Motu Working Paper* 13-07 Wellington: Motu Economic and Public Policy Research

Grimes, A, E Apatov, L Lutchman & A Robinson (2016) 'Eighty years of urban development in New Zealand: impacts of economic and natural factors' *New Zealand Economic Papers* 50(3), pp.303-322

Jansen, M, M Judas, & J Saborowski (2002) *Spatial modelling in Forest Ecology and Management.* New York: Springer

Kerr, S, D Maré, W Power & J Timmins (2004) 'Internal mobility in New Zealand' *Treasury Working Paper 01/04* Wellington: Motu Economic and Public Policy Research Trust

Leathwick, J, F Morgan, G Wilson, D Rutledge, M McLeod & K Johnson (2002) 'Land environments of New Zealand: a technical guide' Ministry for the Environment, New Zealand

Lee, ES (1966) 'A theory of migration' *Demography* 3, pp.47-57

McGranahan, DA (2008) 'Landscape influence on recent rural migration in the U.S.' *Landscape and Urban Planning* 30, pp.228–224

McMillan, R (2016) 'The shrinkage pathway: managing regional depopulation', in P Spoonley (ed) *Rebooting the Regions: How low or zero growth needn't mean the end of prosperity* pp.213-237, Albany, NZ: Massey University Press

Morrison, PS & WAV Clark (2011) 'Internal migration and employment: Macro flows and micro motives' *Environment and Planning A* 43(8), 1948-1964

Newsome, P (1987) 'The vegetation cover of New Zealand' Wellington: Ministry of Works and Development

Poot, J (1986) 'A system approach to modelling the inter-urban exchange of workers in New Zealand' *Scottish Journal of Political Economy,* 33(3), pp.249-274

Robinson, WS (1950) 'Ecological correlations and the behavior of Individuals' *American Sociological Review* 15(3), pp.351-357

Rodriguez-Galiano, VF, B Ghimire, J Rogan, M Chica-Olmo & J P Rigol-Sanchez (2012) 'An assessment of the effectiveness of a random forest classifier for land-cover classification' *ISPRS Journal of Photogrammetry and Remote Sensing* 67(0), pp.93-104

Sloan, M & PS Morrison (2016) 'The post-move satisfaction of internal migrants' *Migration Studies* 4(1), pp.97-115

Statistics New Zealand (2015) 'Area of usual residence, work and labour force status for the census usual resident population count aged 15 years and over' Customised database

Statistics New Zealand (2017) 'Classification of Urban Area' www.stats. govt.nz/methods/classifications-and-standards/classification-related-stats-standards/urban-area.aspx

Swaffield, SR & RJ Foster (2000) 'Community perceptions of landscape values in the South Island high country: a literature review of current knowledge and evaluation of survey methods' Wellington, NZ: Department of Conservation

Vukomanovic, J & BJ Orr (2014) 'Landscape aesthetics and the scenic drivers of amenity migration in the New West: Naturalness, visual scale, and complexity' *Land* 3(2), pp.390-413

Wood, J (2017) 'Growing beyond growth. Rethinking the goals of regional development in New Zealand' *Maxim Institute Discussion Paper* Auckland, NZ: Maxim Institute

William Cochrane and Ian Pool

Māori in New Zealand's Contemporary Development

Introduction

By conventional economic indicators, such as GDP per capita and unemployment, New Zealand is among the better off of the OECD countries (OECD, 2015). This, however, is not true for all areas in the country. The other empirical articles in this issue focus on the disparities between towns and rural centres across New Zealand, especially those in decline.

This article takes a different approach, focusing on the contribution of Māori to national and sub-national population and development.[1] Its underlying postulate is that the Māori contribution to sub-national dynamics has been insufficiently valued. Instead, in past public discourse on ethnicity, Māori have too often been viewed as a fiscal burden and as benefit-dependent. This article will discuss two related issues. Using national level data sets and case-study regions, it will document the contribution that Māori have made to population replenishment and thereby New Zealand's economic development. At the same time, it also shows that this contribution has been achieved by overcoming contemporary inequalities that have their roots in colonisation.

It is fundamental to our article that until World War II, due to the loss of resources and sovereignty suffered by Māori in the 19th and early 20th centuries, Māori were disproportionately living either in low fertility, hilly regions of the North Island, or, if residing in lowland areas, were in communities that had limited resources; in the 1890s Māori were in a deep 'under-development trap' (Pool 2015). The land available to them, moreover, was so subject to multiple-ownership, a residual effect of the individualisation of titles in the 1865 Native Lands Act, that economic development was well-nigh impossible (Hunn 1961: 141ff; Ward 1997 v1: xxiv). Many whānau and hapū are still located in these underdeveloped areas within their rohe. Finally, the modern method of escaping underdevelopment traps, by gaining access to financial capital for investment, was, until recently, largely closed to Māori (Belich 2001: 60-62; Monin 2009: 142-43). The Waitangi settlements have seen capital compensatory sums disbursed to some iwi, allowing them to become corporate players of significance, with, for example, Ngāi Tahu holdings being rated among the top 100 companies in New Zealand (Deloitte 2016). It is beyond the scope of this article to investigate whether Waitangi settlements and reparations have had a major impact, particularly at a regional level, as the disbursements to runanga have been diffused often outside the rohe limits.

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After World War II, however, Māori initiated their own strategy to escape this trap. The 'New Māori migration', as Joan Metge called it (Metge 1964), saw Māori engage in a mass rural exodus, unparalleled anywhere at that time according to a University of California study (Pool 1991:133). In this migration, Māori were assisted by government interventions such as in skill-training, employment, housing and health, but the main driver came from within Māori society. This definitely increased Māori wellbeing, although while the gaps with Pākehā decreased they were never bridged fully (Pool 1991:152-59). A downside, what Ngapare Hopa has called 'the torn whāriki', saw the core tissues of whānau and hapū strained by this exodus (Hopa 1996). This was a more extreme version of the demographic, economic and social

The model has been elaborated particularly in the context of colonialism, notably in Africa (Cordell et al 1994). Far more critical for present purposes is that the framework has been operationalised and elaborated for New Zealand by Jackson (1998), specifically around ethnic stratification. By adopting and adapting this model, she also succeeds in bypassing the two blocks facing analyses of population and development: the fact that the 'demographic' models each deal with only one component of the population system (e.g. natural increase – the demographic transition model; mortality – the epidemiological transition), as well as the basic flaw in much economic development modelling that is monetised and thus oriented away from people.

A well aligned approach to population and development linkages, of direct import

happens for these three dimensions. Above all, we show how Māori have played a role in population and development dynamics, nationally and then in two case-study regions. The regions selected, Northland and Gisborne/Hawke's Bay, have been chosen because of the relatively high proportion of their population that identify as Māori, 30 and 28 percent respectively[2].

Data

Our data are drawn from official data statistics. We recognise that these data are subject to problems of interpretation, notably because of shifts in definition of 'who is a Māori'. Our analyses suggest that this has limited effects on two broad categories: Māori, including reporting Māori, and any other ethnicity and its residual, Non-Māori. We have used regions rather than iwi because reporting by iwi affiliation is incomplete (among those who record Māori descent), and the data are fraught with a range of definitional issues that affect the responses in the census and limit their utility for this article. We feel that, eventually, iwi-generated statistical series will answer many of these issues, but we have not used these, simply because most are not yet widely available for all iwi in the public domain and iwi are often still developing record-keeping protocols[3]. We mainly use census data, although some employment data come from Household Labour Force Surveys. A caveat is that because of small sample sizes in some regions, the latter have limitations.

> By 1991, the Māori birth cohorts of the 1960s and early 1970s, born when their fertility rates were still very high, had reached workforce ages, so their contribution increased to exceed their population share at all ages.

strains seen recently in sub-national non-metropolitan New Zealand, as shown by other articles in this issue. To add to this, many of the jobs Māori entered, such as in manufacturing and forestry, were those most affected by the economic restructuring of the 1980s and 1990s. This was associated with the growth of the Māori diaspora, especially in Australia. Finally, to house Māori in-migrants, and Pasifika whose island exodus paralleled the Māori rural exodus, large housing estates were built, often creating urban concentrations of the poor, predominantly Māori and Pasifika.

This article looks at the Māori contribution to both the factors of production and reproduction, using what is termed a 'total social production model'. This model is outlined in another more theoretical article in this issue (Pool *infra*).

for the present article, comes with the growing corpus of analyses on 'demographic dividends', which interlink broad age-structural changes with economic trends. Its main representation in New Zealand has been work by Jackson which shows that the age-structural transitions of Māori and Pasfika could produce a dividend of wider significance across the entire economy. A caveat to this, which Jackson stresses, is central to our paper: A dividend will be realised only if there is real investment in human capital: education and training, pro-active employment policies and institution building (Jackson 2016; see also Pool 2007).

We look here at the contribution of Māori to growth overall; to the quantum of the child population, which is the future engine of growth; and to labour and employment. Our sole aim is to show what

Historical context

Table 1 provides data on Māori as a percentage of the total population for some variables, and rates for Māori and Total for others. It starts the series in 1936, the first moderately reliable census for Māori, to cover when Māori were still overwhelmingly rural, and men were clustered in farming, including for subsistence (Pool 1991).

The Māori proportion of the total population grew steadily and this was true for their workforce until 1971; nevertheless, movement into larger urban areas was still below their total population contribution. But when reproduction is analysed, Māori contribute greatly to

replacement (births + survivorship of children, measured here by Child-Woman Ratio). This contribution is particularly marked in 1971, when, even though this was still in the Pākehā Baby Boom, and Māori reproductive levels were starting to decline, Māori contributed disproportionately to the child population

By 1991, the Māori birth cohorts of the 1960s and early 1970s, born when their fertility rates were still very high, had reached workforce ages, so their contribution increased to exceed their population share at all ages. This is the base for a 'collateral demographic dividend', as Jackson (2016) has called it. But, as she notes, this is merely 'potential', dependent on improved access of Māori to education, skill training and pro-active labour market policies. That these have not been implemented is evident in the employment data presented here. The economic restructuring of the late 1980s had a major impact, particularly on Māori men. In 1971 both Māori men and women had been closing the employment gap with Pākehā; by 1991 they had widened again dramatically (see following section on the working age population and employment). Accompanying the closing of the employment gap, between 1956 and 1981 Māori incomes converged towards Non-Māori, but started to diverge 1981-86, and this accelerated 1986-91 (Martin 1998: Tables 6.5, 9.4)

Māori and regional population size and growth
Eleven percent of all New Zealanders identified as Māori in 1981, but by 2013 this had risen to 15 percent. Thus, in simple numerical terms, this period saw Māori increase their contribution to the total population of New Zealand. This proportionate increase also had an impact on regional population numbers. Table 2 shows the change in the proportion of people identifying as Māori for both the regions being used as examples, Northland and Gisborne/Hawke's Bay, and nationally over the period 1971-2013. It can be seen that the Māori share in the population rises markedly 1976-1996 before stabilizing post-1996 with both the example regions having Māori shares in the population around twice the national figure.

Table 1 Historical context

Census	1936	1951	1971	1991
Demographic				
Total Population size (% of total)??	5	6	8	10
Living in larger Urban area (%)	[0.6]	[1.5]	6	n/d
Reproduction				
Percent of Children 0-4	11	9*	13*	23
Workforce				
Percent of persons 15-64	4	5	7	13
Employment				
Percent of all persons 15 and over actively engaged				
Male	2	5	6	10
Female	2	4	6	10

b) Rates				
*Child-Woman Ratios = ([Children 0-4/Women 15-44] * 100)*				
Census:	1936	1951	1971	1991
Māori	87	90	79	56
Total Population	36	58*	52*	31

*Employment rate = ([Actively Engaged/Population 15-64] * 100)*

	1936		1951		1971		1991	
	M	F	M	F	M	F	M	F
Māori	58	14	85	24	89	36	69	49
Total Population	88	27	98	34	91	39	93	61

* Period of Pākehā Baby Boom, when Pākehā childbearing rose, while Māori rates remained constantly high although declining a little by 1971

Table 2   Proportion Māori by year*

	Year				
Area	1976	1996	2001	2006	2013
Northland	20.2	33.0	32.6	31.4	33.5
Gisborne/Hawke's Bay	17.9	29.1	29.6	29.2	30.5
New Zealand Total	11.4	15.4	15.1	14.9	15.6

Source: New Zealand Census, 1976-2013

The child population
Māori family sizes are larger than Pākehā, but the difference has decreased dramatically over recent years. Most notably, Māori went through a rapid fertility decline in the 1970s.

The important statistic is how Māori contribute to the child population, the engine of growth for a region as they survive to working age. Today, almost all children, Māori or Pākehā, will survive to middle-age.

Two common measures of the Māori contribution to the vitality of a region are the ratio of children to women at child bearing age and the percentage contribution of Māori to the total population aged 0-4 years. These measures are defined in the Appendix to this article.

Table 3 shows the child-woman ratio for our selected regions, and total New Zealand. Māori child to woman ratios across the 1976-2013 period are consistently higher than those of the total population, indicating that they are making an above average contribution to population growth (as evidenced by the rising Māori population share). Except for the final inter-censal period (2006-2013) the ratio declines over time for the areas considered, consistent with the slowing of Māori population growth, and that of New Zealand as a whole. The earlier patterns are consistent with cross-national

Table 3   Child-Women ratio by ethnicity 1976-2013

Year	1976	1996	2001	2006	2013
Māori					
Northland	72.6	58.4	54.1	50.0	60.4
Gisborne/Hawke's Bay	69.9	55.2	53.6	50.2	55.3
New Zealand Total	68.3	54.8	53.0	49.0	54.4
Total					
Northland	51.0	42.1	38.6	37.7	44.1
Gisborne/Hawke's Bay	51.8	39.9	38.7	37.2	41.6
New Zealand Total	52.0	34.4	32.7	31.3	34.5

Source: New Zealand Census, 1976-2013

Table 4   Contribution (%) of Māori to population aged 0-4 years

Year	1976	1996	2001	2006	2013
Northland	27.6	50.6	52.5	49.2	55.2
Gisborne/Hawke's Bay	20.6	45.0	64.5	63.2	66.8
New Zealand Total	13.5	26.3	26.5	25.5	26.9

Source: New Zealand Census, 1976-2013

trends summarised in another article in this issue (Pool *infra*). The result for the most recent census is inconsistent with past trends, and requires further examination for it is national as well as regional. Is it a function of higher fertility, which seems unlikely for that date as Māori Total Fertility rates had declined 2008-14, or an artefact of a shift in registration, whereby parents declare Māori as the birth's ethnicity, or a disjunction between ethnicity as reported for numerators (vital data-based) and denominators (census-based)? A further possibility, passive migration, could be an explanation for Northland, as its child-woman ratio increases more sharply than does that for New Zealand as a whole.

The contribution of the Māori population to the reproduction of the total population is clearly seen in Table 4, which shows the share of the Māori population 0-4 years in each region's total population aged 0-4 years. At the end of the period considered (2013) the Māori share is 2-3 times larger than in 1976, indicating the increasing role Māori play in the reproduction of these region's populations, especially Gisborne/Hawke's Bay. By contrast, the Māori share nationwide barely changes at all from 1996 to 2013. Nevertheless, Māori contribute disproportionately to the

nation's stock of child-capital, but it is problematic that this contribution is heavily concentrated in marginal regions

This point about 'contribution' needs underlining. The child-capital of a country is really its future, as they become the young workers of tomorrow, provided, and this is an important proviso, that they are well educated/trained and employed. Many commentators argue that, as taxpayers, they should not be responsible for the children of others. However, when they themselves are old, even the wealthiest, or the most prudent savers, they will still need younger people to care for them, physically and in other ways – in New Zealand they will particularly rely on them to fund health care, superannuation, and the welfare state in general.

The working age population and employment
Labour markets have two dimensions: how many people are at working age, and the employment patterns of those people. However, their significance goes far beyond production and jobs. There are, however, major issues such as the changing industry structure of regions or the impact of technological change and the demand for skills that we do not discuss here. Those at the working ages are also the lead consumers in their households. Furthermore, they are

instrumental in the reproduction of the whanau, as they typically also provide the intra-family support for other family members, especially the children and the elderly. Finally, they are the parents or potential parents of the next generation. So, their roles and functions are not just in terms of the 'factors of production', but also for the 'factors of reproduction'.

Two measures are considered here: the proportion of the working age population who identify as Māori, an indicator of the contribution of Māori to the potentially economically active population; and the employment rate which is the percentage of the population of working age in employment (see Appendix).

The choice of the employment rate, as opposed to the more commonly-used unemployment or labour force participation rates (as used in Table 1) requires justification. Both the unemployment rate and the labour force participation rates exclude various forms of discouraged or unavailable workers (Statistics New Zealand 2017) due to the restrictive definition of unemployment used in official statistics. Consequently, as a measure of labour market conditions, the meaning of the unemployment rate, and hence of participation rates, is ambiguous (Murphy & Topel 1997), as it reflects the number of people looking for employment rather than the extent to which the working age population is utilized in the labour market. This has perverse results, for when labour market conditions are poor many workers abandon job search and hence are not classed as unemployed, depressing the unemployment rate. Conversely when labour market conditions improve these workers may resume job search, exerting upward pressure on the unemployment rate. Due to these properties, the employment rate is preferred by many (and used here) as its meaning is clear cut; it is the proportion of the potentially employed population who actually have jobs – an unambiguous measure of labour utilisation.

From Figure 1 it can be seen that the proportion of Māori in the working age population nationally has increased over the 1986-2013 period, albeit at a decelerating rate, from about 10 percent

in 1986 to 13 percent in 2013, that is, in line with the growth in the proportion of the population identifying as Māori. For our two exemplar regions the growth is more dramatic, with the proportion of Māori in the total working age population in both regions increasing from around 18 percent in 1986 to close to 30 percent in 2013.

The evolution of the national level employment rates shown in Figure 2 can be loosely divided into three periods. The first of these (labelled 'Restructuring' in the Figures) commences in the mid-1980s and reflects the impact of the economic restructuring of the 1980s and early 1990s. Māori employment rates at the beginning of our time series are over 60 percent, albeit 5 percentage points lower than for non-Māori, but decline dramatically to a low of 44 percent in 1991-1992. This should be contrasted with the decline in non-Māori employment rates from 65 to 58 percent, around half that experienced by Māori.

After 1991-92 (labelled 'Recovery' in the Figures) the employment rates of both non-Māori and Māori begin to recover. Nevertheless, it takes until the mid-2000s for the employment rate, for both non-Māori and Māori, to rise to pre-restructuring levels. The increase in employment rates continues until around the time of the global financial crisis (labelled 'Financial Crisis' in the Figures) when this trend again reverses and rates begin to decline.

For Māori nationally, the decline in employment rate following the global financial crisis was considerably larger than for non-Māori, with the Māori employment rate falling from nearly 64 percent in the final quarter of 2007 to 57 percent in the final quarter of 2009 – a difference of seven percentage points. In comparison to the decline in employment rate experienced by Māori during restructuring (16 percentage points), the decline associated with the global financial crisis was around half that size.

The non-Māori employment rate on the other hand fell from a peak of 67 percent in the last quarter of 2007, immediately prior to the global financial crisis, to a low of 64 percent in the final quarter of 2009. Again, this was about half

Figure 1: Māori share (%) of total working age population
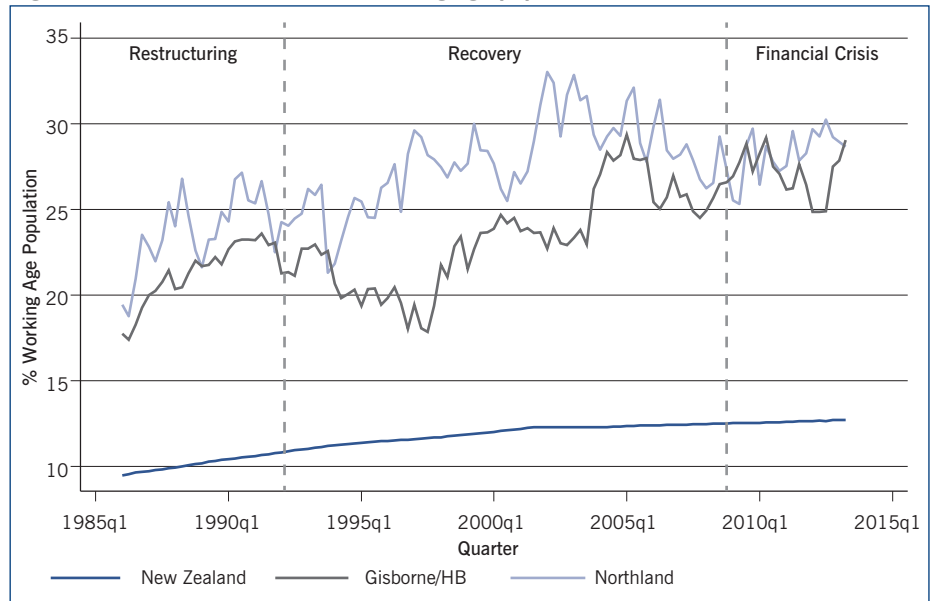
Source: Household Labour Force Survey 1986-2013

Figure 2: Employment rates for New Zealand 1986-2013 by ethnicity (Māori /Non-Māori)
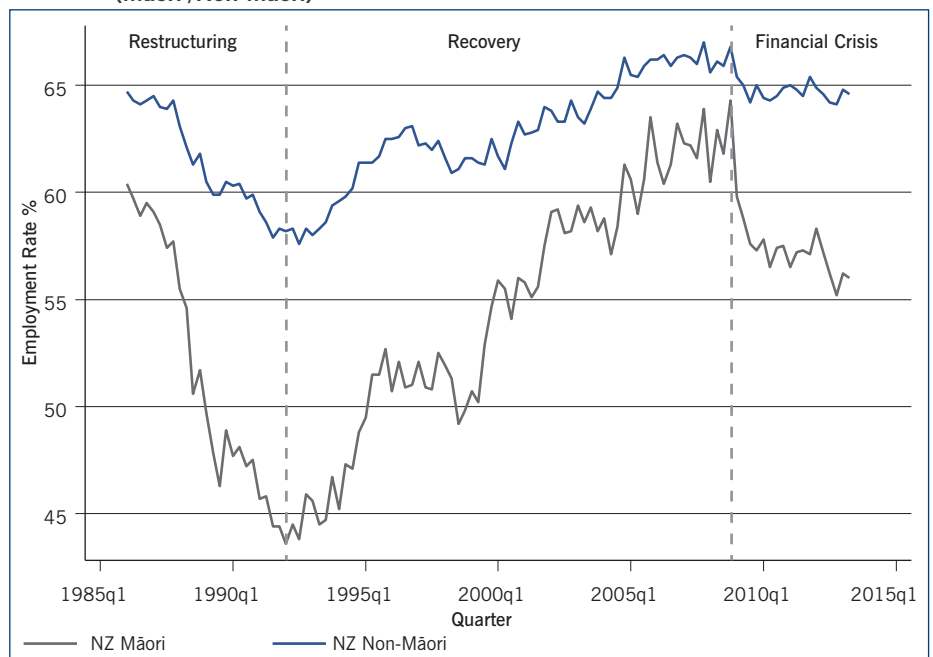
Source: Household Labour Force Survey 1986-2013

the size of the employment shock experienced during the period of economic restructuring.

Turning to the first of our examples, Northland, the trajectory followed by the employment rate is similar in profile to that of the national employment rate for Māori. That said, however, Northland Māori employment rates (50 percent) at the beginning of our time series are markedly lower than that of the national series (60 percent) for Māori. The size of the disparity between Northland and national employment rates varies over

time, coming close to zero in the period of low unemployment in the mid-2000s, but rapidly widens post the global financial crisis, the employment rate falling from a pre-crisis high of 64 percent in the final quarter of 2007 to a low of 49 percent in the last quarter of 2009.

The impact of the restructuring period is clearly apparent from Figure 3 with the Māori employment rate falling precipitously from 54 percent at the beginning of 1986 to 35 percent in the September quarter of 1988. Not only is this downturn in employment sharp, but

**Figure 3: Employment rate for Northland 1986-2013 by ethnicity
(Total NZ Māori /Total NZ Non-Māori)**
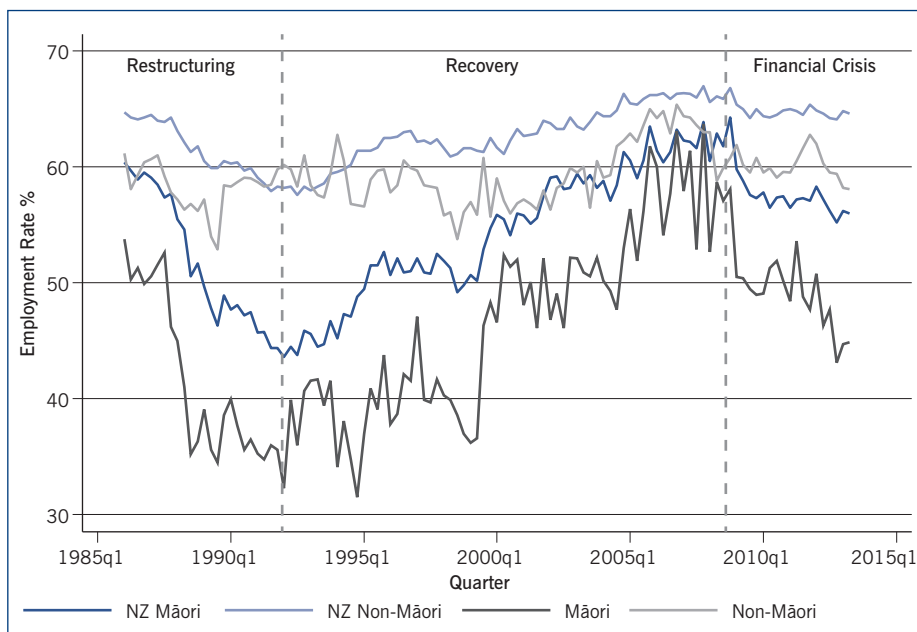
Source: Household Labour Force Survey 1986-2013

**Figure 4: Employment rate for Gisborne/Hawkes Bay 1986-2013 by ethnicity
(Total NZ Māori /Total NZ Non-Māori)**
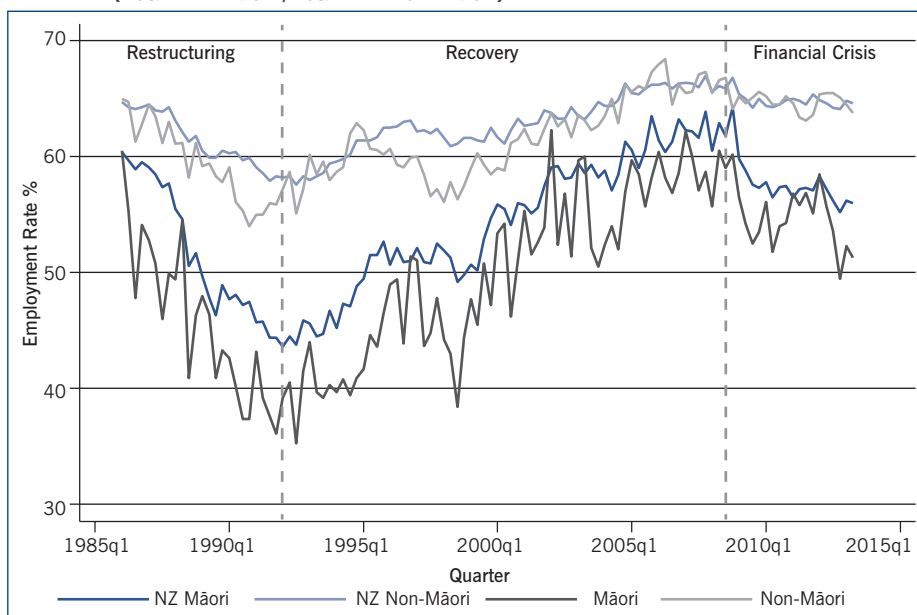
Source: Household Labour Force Survey 1986-2013

it is sustained, with the average Māori employment rate in the period June 1988 to June 1999 being only 38 percent. In fact, the 1986 rates of employment for Māori were not attained again until the early to mid-2000s.

The severity of the downturn in Northland Māori employment rates can be seen as an exacerbation of the general effects of economic and administrative restructuring by the concentration of Māori employment in sectors that were particularly hard hit, notably meat processing and forestry (Darroch 2010).

By contrast, the employment rates for non-Māori in these regions, while somewhat lower than the non-Māori national figures (60 percent versus 65 percent), respond less dramatically to the restructuring period. They reach a low of 53 percent in the September quarter of 1989 before recovering most of the decline by the middle of the 1990s. That said, the employment rates of non-Māori do not recover fully until the late 1990s/early 2000s.

As for Northland, the Māori employment rate for Gisborne/Hawke's

Bay follows a similar profile to the national rate, although somewhat below it in terms of level for much of the 1986-2013 period. The pattern is one of a strong initial decline, from a Māori employment rate of around 60 percent at the beginning of 1986 to a low of 35 percent in the September quarter of 1992, followed by period of rising employment rates that see rates around 60 percent being reached again in the early to mid-2000s.

The trajectory of the employment rate for Gisborne/Hawke's Bay in the restructuring period was heavily influenced by the closure of two large meat processing plants, Whaketu and Tomona, as well as by other economic and administrative changes. This in particular affected Māori, with 27 percent of all Māori men aged 15-59 years in the meat processing plants' commuting zone becoming unemployed as a result of plant closures[4]. From a demographic perspective, the situation was particularly dire, with 60 percent of all Māori at the works being at peak reproductive age; among Māori males aged 20-29 years in the commuting zone 62 percent were employed in meat processing (Keefe et al 2002). This pattern is similar to that observed for Northland; the concentration of Māori employment in the sectors most affected by restructuring led to a prolonged period of low employment rates and a slow return to pre-restructuring employment rate levels.

The rising trend observed in the period from 1994 to the mid-2000s again reverses with the onset of the global financial crisis, falling from a pre-crisis level of close to 60 percent, to 50 percent in the last quarter of 2012. On the other hand, the trajectory of the employment rate of Non-Māori in the Gisborne/ Hawke's Bay Region closely tracks the national rate, though on average the level of the rate is one percentage point or so lower.

Conclusion

The historical data briefly summarised here carry two positive messages. First, until the 1970s, Māori and Pākehā trends were converging in both demographic and economic terms. Second, Māori were making a major contribution to the

nation's stock of children, essential for the country's future growth and potential workforce. The aim of government policy at the time was to facilitate the movement of hitherto under-employed Maori from isolated rural areas to 'economic' zones where there were jobs. As the data in Table 1 show this was largely successful until economic restructuring was undertaken in the late 1980s/early 1990s to satisfy objectives that were rational for financial capital needs, but without apparent concern about the human capital costs. Potentially, as Jackson (2016) argues,

New Zealand could have a collateral demographic dividend driven mainly by Māori (and Pasifika). But our data show that other gaps, dating from the restructuring, have re-emerged. This is not just a factor that affects Māori, but a failure to resolve it affects all the society and economy, both on the demand side (benefits) and the supply (depriving New Zealand of a young adult workforce). There is thus a 'double-burden' here: Māori, and particularly the North Island's marginal regions (as exemplified by our two case-studies), with poor employment

prospects also disproportionately bear responsibility for the nation's child capital that, eventually, could bring the country a demographic dividend. An unrequited dividend is, of course, the raw material of severe fiscal and familial burden.

1   This article draws on examples of case-studies covering all New Zealand regions and the iwi rohe within them: Cochrane and Pool (2017a-m).
2   2013 Census, Statistics NZ.
3   This is a rapidly emerging area in which Māori are playing a key role: see Tahu Kukutai and John Taylor (eds) Indigenous Data Sovereignty, Canberra, ANU Press 2016.
4   More detailed accounts of this maybe found in Calder and Tyson (1999), though this is mainly focused on management and enterprise level issues, Grimes and Young (2011), Keefe et al (2002) and Spoonley et al (1993).

References

Belich, J (2001) *Paradise Reforged: A History of the New Zealanders from the 1880s to the Year 2000,* Auckland: Allen Lane Penguin

Calder, M & J Tyson (1999) *Meat Acts: The NZ Meat Industry 1972-97,* Wellington: Meat NZ.

Cochrane, W & I Pool (2017a) *The contribution of Maori to New Zealand's development since 1981: findings for Iwi Runanga in the Northland region,* Marsden Fund Programme 'Tai timu Tangata –taihoa e? The subnational mechanisms of the ending of population growth. Towards a theory of depopulation', National Institute of Demographic and Economic Analysis, University of Waikato, Hamilton

Cochrane, W & I Pool (2017b) *The contribution of Maori to New Zealand's development since 1981: findings for Iwi Runanga in the Auckland region,* Marsden Fund Programme 'Tai timu Tangata –taihoa e? The subnational mechanisms of the ending of population growth. Towards a theory of depopulation', National Institute of Demographic and Economic Analysis, University of Waikato, Hamilton

Cochrane, W & I Pool (2017c) *The contribution of Maori to New Zealand's development since 1981: findings for Iwi Runanga in the Waikato region,* Marsden Fund Programme 'Tai timu Tangata –taihoa e? The subnational mechanisms of the ending of population growth. Towards a theory of depopulation', National Institute of Demographic and Economic Analysis, University of Waikato, Hamilton

Cochrane, W & I Pool (2017d) *The contribution of Maori to New Zealand's development since 1981: findings for Iwi Runanga in the Bay of Plenty region,* Marsden Fund Programme 'Tai timu Tangata –taihoa e? The subnational mechanisms of the ending of population growth. Towards a theory of depopulation', National Institute of Demographic and Economic Analysis, University of Waikato, Hamilton

Cochrane, W & I Pool (2017e) *The contribution of Maori to New Zealand's development since 1981: findings for Iwi Runanga in the Gisborne/Hawke's Bay regions,* Marsden Fund Programme 'Tai timu Tangata –taihoa e? The subnational mechanisms of the ending of population growth. Towards a theory of depopulation', National Institute of Demographic and Economic Analysis, University of Waikato, Hamilton.

Cochrane, W & I Pool (2017f) *The contribution of Maori to New Zealand's development since 1981: findings for Iwi Runanga in the Taranaki region,* Marsden Fund Programme 'Tai timu Tangata –taihoa e? The subnational mechanisms of the ending of population growth. Towards a theory of depopulation', National Institute of Demographic and Economic Analysis, University of Waikato, Hamilton.

Cochrane, W & I Pool (2017g) *The contribution of Maori to New Zealand's development since 1981: findings for Iwi Runanga in the Manawatu/Wanganui regions,* Marsden Fund Programme 'Tai timu Tangata – taihoa e? The subnational mechanisms of the ending of population growth. Towards a theory of depopulation', National Institute of Demographic and Economic Analysis, University of Waikato, Hamilton

Cochrane, W & I Pool (2017i) *The contribution of Maori to New Zealand's development since 1981: findings for Iwi Runanga in the Wellington region,* Marsden Fund Programme 'Tai timu Tangata –taihoa e? The subnational mechanisms of the ending of population growth. Towards a theory of depopulation', National Institute of Demographic and Economic Analysis, University of Waikato, Hamilton.

Cochrane, W & I Pool (2017j) *The contribution of Maori to New Zealand's development since 1981: findings for Iwi Runanga in the Tasman/Nelson/Marlborough/West Coast regions,* Marsden Fund Programme 'Tai timu Tangata –taihoa e? The subnational mechanisms of the ending of population growth. Towards a theory of depopulation', National Institute of Demographic and Economic Analysis, University of Waikato, Hamilton

Cochrane, W & I Pool (2017k) *The contribution of Maori to New Zealand's development since 1981: findings for Iwi Runanga in the Canterbury region,* Marsden Fund Programme 'Tai timu Tangata –taihoa e? The subnational mechanisms of the ending of population growth. Towards a theory of depopulation', National Institute of Demographic and Economic Analysis, University of Waikato, Hamilton

Cochrane, W & I Pool (2017l) *The contribution of Maori to New Zealand's development since 1981: findings for Iwi Runanga in the Otago region,* Marsden Fund Programme 'Tai timu Tangata –taihoa e? The subnational mechanisms of the ending of population growth. Towards a theory of depopulation', National Institute of Demographic and Economic Analysis, University of Waikato, Hamilton

Cochrane, W & I Pool (2017m) *The contribution of Maori to New Zealand's development since 1981: findings for Iwi Runanga in the Southland region,* Marsden Fund Programme 'Tai timu Tangata –taihoa e? The subnational mechanisms of the ending of population growth. Towards a theory of depopulation', National Institute of Demographic and Economic Analysis, University of Waikato, Hamilton

Darroch Limited (2010) *Sub-Regional housing demand in the Northland Region,* Wellington: Centre for Housing Research, Aotearoa New Zealand

Deloitte (2016) *Top 200 Awards 2016,* Retrieved from https://top200. co.nz/wp-content/uploads/Top-200-Awards-2016-Top-200-rankings.pdf

Grimes, A & C Young (2011) 'Spatial effects of 'mill' closures: Does distance matter?' *Australasian Journal of Regional Studies* 17(3), pp.264

Hopa, N (1996) 'The torn whāriki'', in A Smith & N Taylor (eds) *Supporting children and parents through family change,* Dunedin: University of Otago Press, pp.53-60

Hunn, J (1961) *Report on the Department of Maori Affairs*, Wellington: Govt Printer

Jackson, NO (1998) *Ethnic stratification in New Zealand: A 'total social production' perspective'* PhD Thesis, Canberra: Australian National University

Jackson, NO (2016) 'The Potential Collateral Demographic Dividend', in R Pace & R Ham Chande (eds) *Demographic Dividends: Emerging Challenges and Policy Implications*, pp.117-34, Cham, Switzerland: Springer

Keefe, V, P Reid, C Ormsby, B Robson, G Purdie, J Baxter & Ngati Kahungunu Iwi Inc (2002) 'Serious health events following involuntary job loss in NZ meat processing works', *International Journal of Epidemiology (Health Module)* December 31(6) pp.1155-1161

Martin, B (1998) *Incomes of individuals and families in New Zealand, 1951 to 1996*, Hamilton, NZ: University of Waikato

Metge, (A)J (1964) *A New Maori Migration: Rural and Urban Relations in Northern New Zealand,* London: Athlone & Melbourne University Presses

Monin, P (2009) 'Maori economies and colonial capitalism', in Byrnes, G (ed) *The New Oxford History of New Zealand,* pp 123-146, Melbourne: Oxford University Press

Murphy, KM & R Topel (1997) 'Unemployment and non-employment', *The American Economic Review* 87(2), pp.295-300

OECD (2015) *OECD Economic Surveys New Zealand* OECD (retrieved from https://www.oecd.org/eco/surveys/New-Zealand-2015-overview. pdf)

Pool, I (2015) *Colonization and Development, New Zealand, 1769-1900: The Seeds of Rangiatea*, Cham, Switzerland: Springer

Pool, I (2007) 'Demographic dividends. Determinants of development or merely windows of opportunity?' Oxford Institute of Ageing, *Ageing Horizons* 7, pp.28-35

Pool, I (2017) 'New Zealand's Population and Development Path: Unravelling the 'when', 'how' and 'why'' *Policy Quarterly* Supplementary Issue, pp.10-21

Pool, I (1991) *Te Iwi Maori: population, past, present & projected* Auckland: Auckland University Press

Pool, I, S Baxendine, W Cochrane & J Lindop (2006) *New Zealand Regions, 1986-2001: Labour Market Aspects of Human Capital,* Hamilton, NZ: University of Waikato

Spoonley, P, C Teariki, J Newell & Taiwhenua o Heretaunga (1993) *Mahi Awatea,* Palmerston North, NZ: Massey University Department of Sociology and Taiwhenua o Heretaunga

Statistics New Zealand (2017) Labour force categories used in the Household Labour Force Survey, (retrieved March 14, 2017 from http://www.stats.govt.nz/browse_for_stats/income-and-work/ employment_and_unemployment/Labour-force-categories-in-HLFS. aspx).

Ward, A (1997) *National Overview* 3 Vols, Wellington: Waitangi Tribunal, Rangahaua Whanui Series

Appendix – Definitions of measures used

Māori Contribution

$$M\bar{a}ori\ Contribution = \frac{100 \times M\bar{a}ori\ Population\ Aged\ 0\text{-}4\ years}{Total\ Population\ Aged\ 0\text{-}4\ Years}$$

Māori as a Percentage of the Working Age Population

$$\%\ Working\ Age\ Population: M\bar{a}ori = \frac{100 \times M\bar{a}ori\ Working\ Age\ Population\ Total}{Working\ Age\ Population}$$

Where the working age population is the usually resident population aged 15 years and over. It should be noted that the New Zealand practice of defining the working age population in these terms differs from many countries where the working age population is defined as those aged 15 to 64 years (Statistics New Zealand, 2017).

Māori as a Percentage of the Working Age Population

$$Employment\ Rate\ (\%) = \frac{100 \times Total\ Employment}{Working\ Age\ Population}$$

Where the working age population is defined as above and total employment is the total number of people who work for at least an hour per week for pay.

Michael P. Cameron

The relative (un)certainty
of subnational population decline

Introduction

"*Prediction is very difficult, especially about the future.*" This quote is attributed to Danish physicist and Nobel prize winner Niels Bohr, but the difficulty of making predictions does not stop us from making forecasts of economic, demographic, and other variables. Investors, businesses, policy makers and others use these forecasts to inform their decisions about investments and policy settings where understanding of the future trajectory and levels of costs and benefits are essential. One key example is forecasts of future population. The size and distribution (whether geographic, age, ethnic, or some other distribution) of the future population is a critical input into urban and other planning. Understanding the methods and limitations of forecasts is an important but often under-appreciated task for planners and policymakers.

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In this article, I draw on more than a decade of experience in developing population projections for local councils and others, as well as the latest in population projection methods, to provide an answer to the question: "Is population decline inevitable for New Zealand's rural and peripheral areas?" A recent term, coined by economist Shamubeel Eaqub (2014), 'zombie towns', refers to population centres facing irreversible population decline. However, such a categorical statement ('irreversible population decline'), does not reflect the uncertainty of population projections, or indeed the uncertainty of the future population distribution of New Zealand. Moreover, as I show in this article, it does not reflect the projected experience of the majority of territorial authorities (TAs) (or indeed, towns) in New Zealand, even many in rural or peripheral areas. While many areas are currently in decline, and these and others will decline in the future, such population decline is not certain except in a minority of cases that is large and growing.

In this article, I first outline some of the key points that decision-makers need to understand about population projections, focusing especially on the

role and sources of uncertainty. I then briefly outline a recently developed state-of-the-art stochastic subnational population projection model (Cameron & Poot 2014a, 2016). Finally, I use the model to evaluate the probability of New Zealand's TAs experiencing population decline over the periods 2013–2023, 2033–2043 and 2053–2063. This exercise complements the analysis at the town level by Jackson and Brabyn (*infra*), and clearly charts the progression from subnational population growth to decline, particularly for rural and peripheral areas.

What everyone should know about population projections

The first thing that decision-makers should understand about population projections is the difference between a

(model uncertainty), the parameters or assumptions that drive the model (parameter uncertainty), and natural variation in the input variables for the model (parametric variability) (Kennedy & O'Hagan 2001).

Acknowledging that population projections are uncertain is challenging for decision-makers. It is attractive to believe, when looking at a single line on a graph tracking a given population projection or a single row of a table, that the numbers represent the 'one true future', because this makes decision-making much simpler. Several times I have encountered decision-makers who, despite understanding that projections are uncertain, are more than willing to ignore that uncertainty for the simplicity of a single 'magic number' population projection.

was the approach adopted by Statistics New Zealand at both the national and subnational levels. Several problems arise with this approach, not least of which is that it makes little use of the known distribution of each parameter (fertility, mortality, and migration). To improve on this, over the last two decades or more demographers have increasingly begun to use stochastic (or probabilistic) population projection models (Tuljapurkar 1992; Bryant 2005; Bijak et al., 2015). These models draw repeatedly from the parameter distributions, creating hundreds or thousands of population projection scenarios. This allows a better understanding of the range of future population to be explicitly quantified. This approach was first piloted for New Zealand national projections by Wilson (2005) before being adopted by Statistics New Zealand (Dunstan 2011). At the subnational level, the method was first employed by Cameron & Poot (2010, 2011), and has since been applied several times (Cameron et al., 2014; Jackson et al., 2014).

> It is attractive to believe, when looking at a single line on a graph tracking a given population projection or a single row of a table, that the numbers represent the 'one true future', because this makes decision-making much simpler.

'forecast' and a 'projection'. A population forecast is a 'best' estimate of the future population (and its distribution) at some future time. In contrast, a population projection is a measure of the future population that is based on a specific model with known and quantified assumptions that are incorporated into the model. A population projection is therefore not necessarily the same as a forecast, since alternative scenarios based on different sets of assumptions will naturally lead to different projections. A range of different sets of assumptions will lead to a range of different projections of the future population.

The second thing that decision-makers should understand is uncertainty. Population projections are uncertain. Uncertainty arises from several sources, including the correctness of the model

The third thing that decision-makers should understand is that the degree of uncertainty in projections is not constant. It is greater the further into the future we project (for example, see Figure 1 below), as we can be more certain (or less uncertain) about the state of the world in the near future than we can about the far future. Uncertainty is also greater for smaller areas (for example, territorial authorities) than for larger areas (for example, regions) (Cameron & Poot 2011).

Fortunately, methods are available that explicitly quantify the degree of uncertainty in population projections. A relatively crude way of quantifying uncertainty is to create a small number of different population projection scenarios (for example, high, medium, and low scenarios). Until relatively recently, this

A subnational stochastic population projection model

The workhorse of population projections methods is the cohort component model (CCM), which I employ at the TA-level (excluding the Chatham Islands). The CCM is simple, intuitive, and elegant. Population is assumed to change through only three components: (1) births; (2) deaths; and (3) migration. To project the population requires only projections of parameters for fertility (for example, age-specific fertility rates), mortality (for example, age-specific mortality or survivorship rates), and migration.

The model I employ is similar to that of Statistics New Zealand, but also different in significant and important ways (Cameron & Poot 2010, 2011, 2014a, 2016). The model uses the same subnational fertility and mortality assumptions as Statistics New Zealand, with a distribution around the median assumption based on past observations of fertility and mortality. The methods used to derive projections of fertility and mortality are fairly similar in most applications, and the degree of uncertainty

is relatively low, so there is little added value in using our own projections.

In contrast, the projection of parameters that capture migration is not only the least certain, but also involves the greatest variation in methods. Statistics New Zealand's subnational population projections incorporate a projection of net migration as a single absolute number for each TA (which sum to net migration for New Zealand as a whole), which is then disaggregated by age and sex. In contrast, the model employed in this article improves on that method in two ways (the methods will be explained in greater detail in a forthcoming working paper). First, migration is disaggregated into international migration (emigration and immigration) and internal migration, which are each modelled separately. Emigration and immigration are each modelled as a single absolute number, similar to Statistics New Zealand (but for international migration in each direction separately, rather than net migration), and then allocated to TAs using a simple model based on population shares, which are then disaggregated by age-sex-specific migration profiles.

Second, internal migration is modelled using a gravity model. Gravity models are excellent tools for modelling directional migration flows and are widely used in trade as well as migration (Poot et al., 2016). The model explicitly recognises that the migration flow between two areas will depend on the population size of the two areas (larger populations in the origin or destination will lead to larger migration flows) and the distance between them (greater distances will lead to smaller migration flows). Gravity models of internal migration flows in New Zealand have recently been developed (Cameron & Poot 2014b; Poot et al., 2016).

The advantages of the model used here is that it allows us to derive population projections based on a full range of directional migration flows (to and from a given area, both internationally and internally within New Zealand). While this makes the model more complex, it also makes the model more believable for end-users since questions of where migrants are

Figure 1: The relative (un)certainty of subnational population decline
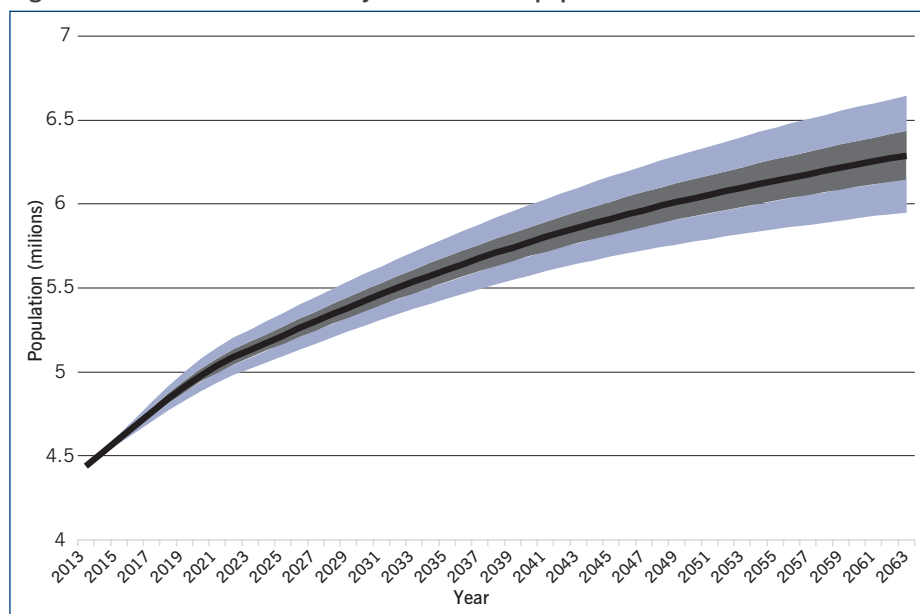
Source: Author's projections

coming from (or going to) can be readily answered (Poot et al., 2016).

The subnational stochastic population projections model was run 1000 times, each time drawing new fertility, mortality, and migration parameters from their distributions. This number of projection runs is sufficient to establish the distribution of projected populations. The results presented below are based on these model runs, and are expressed probabilistically (i.e. as a probability that a given area will experience population decline over a given decade). These results can be evaluated in a vast number of ways. For simplicity, I look only at two 10-year periods: (1) 2023-2033; and (2) 2043-2053. I ignore the first decade of projections for two reasons. First, the degree of uncertainty is fairly low in the initial period, relative to later periods. Second, the initial period includes the current and historically high net migration that New Zealand is experiencing (and which has been included in the modelling assumptions), meaning that few areas are projected to experience population decline in the 2013–2023 decade. However, the current high net international migration is unlikely to continue indefinitely, so after 2023 the projected net international migration is assumed to fall back to levels seen historically. For each of the two decades, I compute the proportion of scenarios for each TA where

population declines over the ten-year period.

Results

Figure 1 provides an illustration of a stochastic (probabilistic) population projection, for New Zealand as a whole. This projection was constructed bottom-up by summing the individual TA-level projections. The solid black line at the centre represents the median projection – this is the point where fifty percent of observed projections are above, and fifty percent of observed projection are below, for each point in time. It is important to note that the median projection does not represent a single projection scenario – it is constructed from all 1000 scenarios. The narrow dark grey band around the median projection is the 50 percent projection interval – 50 percent of the observations in each period fall within this band (and 50 percent outside of that band). The wider (and lighter-coloured) band around the 50 percent projection interval is the 90 percent projection interval – 90 percent of the observations in each period fall within this band, with 5 percent of observations above the top of this band, and 5 percent of observations below the bottom of this band.

Several points should be noted about the national projection in Figure 1. First, the historic period of high international immigration that New Zealand is experiencing is reflected in the high initial

Table 1: TAs facing probable population decline, 2023-2033 and 2043-2053

Probability of population decline	Year	
	2023–2033	2043–2053
5-50%	Central Otago Mackenzie South Wairarapa Southland Thames-Coromandel	Hastings (+) Marlborough (+) Opotiki (-) Rotorua (--) Waimate (+) Waitaki (+)
50-90%	Clutha Gisborne Masterton Opotiki South Taranaki Stratford	Central Otago (+) Hurunui (++) Mackenzie (+) South Waikato (-) South Wairarapa (+) Tasman (++) Wellington (++)
90+%	Central Hawke's Bay Gore Grey Horowhenua Invercargill Kaikoura Kawerau Lower Hutt Otorohanga Porirua Rangitikei Rotorua Ruapehu South Waikato Tararua Wairoa Waitomo Wanganui Westland Whakatane	Buller (+++) Central Hawke's Bay Clutha (+) Gisborne (+) Gore Grey Horowhenua Invercargill Kaikoura Kawerau Lower Hutt Masterton (+) Otorohanga Porirua Rangitikei Ruapehu South Taranaki (+) Southland (++) Stratford (+) Tararua Upper Hutt (+++) Wairoa Waitomo Wanganui Westland Whakatane

N.B. (+) indicates a one-category increase in the probability of population decline; (++) indicates a two-category increase; (+++) indicates a three-category increase; (-) indicates a one-category decrease; and (--) indicates a two-category decrease.

Source: Author's projections

increase in population before flattening out. This is based on the international migration assumptions within the model, which are similar to those of Statistics New Zealand in terms of net international migration – approximately 50,000 per year for the first five years, decreasing to about 15,000 per year from 2023 onwards. Second, the degree of uncertainty in the projections increases over time, as represented by the widening of the 50-percent and 90-percent projection intervals. Third, as a whole, New Zealand is not projected to experience population decline before 2063 under the assumptions in this model. However, a focus on the projected population for New Zealand as a whole would mask substantial differences in the projected populations of different subnational areas, to which I now turn.

Table 1 lists the TAs that are projected to experience population decline in at least five percent of scenarios for each period (2023–2033; and 2043–2053). The TAs are categorised by the relative certainty/uncertainty of population decline into three categories: (1) those with between five and 50 percent probability of population decline; (2) those with between 50 percent and 90 percent probability of population decline; and (3) those with a greater than 90 percent probability of population decline. TAs that are not listed in each period have less than a five percent probability of population decline. These TAs are not listed to single out particular areas are facing problems, but to note the distribution and the change in numbers over time.

Several things should be noted about these lists. First, the number of TAs appearing in each category increases between the two periods. More TAs are facing population decline in the 2043–2053 decade than in the 2023–2033 decade. This corroborates recent work that has shown similar results (Jackson & Cameron 2017; Jackson 2016). In the 2023–2033 decade 20 TAs face a 90 percent or greater probability of population decline, compared with 26 TAs in the 2043–2053 decade. Granted, these TAs have relatively small populations, representing 12.2 percent of the national population in 2023 (for the 2023–2033 group based on median population size) and 17.2 percent of the national population in 2043 (for the 2043–2053 group).

Second, many TAs increase in the likelihood of population decline over time, shifting from a lower probability group (or unlisted) to a higher probability group. Two TAs in this group (Buller District and Upper Hutt City) are particularly notable in that they switch from a very low probability of population decline in the 2023–2033 decade (less than five percent) to a very high probability of decline in the 2043–2053 decade (greater than 90 percent).

Third, three TAs (Rotorua District, Opotiki District, and South Waikato District) move in the opposite direction, reducing in the probability of population decline between the two decades. These TAs have both relatively young populations and relatively high fertility rates, which may explain this unexpected result.

Finally, the TAs on the list are mostly (but not exclusively) rural and peripheral areas. With the exception of Wellington, the main centres do not make an appearance anywhere on the list. As population decline is projected to be an increasing, and increasingly likely, feature of rural and peripheral New Zealand, population will concentrate further in the main urban centres. For instance, based on median projections Auckland city is projected to grow from 33.6 percent of the total population in 2013 to 40.2 percent in 2053.

Conclusion

This article posed the question: "Is population decline inevitable for New Zealand's rural and peripheral areas?" The answer is clearly 'no'. I have demonstrated that fewer than one-third of TAs are projected to experience near-certain decline, which may be a high or a low proportion, depending on one's perspective. However, demography is clearly not destiny. In a few TAs, the probability of population decline reduces over time. Those TAs tend to have relatively youthful populations and relatively high fertility rates, neither of which are necessarily replicable for policy-makers in other areas.

This presents a clear challenge for policy-makers in rural and peripheral areas that are facing near-certain decline.

As explained by Jackson and Cameron (2017), migration is no panacea for these areas – the number of migrants required to reverse population decline that is driven in large part by ageing rural populations is simply too great. Moreover, as Jackson and Cameron (2017) note, migrants eventually add to the problem of an ageing population in declining areas. A recent Maxim Institute report outlines the case for 'accepting and adapting' to depopulation (Wood 2017), and this approach would seem to be most suitable in a lot of rural and peripheral areas (see also McMillan 2016). Creative ways will need to be found to adapt to a declining rating base, to ensure that a minimum level of services is available to remaining residents.

The analysis presented here has several limitations. The model is still under further development, particularly in terms of the projection of international migration (Cameron & Poot 2016). Future developments and improvements are likely to change the projections presented here. The model can capture parameter uncertainty and parametric variability, but cannot adequately deal with model uncertainty. Uncertainty about the optimal model to use for population projections will persist, and provides good reason for Statistics New Zealand to not be the sole provider of subnational population projections in New Zealand. Where the Statistics New Zealand and other projections provide similar results, this should provide additional confidence in their validity, and where they diverge, we should consider the projections to be somewhat more uncertain.

In future research, my collaborators and I will look at the factors associated with a high (or low) probability of population decline, to attempt to identify the lead indicators of the decline. This will build on work based on Statistics New Zealand projections by Jackson (2016). Developing a better understanding of the lead indicators of population decline will enable decision-makers to better anticipate the resulting changes in the population.

References

Bijak, J, I Alberts, J Alho, J Bryant, T Buettner, et al., (2015) 'Probabilistic population forecasts for informed decision making' *Journal of Official Statistics* 31(4), pp.537–544

Bryant, J (2005) 'What can stochastic population projections contribute to policy analysis?' *New Zealand Population Review* 31(1), pp.1-11

Cameron, MP, NO Jackson & W Cochrane (2014) *Baseline and Stochastic Population Projections for the Territorial Authorities of the Waikato Region for the Period 2013–2063* Hamilton: National Institute for Demographic and Economic Analysis, University of Waikato

Cameron, MP & J Poot (2010) *A Stochastic Sub-national Population Projection Methodology with an Application to the Waikato Region of New Zealand, Population Studies Centre Discussion Paper* No. 70 Hamilton, NZ: Population Studies Centre, University of Waikato

Cameron, MP & J Poot (2011) 'Lessons from stochastic small-area population projections: The case of Waikato subregions in New Zealand' *Journal of Population Research* 28(2-3), pp.245-265

Cameron, MP & J Poot (2014a) 'Developing a systems-based multi-region stochastic population projections model for New Zealand',

paper presented at the Australia and New Zealand Regional Science Association International 38th Annual Conference, Christchurch, 1–4 December

Cameron, MP & J Poot (2014b) 'Projecting future inter-regional migration using age-gender-specific gravity models – Application to New Zealand', paper presented at the 16th Conference on Labour, Employment and Work, Wellington, 27–28 November

Cameron, MP & J Poot (2016) 'Multi-region stochastic projections for New Zealand: Results and implications for ethnic projections', paper presented at the Pathways, Circuits and Crossroads 2016 Conference, Wellington, 9–11 November

Dunstan, K (2011) *Experimental stochastic population projections for New Zealand: 2009(base)–2111, Statistics New Zealand Working paper* No 11–01 Wellington: Statistics New Zealand

Equab, S (2014) 'NZ has zombie towns that need to close — economist'. *National Business Review* 12 July, https://www.nbr.co.nz/article/nz-has-zombie-towns-need-close-%E2%80%94-economist-ns-159124 (retrieved 26 March 2017)

Jackson, NO (2016) 'Irresistible forces. Facing up to demographic change', in P Spoonley (ed) *Rebooting the Regions. Why low or zero growth needn't mean the end of prosperity* pp.43-75, Albany, NZ: Massey University Press

Jackson, NO & L Brabyn (2017) 'The mechanisms of subnational population growth and decline in New Zealand 1976-2013' *Policy Quarterly* Supplementary Issue, pp.22-36

Jackson, NO & MP Cameron (2017) 'The unavoidable nature of population ageing and ageing-driven growth – an update for New Zealand' *Journal of Population Ageing*, doi: 10.1007/s12062-017-9180-8

Jackson, NO, MP Cameron & W Cochrane (2014) *2014 Review of Demographic and Labour Force Projections for the Bay of Plenty Region for the Period 2013–2063* Hamilton, NZ: National Institute for Demographic & Economic Analysis, University of Waikato

Kennedy, MC & A O'Hagan (2001) 'Bayesian calibration of computer models' *Journal of the Royal Statistical Society, Series B* 63(3), pp.425–464

McMillan, R (2016) 'The shrinkage pathway: managing regional depopulation', in P Spoonley (ed) *Rebooting the Regions: How low or zero growth needn't mean the end of prosperity* pp 213-237, Albany, NZ: Massey University Press

Poot, J, O Alimi, MP Cameron, & DC Maré (2016) 'The gravity model of migration: The successful comeback of an ageing superstar in regional science' *Investigaciones Regionales – Journal of Regional Research* 36(1), pp.63-86

Tuljapurkar, S (1992) 'Stochastic population forecasts and their uses' *International Journal of Forecasting* 8(3), pp.385-391

Wilson, T (2005) 'Application of a probabilistic framework to New Zealand's official national population projections' *New Zealand Population Review* 31(1), pp.51-76

Wood, J (2017) *Growing beyond growth. Re-thinking the goals of regional development in New Zealand* Auckland: Maxim Institute

William (Bill) Cochrane and David Maré

Urban influence and population change in New Zealand

Introduction

While the New Zealand population overall continues to grow, a large proportion of towns and communities in rural or peripheral areas exhibit near-certain stagnation (Cameron *infra*) or decline in their populations (Jackson & Brabyn *infra*).

This is in part due to declining fertility and ageing, and in part due to migration for economic or amenity-related reasons (Brabyn *infra*).

This is not, however, the fate of all such areas, as it has long been thought that rural areas can benefit from growth spill-overs from nearby urban agglomerations. These spill-overs arise as workers with strong preferences for rural or less dense urban environments, but who wish to avail themselves of the employment opportunities available in urban labour markets, locate in the rural areas contiguous with or close to urban areas and commute to work. As a secondary effect the presence of these 'commuters' in an area may support local growth via the demand for local goods and services they generate.

There has been a long tradition of conceptualising the relationship between urban and rural areas within a core-periphery framework. In particular, approaches inspired by the trade theories of Nobel Prize winner Gunnar Myrdal (1963) have gained wide popularity (Veneri & Ruiz 2016: 7-9). Myrdal differentiates between spread effects, the positive effects on peripheral localities, when they share in the growth and wealth of a primary-growth centre, and backwash effects, the negative effects on the periphery arising from interaction with the growth centre.

In terms of regional spatial processes Henry et al (1997) define spread-backwash effects as:

> *Spatially, spread-backwash processes may be defined as the complex set of processes including government income and expenditure flows, private capital flows, trade, migration, commuting, and the diffusion of innovation) whereby the level of development of a peripheral area is changed due to spatial relationships with a core area.* (1997: 273)

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The overall impact is the net of spread and backwash effects (Partridge et al 2007); however, the net effect may well be hard to determine as the effect size and direction can vary with the object of interest. For instance, the impacts of proximity to a growth centre could differ between employment, income and population.

This conceptual framework is directly translatable to the study of sub-national spaces, with the role served by a central nation or trading block being taken by the dominant urban area and that of the periphery by the smaller towns and rural areas surrounding the primary urban area (Gaile 1980; Henry et al 1997).

Using a descriptive approach and Statistics New Zealand's (2004) urban-rural classification, we explore a range of impacts of urban-rural interaction and examine whether the spread or backwash effects dominate in the New Zealand context.

The article is structured as follows. In the first section we outline the classification system that we use to distinguish urban areas and the various levels of rurality. This provides us with a firm framework within which to discuss the relationship between the level of urban/rural interaction and a variety of demographic and labour market outcomes. The second section considers population change in the 2001-2013 period, disaggregated to the urban-rural classification, both for the population as a whole and by ethnic group. Our aim here is to describe any systematic variation in the age structure or pattern of population growth with the degree of urban influence. In the third section we reprise the approach taken in the second, but with the focus now on the labour market, particularly the employment rate and occupation structure. The penultimate section briefly explores the patterns of migration for the 2001-2013 period, again by urban/rural classification, while the final section discusses the results of previous sections and makes some comments on the policy implications of the descriptive findings.

Urban/Rural Classification
Defining what delineates urban from rural, and how to conceptualise the relationship between the two is no straightforward matter, with there being no standardised all-purpose definition. This is in no small part the result of the elusive nature of the rural, with the word rural invoking a variety of descriptions based in land use (predominantly agricultural), population density, isolation, small communities and so on (Hart, Larson & Lishner 2005; Maré & Poland 2005).

As our focus is on urban/rural interaction in the New Zealand context we adopt the experimental classification schema which was developed by Statistics New Zealand in 2004. This classif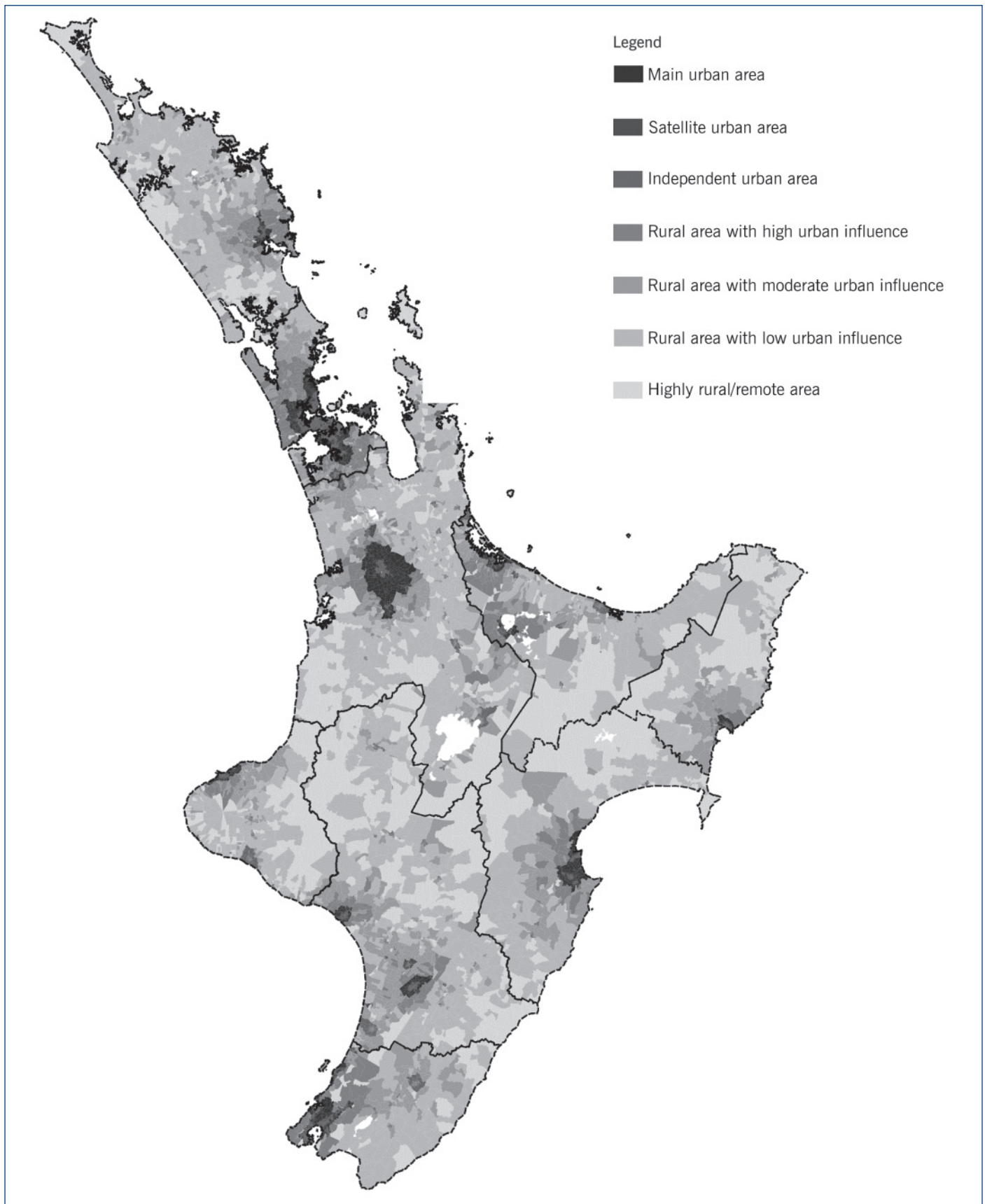ication emphasised the use of commute to work data as a basis for classification rather than population size, as with the standard Statistics New Zealand urban-rural classification. Details of this schema are provided in Table 1 while Figures 1 and 2 show the spatial distribution of these areas.

The data used in this analysis is drawn from the New Zealand Census of Population and Dwellings for the period 2001-2013 and aggregated to Statistics New Zealand's urban-rural profile classification.

Population Change in Rural and Urban Areas
Table 2 shows the distribution of the usually resident population in 2001.

Table 1: Urban Rural Classification 2001

Area	Description
Main urban area	The main urban areas including: Whangarei, Auckland, Hamilton, Tauranga, Rotorua, Gisborne, Napier-Hastings, New Plymouth, Wanganui, Palmerston North, Kapiti, Wellington, Nelson, Christchurch, Dunedin and Invercargill.
Satellite urban community	Towns and settlements with strong links to main urban centres through commuting. Satellite urban communities are defined as urban areas (other than main urban areas) where 20% or more of the usually resident employed population's workplace address is in a main urban area.
Independent urban community	Towns and settlements without significant dependence on main urban centres. Independent urban communities are urban areas (other than main urban areas) where less than 20% of the usually resident employed population's workplace address is in a main urban area.
Rural area with high urban influence	These rural areas can be thought of as being intermediate between urban and rural areas. They lie outside urban areas but a significant proportion of the resident employed population work in a main urban area.
Rural area with moderate urban influence	To be classified in this category an area must either have a large percentage of the resident employed population working in a satellite or independent urban area, or a significant percentage, though less than areas with high urban influence, working in a main urban area.
Rural area with low urban influence	Most of the population in these areas works in a rural area although a number may work in an independent urban area.
Highly rural/remote area	These are rural areas where there is minimal dependence on urban areas in terms of employment, or where there is a very small employed population.

Source: Based on Statistics New Zealand (2004).

Figure 1: Urban Rural Classification (North Island)

Legend
- Main urban area
- Satellite urban area
- Independent urban area
- Rural area with high urban influence
- Rural area with moderate urban influence
- Rural area with low urban influence
- Highly rural/remote area

Overwhelmingly the usually resident population resides in the main urban areas, 72 percent, with a further 14.6 percent residing in some other urban category. This should be borne in mind when comparing rates of change over time for the various areas in the urban-rural classification discussed here.

Figure 3 shows strong evidence of spread, with non-urban areas having a clear gradient in growth for the 2001-13 period, from a high of around 32 percent

Figure 2: Urban Rural Classification (South Island)
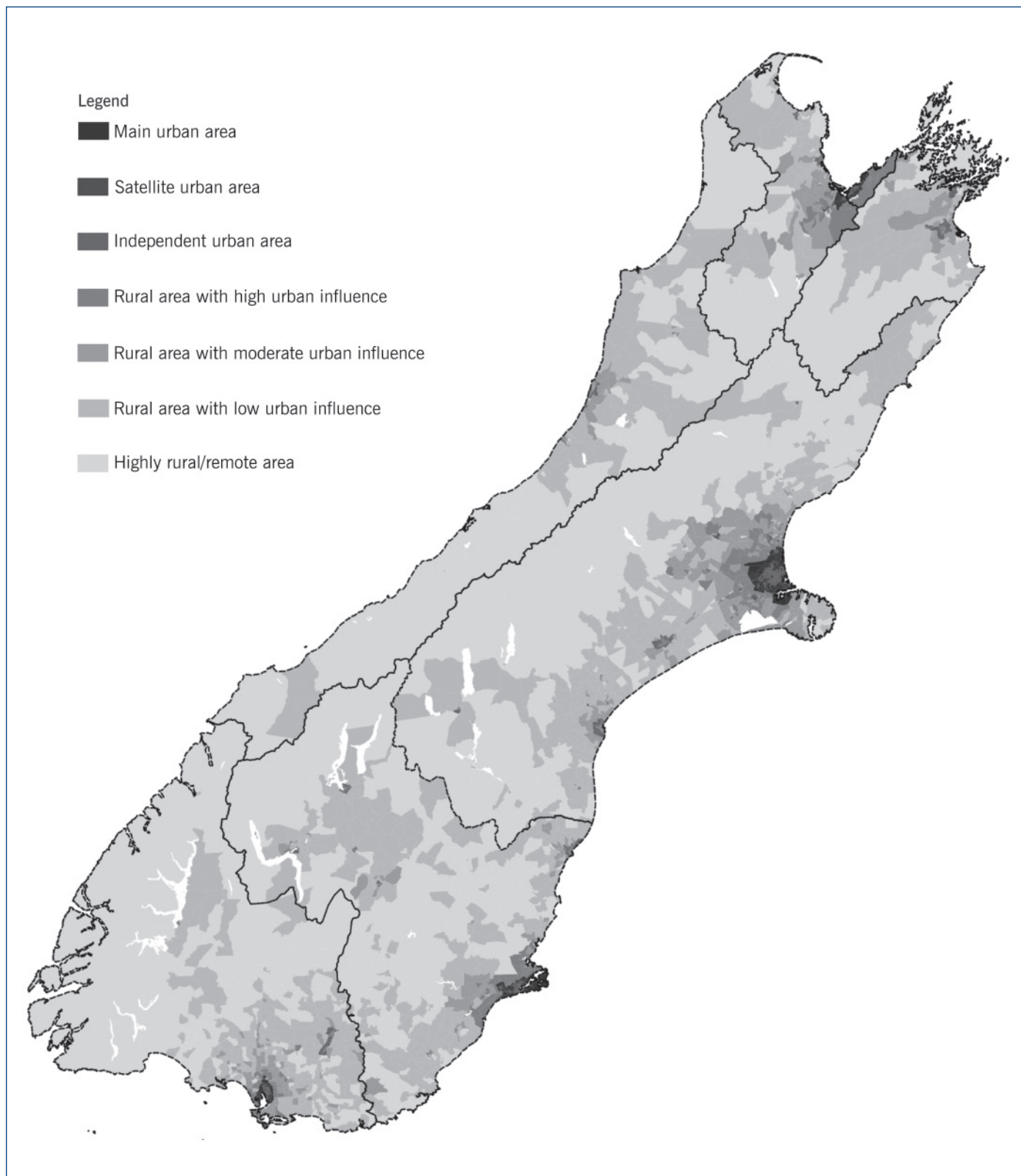
Source: Statistics New Zealand 2004

in areas of high urban influence to a low of 8 percent in areas with a low urban influence. This is in contrast to the most remote category, highly rural/remote, which contracted by about -0.5 percent in the same period.

When considering the urban areas, satellite urban communities grow by an amount intermediate between that of the high and moderate influenced rural areas, again indicative of a hierarchy of growth in the peripheral areas that runs from high growth, high urban influence, to low growth, low urban influence, that is, high levels of commuting to low levels commuting.

Figure 4 disaggregates the population growth 2001-13 by broad age group. The first feature to stand out is that, with the exception of major urban areas, the age group that experiences the highest growth is that aged 65 and over. This is to be expected given the ageing of the 'Baby Boomer' cohort discussed throughout

Table 2: 2001 Usually Resident Population by Urban-Rural Classification

	Urban Influence				Urban			
	Rural/ remote	Low	Moderate	High	Independent	Satellite	Main	Total
Usually Resident Population	51195	196614	134988	105156	417552	114468	2617812	3637785
%	1.4	5.4	3.7	2.9	11.5	3.1	72.0	100.0

Source: Statistics New Zealand 2001-2013 Census of Population and Dwellings

this issue. For the rural population, those in rural/remote and low-high urban influence categories, higher levels of urban influence are associated with higher levels of growth in the 65 years and over population. Turning to the urban areas, the growth in the 65 years and over category is again the growing age group for satellite and independent urban areas; however for the major urban areas, growth in the older working age population, those aged 45-64 years, is slightly higher (by around 3 percentage points). This latter group of older working age people is, with the exception noted above, the second fastest growing group, with growth 2001-13 varying between 67 percent in areas with high urban influence to 12.5 percent in rural/ remote areas. Again there is a clear gradient among the non-urban areas, with high levels of urban influence being associated with high levels of population growth while lower levels of urban influence are associated with lower levels of population growth.

The younger working age population, 25-44 years, declines in all areas except satellite urban and major urban areas. This decline is particularly pronounced in the rural/ remote, low urban influence areas and, to a lesser extent, independent rural areas, creating a dichotomy between areas with significant decline in this age group (in the range of 10-17 percent) and those with low levels of decline or growth (-3.5 to 2 percent).

People in the 15-24 year age group are either in education or training, or attaching to the labour market, making them particularly important to an area's economic vitality. Of the various areas considered here, areas with high levels of urban influence have enjoyed the largest increases in this age group 2001-13 (37 percent), while independent urban areas experienced the lowest growth in this age

group (4 percent). Restricting ourselves to the non-urban areas we again see a continuum of high urban influence/high grow to low urban influence/low growth with satellite urban areas seeing growth in the 15-24 age group intermediate between that of the high and moderate urban influence areas.

Lastly, we look at the youngest of the age groups, those aged 0-14 years, which are strongly related to the vitality of an area's population. The areas considered here split into two clear groups in terms of the growth of the 0-14 age group. One group, made up of independent urban, low urban influence and remote/rural areas, experiences declines of between -9 percent and -12 percent while the main, satellite and high influence urban areas grow by between 5 percent and 14 percent. The moderate urban influence is intermediate between these two groups with growth in the 0-14 age group being close to zero (-0.6 percent).

Considering Figure 5[1] and taking 2001 as a base year it is apparent that the majority of the population in the areas considered at least partially identify as European New Zealanders. There is, however, some variation in the proportion European, with over 90 percent of the population of areas with high urban influence so identifying, compared with around 77 percent in the major urban areas. For the non-urban areas, the gradient observed in Figures 3 and 4 is less pronounced here, with European affiliation declining from the 90 percent in high urban influence areas to a low of 86 percent in remote/ rural areas. Urban areas have notably lower levels of European affiliation than non-urban.
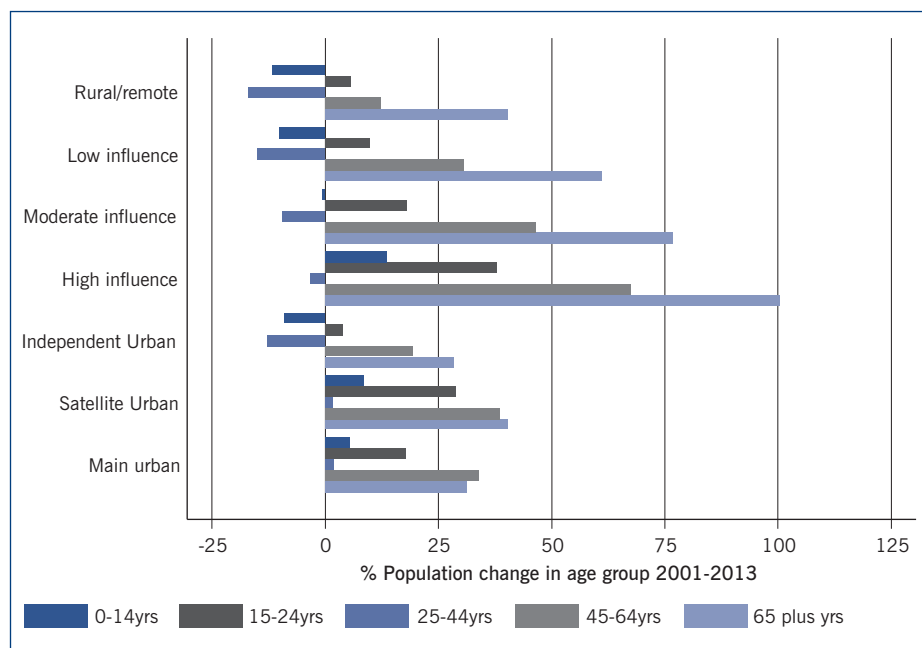
Turning to those who identify as Māori, the 2001 proportions vary markedly between area types, with Māori being around 18-20 percent of the population in independent, satellite urban, low urban influence and remote/

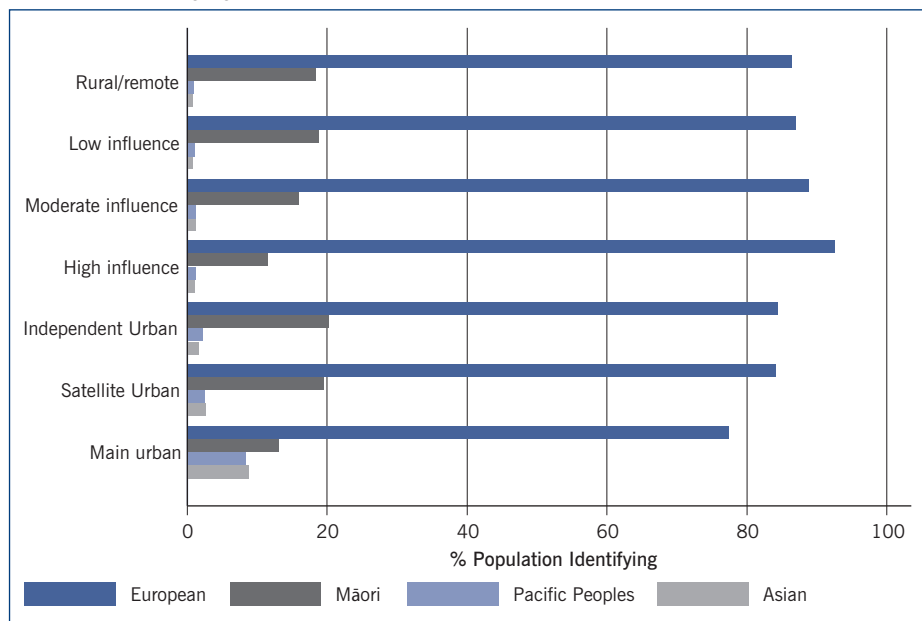**Figure 3: Percentage Change in Usually Resident Population 2001-13 by Urban-Rural Classification**

Source: Statistics New Zealand, 2001-2013 Census of Population and Dwellings.

Figure 4: Percentage Change in Usually Resident Population 2001-13 by Age & Urban-Rural Classification

Source: Statistics New Zealand, 2001-2013 Census of Population and Dwellings.

Figure 5: Percentage Usually Resident Population (2001) Identifying with Ethnicity by Urban-Rural Classification

Source: Statistics New Zealand, 2001-2013 Census of Population and Dwellings.

existing populations still approximately double the number of those identifying as Asian in the 2001-2013 period. Another factor in the rapid growth in the proportions of Asians in rural/remote or low urban influence regions may be the recent trend to employ foreign workers, particularly from the Philippines, in various agricultural or horticultural roles in peripheral areas (Trafford and Tipples 2012).

In terms of the other ethnicities the growth in those identifying as European is greatest in areas of high urban influence, being almost twice as high (28 percent) as the next highest growth rate (satellite urban areas, 15.6 percent). European population shares declined somewhat in remote/rural (-5.1 percent) and independent urban (-1.8 percent) areas, but were positive in the remaining areas.

Employment in Rural and Urban Areas

The employment rate, that is, the ratio of the total number of people employed to the working age[2] population, shown in Figure 7 is a good measure of the utilisation of labour in an area. It serves as an alternative to the conventional unemployment rate and is in some ways preferable as it is more robust to definitional issues arising from the distinction between 'not in the labour force' and 'unemployed' (Murphy & Topel 1997).

In general the non-urban areas have employment rates higher than the urban, the gap typically being 6 to 10 percentage points. Areas of high urban influence have the highest employment rates in both 2001 (70.9 percent) and 2013 (70.7 percent), while independent urban areas have the lowest in both 2001 (56.6 percent) and 2013 (57.7 percent). Considering change over time, most of the employment rates are stable with the 2001-2013 difference in rates in most areas being under one percentage point.

The exceptions to this are independent urban areas (1.1 percentage point) and satellite urban areas (2.6 percentage points).

Having discussed the level of engagement with the labour market of the population in the areas under consideration we turn now to what the population actually does; that is, what

rural areas while in the main urban and high urban influence areas the proportion is between 11 percent and 13 percent.

Pacific peoples are primarily concentrated in the main urban areas, accounting for 8.5 percent of those populations, with the proportion of independent and satellite urban communities being between 2 percent and 3 percent, and the remaining areas close to 1 percent. Those identifying as Asian are distributed in a manner similar to Pacific peoples, primarily concentrated

in the major urban areas (8.8 percent), with lesser concentrations in satellite urban areas (2.7 percent) and the remaining areas being in the 1 percent to 2 percent range.

Figure 6 shows the percentage change in persons identifying with each ethnicity. The most striking feature of this is the rapid increase in the number of people identifying as Asian across all areas. Part of this may be a low baseline (see Figure 5 and Table 2) in the case of non-urban areas, however areas with substantial pre-

occupations the usually resident populations are engaged in. Occupational category captures not only the job an individual does, but also serves as an indicator of how much human capital the individual possesses, their likely income and their social status (Milne et al 2013). The distribution of the population of an area between occupations, then, is a good guide to the socio-economic context of that area.

Figure 8 shows the occupational distribution for each of the areas in 2001. The occupational classification used is NZSCO99[3] rather than ANZSCO[4] as we wished to look at change over the 2001-13 (see Figure 7) period[5].

As a baseline we start by looking at the 2001 occupational structure. The most striking feature is the clear relationship between the degree of urban influence and the proportion of the population involved in manual occupations. The rural/remote areas have nearly 70 percent of their work force involved in manual labour while the areas with high urban influence have less than half this (33 percent). Major urban areas have the least participation in manual occupations (21 percent) while independent and satellite urban areas are very similar to areas with high urban influence, with participation in manual occupations 32 percent and 34 percent.

At the other end of the skills spectrum, employment in management/professional occupations in non-urban areas also gradate, albeit in the opposite direction to manual occupations, with higher degrees of urban influence being associated with higher levels of participation in management/professional occupations. When comparing areas of high urban influence with the urban areas it can be seen that the level of participation in management/professional occupations is higher in the high urban influence areas (26.5 percent) than either satellite or independent areas (by around 6 percentage points), but lags the main urban areas by approximately 3 percentage points.

The technical and trades occupational group is around 20-23 percent of the employed in the main urban, satellite urban and high urban influence areas,

Figure 6: Percentage Change in Usually Resident Population 2001-13 by Ethnicity and Urban-Rural Classification
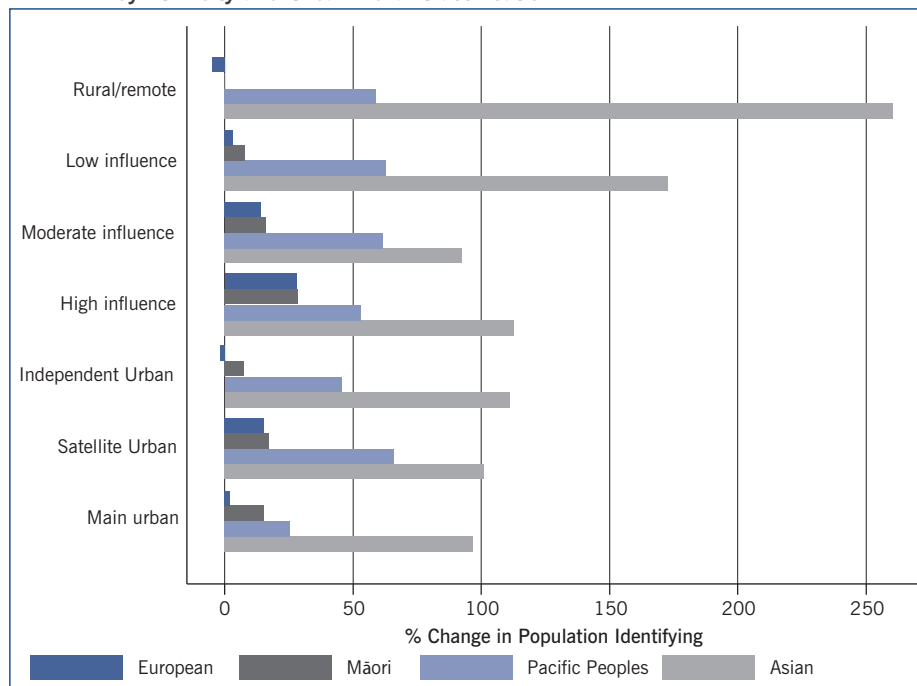
Source: Statistics New Zealand, 2001-2013 Census of Population and Dwellings.

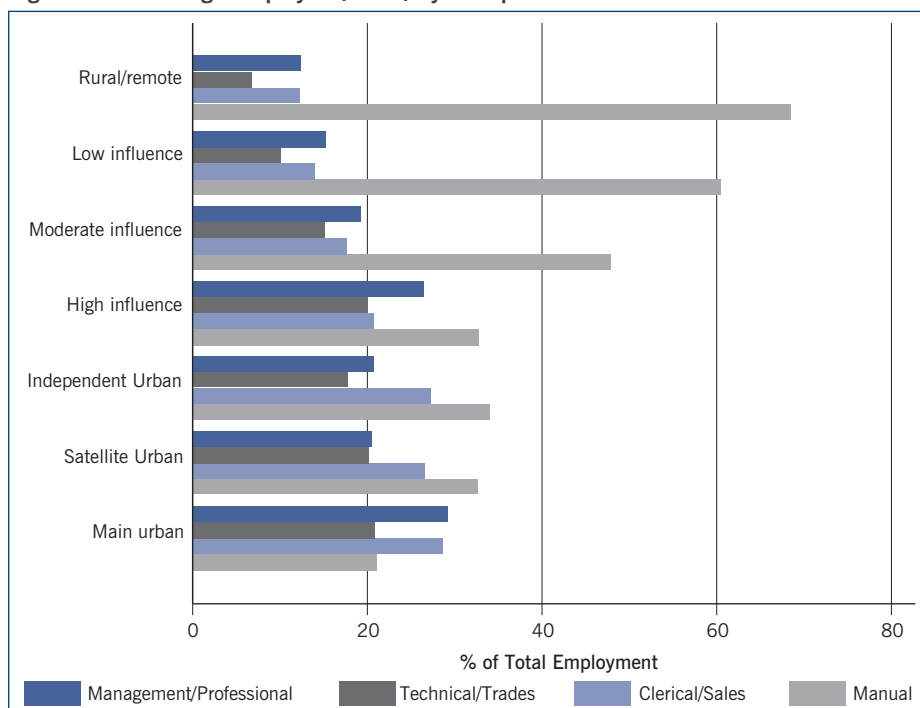**Figure 7: Employment Rate (%) by Urban-Rural Classification**
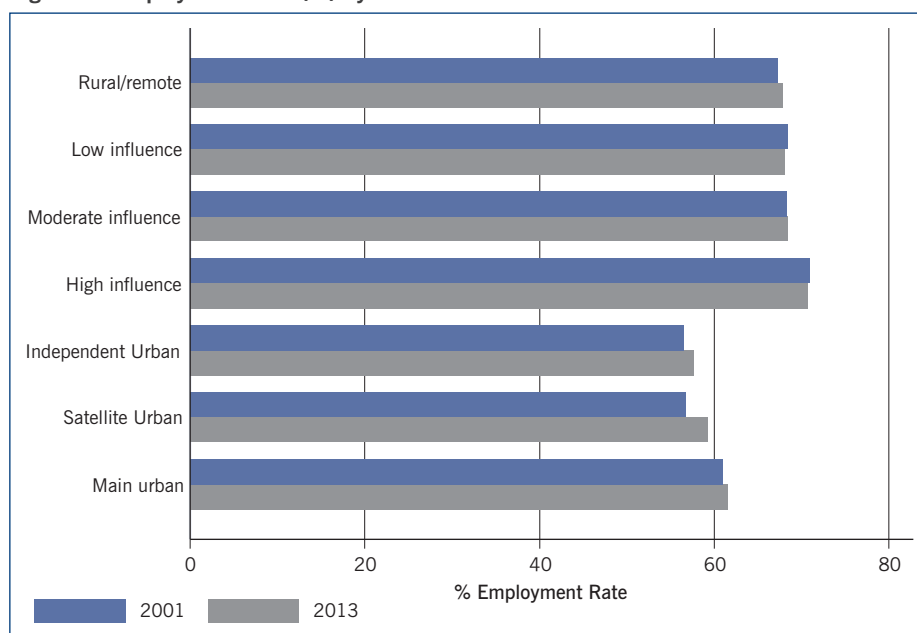
Source: Statistics New Zealand, 2001-2013 Census of Population and Dwellings.

while in the independent urban and moderate influence areas this proportion is 5 or 6 percentage points lower, with the remaining two groups, low urban influence and rural/remote areas, being around 6%-10%.

Lastly, the proportion in the clerical/ sales group is roughly equal in the main, satellite and independent urban areas (26%-29%), while the remaining areas range between 12 percent (rural/remote) and 20 percent (high urban influence).

Having considered the baseline 2001 occupational distribution we turn now to look at the changes in this distribution for the 2001-13 period (Figure 9). Growth in the management/ professional group has been rapid, with this group being the fast growing occupation in all but the rural/ remote and low urban influence areas. In particular growth in the management/ professional category in satellite urban and high urban influence and medium urban influence areas is very high, with

Figure 8: Percentage Employed (2001) by Occupation & Urban-Rural Classification

Source: Statistics New Zealand, 2001-2013 Census of Population and Dwellings.

Figure 9: Percentage Change in the Usually Resident Employed Population 2001-13 by Occupation & Urban-Rural Classification
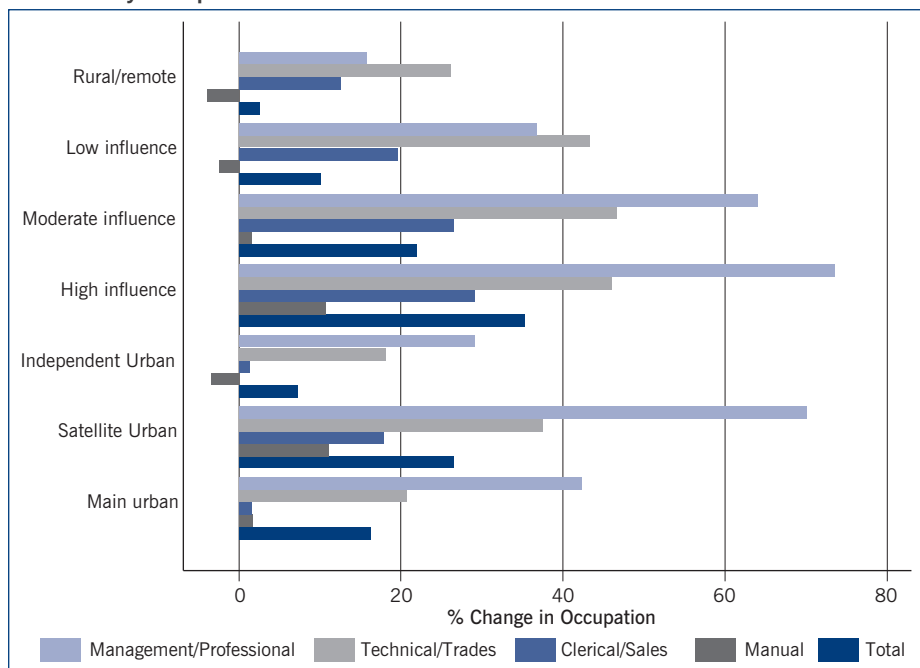
Source: Statistics New Zealand, 2001-2013 Census of Population and Dwellings.

growth rates of 70 percent, 74 percent and 64 percent respectively.

The next fast-growing group is the technical/trades group in, again, all but the rural/remote and low urban influence areas, where this category is the fastest growing. For clerical/sales in the non-urban areas, growth increases with urban influence from 13 percent in rural and remote areas to 29 percent in areas of high

urban influence. For the urban areas growth in the main and independent areas is low, under 2 percent in both cases, but is notably higher, 18 percent, in satellite urban areas.

Growth in the manual occupational category is modest to negative across all areas. The highest growth in this category is 11 percent in satellite urban areas, similar to the high urban influence areas

(10.8 percent), while declines of 2 percent to 4 percent are reported in rural/remote, low urban influence and independent urban areas.

Place of Residence 5 years ago

One of the few sources of information on sub-national migration comes from the census question on where a person usually lived five years ago[6]. This question gives us some insight into the recent mobility of the usual residents of an area. The discussion here will mainly focus on people who were at their current residence 5 years ago, people who were elsewhere in New Zealand 5 years ago, and those who were overseas.

The largest single category in Figure 10 across all areas is those whose place of usual residence is the same as their usual address 5 years ago, that is, they have not moved or they moved away and then returned to their initial area of usual residence. For the areas of low, medium and high urban influence, those who have not moved narrowly constitute an absolute majority (51 percent - 53 percent), however for the main urban and satellite urban areas the proportion of people in this category is some 5-6 percentage points lower.

Around 36 percent of the population of rural/remote and low-high urban influence areas were elsewhere in New Zealand 5 years prior to the 2013 census. In the urban areas those who are in the 'elsewhere in NZ' category constitute between 40 percent (main urban areas) and 42 percent (satellite urban areas) of the population, with the rural/remote category, at 48 percent, being intermediate between the areas under urban influence and the urban areas themselves.

The 'not born 5 years ago' category varies by under 2 percentage points, from a low of 6.5 percent in areas of high urban influence to a high of 8.1 percent in rural or remote areas.

'Overseas 5 years ago' is the category that potentially excites the most interest given its relationship to the controversial topic of migration. While the proportion of the population overseas 5 years ago is relatively small, less than 10 percent in all cases, the areas under consideration fall into 3 distinct groups; the main urban

areas where the proportion of people overseas 5 years ago is considerably larger, by 3.5 percentage points or more, than the other areas; satellite urban, independent urban and rural/remote, where the proportion is 4.5% - 5%, and the remainder with the proportion overseas 5 years ago being close to 4 percent.

Discussion and Policy Implications
In this section we reflect on the empirical patterns described and consider a few of their policy implications.

The first point to note is that the description of the various areas in the urban-rural profile offered here is at a very high level of aggregation, hence much of the spatial heterogeneity[7] that no doubt exists in relations between urban core and rural periphery (and the gradations between the two) will have been suppressed. Essentially we have an averaging effect that extinguishes the variability within the categories considered, hence actual conditions in a specific location might differ markedly from the average values presented here.

Table 3 summarises some of the key outcomes discussed above by rank order with 1 indicating that that area has the highest value, and 7 the lowest, on the variable under consideration. As noted earlier (see Table 1) the high urban influence areas have the highest interaction, through travel to work commuting, with urban areas of all the non-urban categories. The performance[9] of the high urban influence area on the four outcome variables considered is very good, with this category being the best performing of the areas on three of the outcome variables (population growth,

Figure 10: Where were you 5 years ago? (2013)
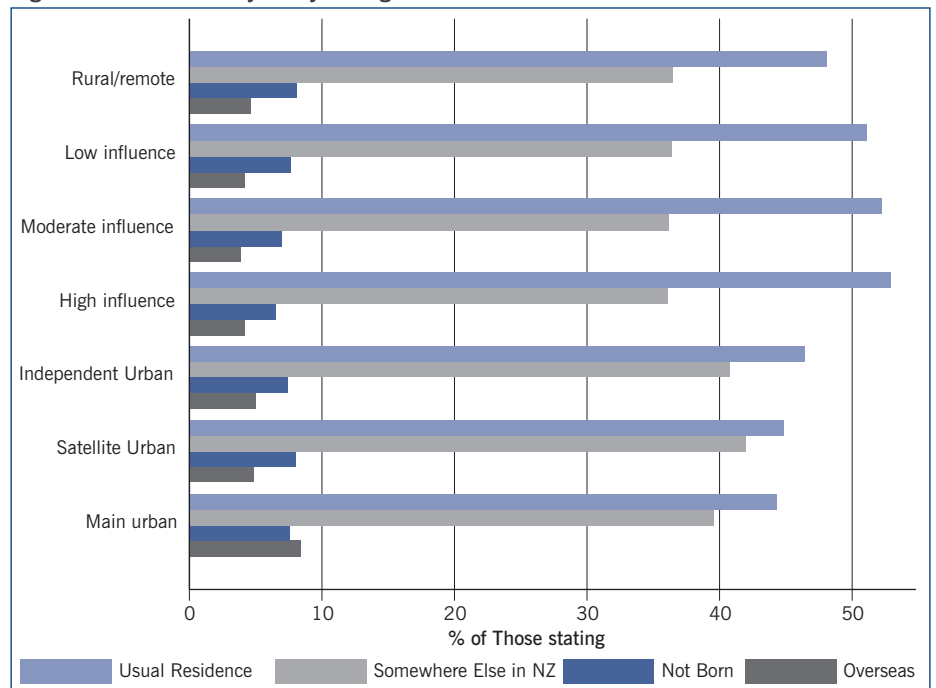
Source: Statistics New Zealand, 2001-2013 Census of Population and Dwellings.

employment rate and growth in high skilled jobs), and second best on the remaining variable (employment in high skill jobs). This would seem to be more consistent, at least at this highly aggregated level, with the spread interpretation of urban-rural interaction, than with backwash. If backwash effects dominated we would expect to see a more muted performance on the variables in Table 2.

For the other non-urban areas, performance declines with the degree of urban influence, that is, high > moderate > low > rural/remote corresponding to a clear pattern of level of urban influence equating to the performance of the area. Again this is what one would expect to see if a spread interpretation of urban-rural interaction held.

Looking at the urban categories, independent urban areas do not fare well with their performance on population growth, employment rate, and growth in high skilled employment, being either the worst or the second to worst of the categories. On the other hand the performance of the independent urban areas on the dimension of the level of employment is in the top half of the rankings. This, combined with the low rate of growth in high skilled jobs, is indicative of a relatively stable occupational share of skilled workers in the population. Satellite urban areas resemble high urban influence areas on several dimensions, being second to them in the population growth and growth in high skilled jobs ranking, but having somewhat worse, though still middling,

Table 3: Rank of Area by Outcome Variable

	Urban Influence				Urban		
	Rural/Remote	Low	Moderate	High	Independent	Satellite	Main
Population Growth (2001-2013)	7	5	3	1	6	2	4
Employment Rate (2001)	4	3	2	1	7	6	5
% Employed in High Skill Jobs[1] (2001)	7	6	5	2	3	4	1
% Growth in High Skilled Jobs (2001-13)	7	5	3	1	6	2	4

Rank 1 (Highest) to 7 (Lowest)

performance on the other dimensions considered. The main urban areas, while having the highest level of high-skilled labour at the beginning of the period (2001), are ranked fourth out of the seven urban-rural categories for both population growth and the growth in high-skilled labour, while they are fifth on the employment rate (2001). This would indicate that on many dimensions the main urban areas perform considerably worse than the high urban influence areas that tend to surround them.

Given that on this reading the high urban influence areas are the best performing, it is interesting to return to our discussion of the age and ethnic characteristics of these areas. From Figure 5 it is clear the high urban influence areas have the highest level of people identifying as European in 2001 (in keeping with the other non-urban areas) and the highest growth in people identifying as European 2001-2013. In terms of ageing the high urban influence area has the highest growth of all the areas in the 65 years plus group, the 45-65 year age group, and the 15-24 year age group. Hence, considering also our previous discussion, it would appear that these areas are largely European, with high occupational (in terms of skill) attainment and rapidly growing older populations.

Bringing this all together then, the area of main interest here, areas of high urban interest, have managed to maintain or grow their populations (Figure 3), employment rates (Figure 7) and skills levels despite having: high growth in the older population (Figure 4), the lowest proportion of people not born 5 years ago (Figure 10), low gross international migration (Figure 10), and a pattern of internal migration similar to other non-urban areas (Figure 10).

Briefly, let us consider what this might mean from a policy perspective. It would seem that on the basis of the descriptive evidence presented here, the success of an area outside of the urban areas is in part associated with the level of interaction that area has with urban areas. As the areas used here are predominantly defined with respect to the travel to work behaviour of the usually resident population this is largely a story based on locational choice, that is, the decision on where a household will locate. Locational choice in turn arises from a complex interaction of the value a household places upon a locations amenities, the cost of commuting and the budget constraint faced by the household (Partridge et al 2010).

If a rural area wishes to increase the level of interaction with urban areas with the aim of improving its population growth and economic success it has two main avenues open to it: decrease the cost of commuting and/or increase the amenity value of the area. This assumes of course that there is little local government can do short run about local income levels.

Decreasing the cost of commuting could be achieved by a number of means, engineering enhancements to motor vehicles or lowering the cost of fuel for example, but many of these factors lie well beyond the control of local governance. What is open to control, albeit within often tight bounds, is investment in infrastructure; upgrading the road network or improving the provision of public transport both might facilitate growth (economic and/or population)[10] by reducing the amount of travel time and cost of travel.

Improving the amenity value of an area might be somewhat harder, as it is difficult to conjure forth a scenic lake or mountain; however, it is possible to make somewhere a nicer place to live by building social capital in the area, fostering the development of pony clubs or sporting teams for instance, or providing convenient schooling or childcare for commuters.

The take away message here is that for those in the vicinity of urban areas the use of infrastructural investment and/or the improvement of local amenities maybe a viable approach to development. However, if it is not possible to commute to a main urban area or the location lacks amenities, it may prove difficult to foster growth in a locale absent some innovative strategy.

1　Note that the official measure of ethnicity used in New Zealand allows individuals to identify with more than one ethnic group, hence the ethnicities used here are not mutually exclusive – see Callister et al (2007: 301-310) for a discussion of the measurement of ethnicity in New Zealand.

2　Where the Working Age Population is the usually resident population aged 15 years and over. It should be noted that the New Zealand practice of defining the working age population in these terms differs from many countries, where the working age population is defined as those aged 15 to 64 years (Statistics New Zealand 2017).

3　For ease of exposition we have aggregated the NZSCO major groups as follows; Management/Professional consists of the NZSCO categories of Legislators, Administrators and Managers and Professionals; Technical/Trades of Technicians and Associate Professionals and Trades Workers; Clerical/Sales of Clerks and Service and Sales Workers; and, Manual which is comprised of Agriculture and Fishery Workers, Plant and Machine Operators, and Assemblers and Elementary Occupations.

4　Details of these classification schema are to be found here: http://www.statistics.maori.nz/~/media/Statistics/surveys-and-methods/methods/class-stnd/occupation/NZSCO-99-manual.pdf and http://www.stats.govt.nz/methods/classifications-and-standards/classification-related-stats-standards/occupation.aspx.

5　Classification of occupation by ANZSCO is not readily available for the 2001 census year.

6　The actual question (question 7) in the 2013 Census of Population and Dwellings read: 'Where did you usually live 5 years ago, on 5 March 2008?'

7　Essentially spatial heterogeneity refers to the variation of a phenomenon across space (Anselin 2010).

8　High skill job refers to employment in the managerial/professional category.

9　Here performance is equated with high values on the measure being considered.

10　See Cochrane et al (2016) for a discussion of the impacts of local infrastructural investment in a New Zealand context.

References

Anselin, L (2010) Thirty years of spatial econometrics *Papers in Regional Science* 89(1), pp.3-25 https://doi.org/10.1111/j.1435-5957.2010.00279.x

Brabyn, L (2017) 'Declining towns and rapidly growing cities in New Zealand: developing an empirically based model that can inform policy' Policy Quarterly Supplementary Issue, pp.37-46

Callister, P, R Didham, D Potter & T Blakely (2007) 'Measuring ethnicity in New Zealand: developing tools for health outcomes

analysis' *Ethnicity & Health* 12(4), pp.299-320 https://doi.org/10.1080/13557850701300699

Cameron, M (2017) The relative (un)certainty of subnational population decline Policy Quarterly Supplement Issue, pp.55-60

Cochrane, W, A Grimes, P McCann & J Poot (2016) 'Spatial impacts of endogenously determined infrastructure investment', in H Shibusawa, K Sakurai, T Mizunoya & S Uchida (eds) Socioeconomic Environmental Policies and Evaluations in Regional Science: Essays in Honor of

Yoshiro Higano, pp.227-247, Singapore: Springer

Gaile, GL (1980) 'The spread-backwash concept' Regional Studies 14(1), pp.15–25 https://doi.org/10.1080/09595238000185021

Hart, LG, EH Larson & DM Lishner (2005) 'Rural definitions for health policy and research' American Journal of Public Health 95(7), pp.1149–1155 https://doi.org/10.2105/AJPH.2004.042432

Henry, MS, DL Barkley & S Bao (1997) 'The Hinterland's Stake in Metropolitan Growth: Evidence from Selected Southern Regions' Journal of Regional Science 37(3), pp.479-501

https://doi.org/10.1111/0022-4146.00065

Jackson, NO & L Brabyn (2017) 'The mechanisms of subnational of population growth and decline 1976-2013' Policy Quarterly Supplementary Issue, pp.22-36

Maré, DC & M Poland (2005) 'Defining geographic communities' No. 05/09 Wellington: Motu Economic and Public Policy Research

Milne, B, U Byun & A Lee (2013) New Zealand socio-economic index 2006 Wellington: Statistics New Zealand

Murphy, KM & R Topel (1997) 'Unemployment and non-employment' The American Economic Review 87(2), pp.295-300

Myrdal, G (1963) Economic Theory and Under-developed Regions London: Methuen.

Partridge, M, K Ali & MR Olfert (2010) 'Rural to Urban Commuting: Three Degrees of Integration' Growth and Change 41(2), pp.303-335

Partridge, M, RD Bollman, MR Olfert & A Alasia (2007) 'Riding the wave of urban growth in the countryside: spread, backwash, or stagnation?' Land Economics 83(2), pp.128-152

Statistics New Zealand (2017) Labour force categories used in the Household Labour Force Survey (retrieved March 14, 2017)

Statistics New Zealand (2004) New Zealand: An Urban/Rural Profile Wellington: Statistics New Zealand

Trafford, S & R Tipples (2012) A foreign solution: The employment of short term migrant dairy workers on New Zealand dairy Farms (Report prepared for OneFarm) Centre for Excellence in Farm Business Management: Massey University/Lincoln University

Veneri, P & V Ruiz (2016) 'Urban-to-Rural Population Growth Linkages: Evidence from OECD TI3 Regions' Journal of Regional Science 56(1), pp.3-24 https://doi.org/10.1111/jors.12236