



CaDDANZ

Capturing the Diversity Dividend
of Aotearoa/New Zealand

Multi-region stochastic projections for New Zealand

Results and implications
for ethnic projections

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- We thank Statistics NZ for providing much of the data that underlies the models

CADDANZ



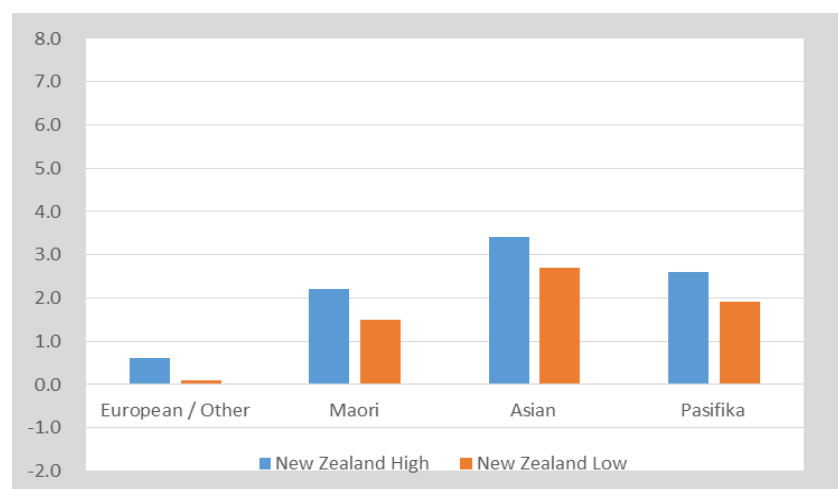
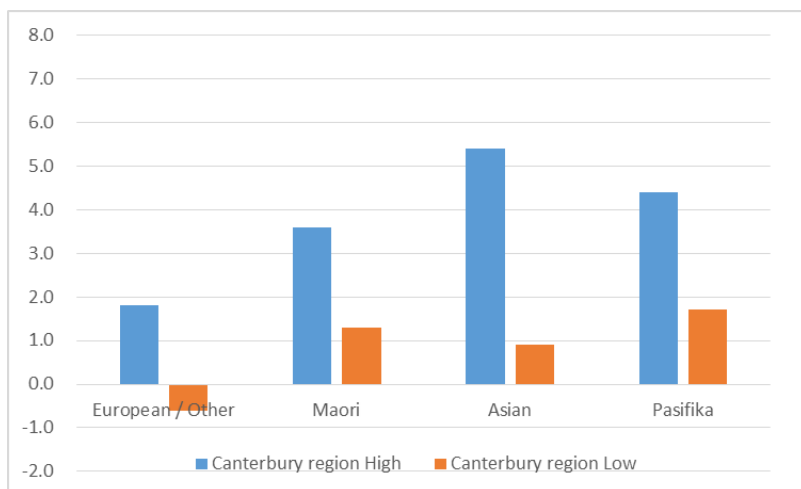
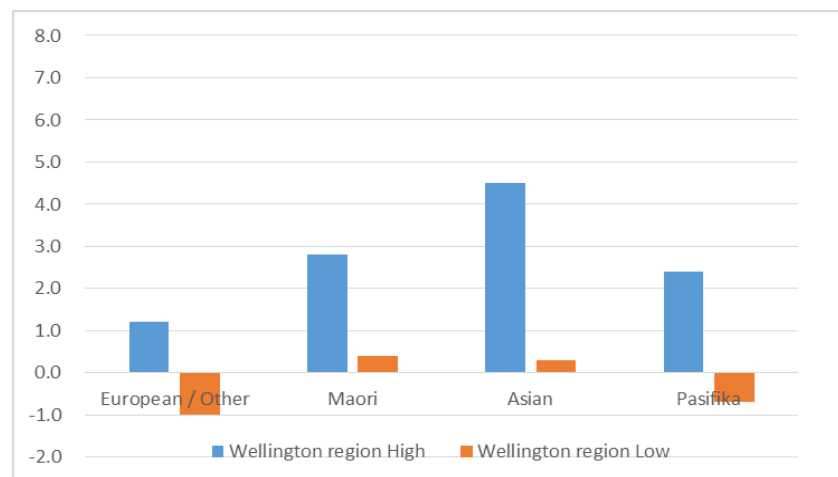
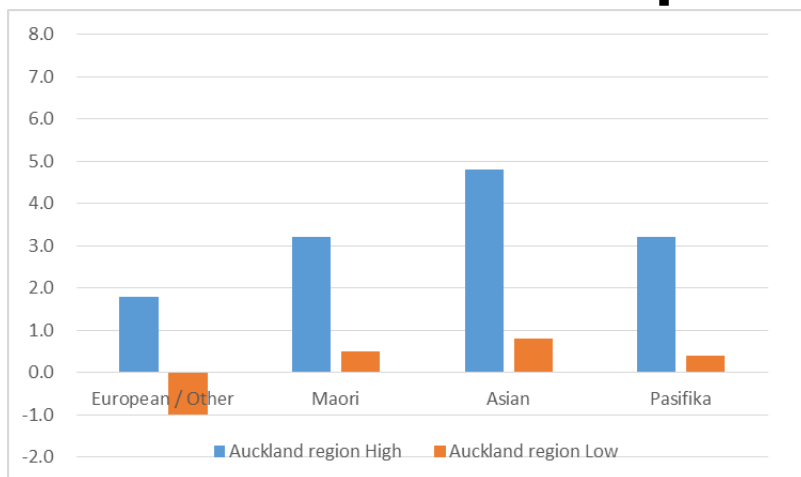
- In the CADDANZ project, we are not only concerned with looking at New Zealand's past and current experience of diversity, but looking ahead to the future
- We will do this through two methods:
 - Subnational ethnic population projections
 - Spatial microsimulation modelling
- Today I want to outline some initial work on the first of these two methods

Why do ethnic population projections?



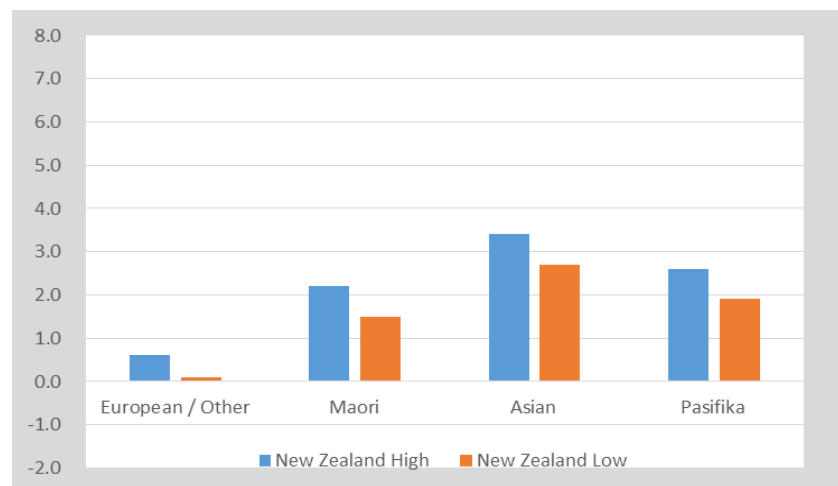
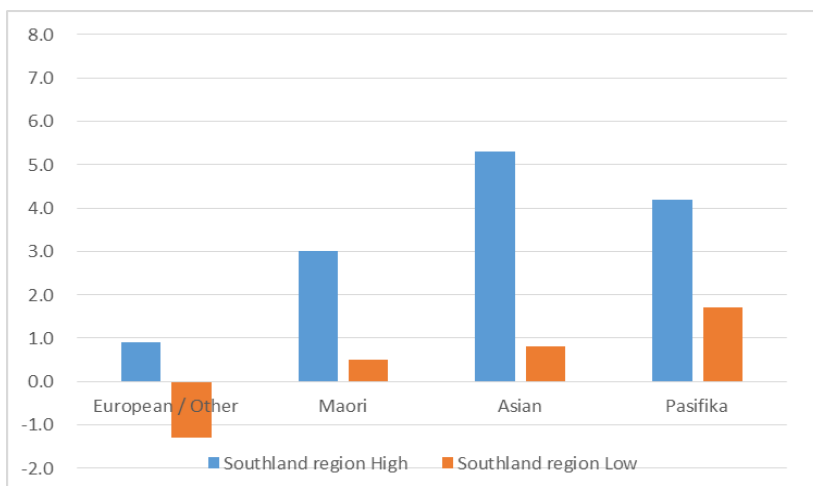
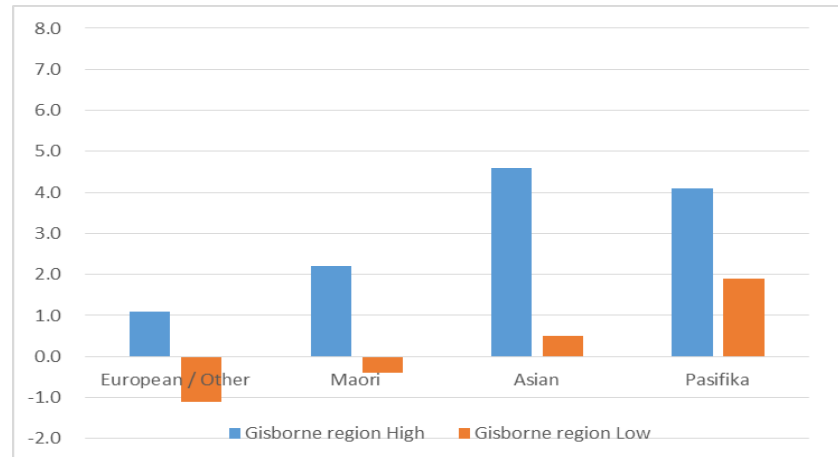
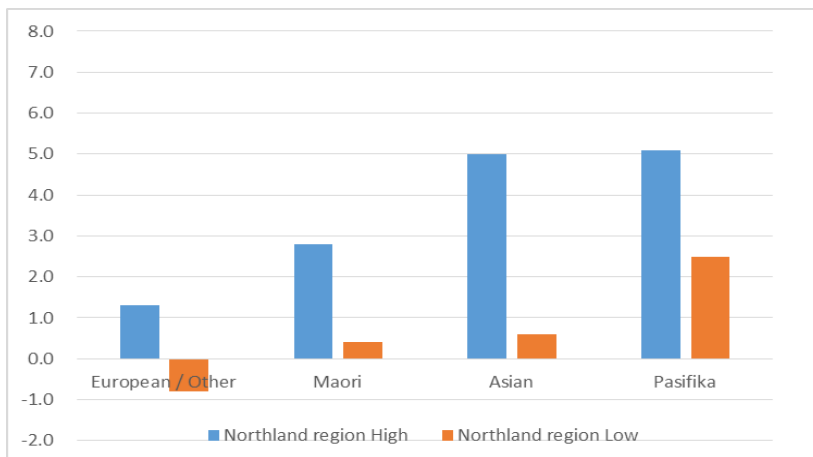
- To show trends in diversity and differences between regions, cities and suburbs
- To deliver appropriate ethnic-group targeted public services in health and education
- To provide context for other socio-economic trends

Regional diversity in projected average annual ethnic population growth 2013-2038: metropolitan areas



Source: Statistics New Zealand Subnational Ethnic Population Projections: 2013(base)-2038

Regional diversity in projected average annual ethnic population growth 2013-2038: peripheral areas



Source: Statistics New Zealand Subnational Ethnic Population Projections: 2013(base)-2038

Why introduce a new approach to ethnic projections?



- Complementing SNZ projections with projections produced using alternative methods can provide more confidence in the projected trends
- Modelling transitions explicitly provides a better understanding of the underlying:
 - transitions of age, marital status, labour force participation, location
 - transitions of ethnic identity
- Implementation depends on data availability and the ability to construct plausible future transition assumptions; the maths model (Markov chain) is straightforward and the computational burden no longer a problem
- Complexity and uncertainty increases from national population to sub-national population to sub-national population by ethnicity
- Stochastic (probabilistic) projections can quantify uncertainty

Advantages of stochastic (probabilistic) projections (e.g., Bryant 2005)



- Statements that the future population will be between x and y with $z\%$ probability are more informative than just quoting low, medium and high projections
- Probabilistic statements can also be made regarding other interesting demographic indicators, such as demographic dependency ratios (e.g., pop. 65+ / pop 15-64)
- Moreover, differences in regional uncertainty can be quantified in terms of differences in the underlying parameter distributions
- The consistency of fertility, mortality and migration assumptions can be assured through modelling

Stochastic projections in New Zealand



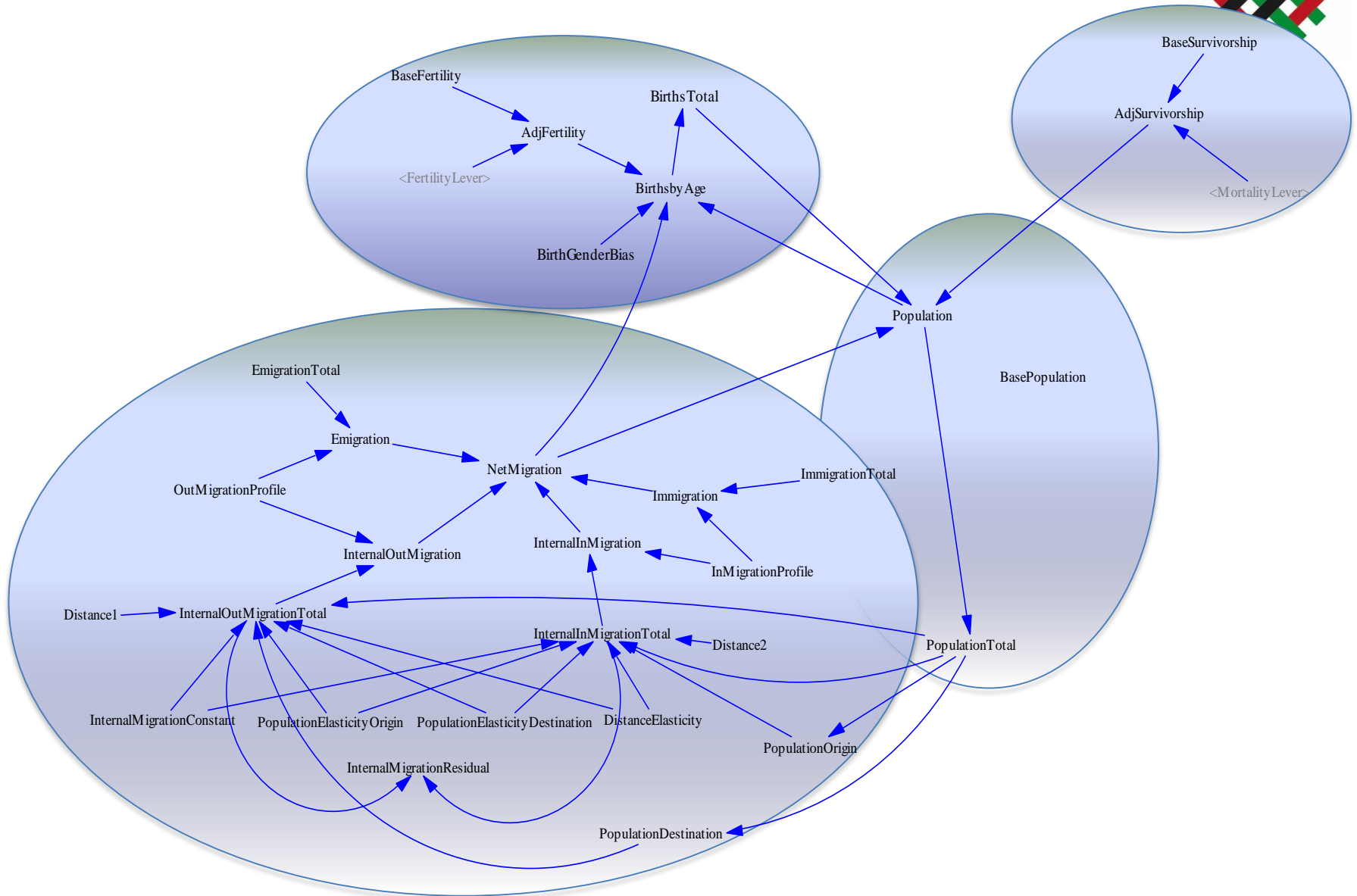
- Wilson (2005) was the first to apply stochastic population projections methodology in NZ
- Cameron and Poot (2010; 2011) were the first to apply the method at the subnational level (for parts of the Waikato Region, at the TA level)
- Statistics NZ began producing national-level experimental stochastic projections at the national level in 2011 (Dunstan, 2011); these became 'official' from 2014
 - National ethnic projections are also stochastic
 - Subnational stochastic projections have been completed, but are still experimental (i.e. not 'official' projections)
 - No stochastic subnational ethnic projections

Projections at the subnational level



- There are essentially two broad approaches for projecting the population at the subnational level:
 1. top-down, where a national population projection model is run initially, then sub-national models are undertaken and subsequently moderated to ensure that the sum of the sub-national projections is equal to the national projection; or
 2. bottom-up, where sub-national projections are run without recourse to a national projection, commonly with these sub-national projections each being independent (though often with a common set of underlying assumptions)
- The former method is that preferred by Statistics NZ, whereas many consulting firms, and NIDEA, have typically adopted the latter

The prototype multi-region model



The challenge

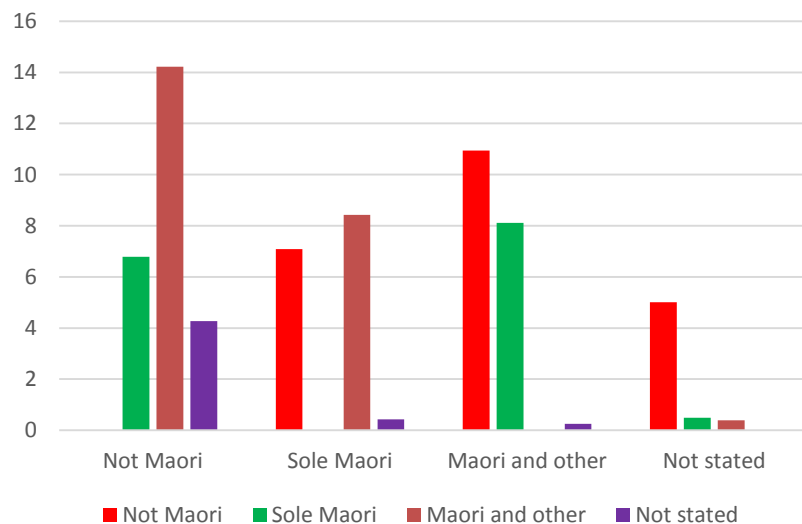


- With a conventional (total) population projection, only three components of population change need to be projected:
 1. Fertility (births)
 2. Migration (internal and international)
 3. Mortality or survivorship (deaths)
- But with ethnic projections, because ethnicity is self-determined and people can change their ethnic identity, we also need to project changes in ethnicity within the population (inter-ethnic mobility)

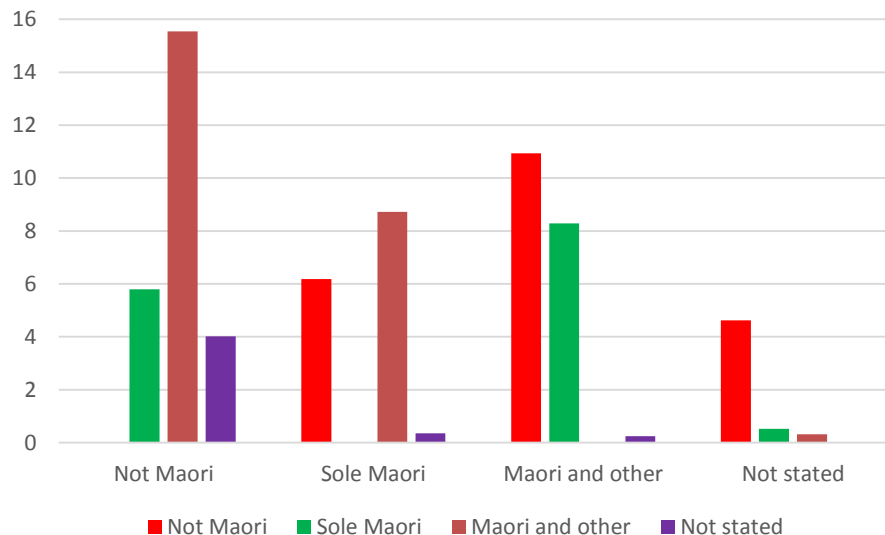
Example of inter-ethnic mobility: Māori 2006-2013 (6.5%)



2006-2013 male



2006-2013 female



Distribution of those who changed category (percent)

The horizontal axis main label indicates how people were self-identified in 2013; the vertical % bars for each main label indicate what percentage of a 2006 ethnicity group (indicated by bar colour) had changed ethnicity by 2013

Source: Robert Didham (2015), *Ethnic mobility*.

Where does inter-ethnic mobility fit in our model?



- Our intention is to incorporate inter-ethnic mobility within a gravity model framework
 - This is the same framework we currently use for internal migration (and similar to that used for international migration)
- The challenge is in incorporating both forms of mobility (spatial and inter-ethnic) in the same model
 - An open question is whether we:
 1. Move migrants first, then project inter-ethnic movements
 2. Project inter-ethnic movements first, then move migrants
 3. Do both at the same time
- Option (3) is unlikely given available data, but there little steer in the international literature on which option of (1) or (2) should be preferred – though most use (1)
 - If transition rates vary by region, then the order is consequential

International comparison



- Ethnic projections are relatively new
- There is much uncharted or unresolved territory
 - Selection of ethnic groups (or aggregates) to project; Inter-ethnic mobility; Ethnicity breakdown of international migration; Gross internal migration by ethnicity
- International examples
 - USA: Hogan/Ortman/Colby (2015) projecting diversity
 - Native/foreign born; race; broad ethnic groups; gross foreign born & net native born international migration, no inter-ethnic mobility
 - UK: Rees/Clark/Norman/Wohland/Lomax (2015)
 - NewETHPOP, 12 groups, 389 LAs, gross internal migration, no inter-ethnic mobility
 - France: Rallu (2016)
 - National population of migrants by country of birth aged 65 and over; sex/age/origin-specific migration rates, national survival rates
 - Australia: Wilson (2016)
 - National projections of Australia's indigenous population; rates of identification change; indigenous net overseas migration is zero; impact of mixed partnering



Comparing methodologies

	Statistics New Zealand	CaDDANZ
Signalling of uncertainty	Deterministic (Low, Medium, High)	Probabilistic (distribution of outcomes)
Projection horizon	25 years (2013-2038)	ditto
Definition of groups	Individuals can belong to more than one group	Having multiple ethnicities is possible, but individuals belong to only one group
Aggregation	Sum of the groups is greater than the total population	Sum of groups equals total population
Sub-national areas	16 regional council areas, 67 territorial authority areas and 21 Auckland local board areas	16 regional council areas
Fertility	By area: female fertility by single ethnicity; male paternity to generate multiple ethnicities; loss factors compensate for ethnicity overcounting	By area: female fertility by multiple ethnicities
Sex ratio at birth	105.5 males per 100 females for all areas and ethnic groups	ditto
Mortality	By area: mortality rates by age and sex	ditto
Migration	By area: no split between internal & international; net migration level by age, sex and ethnicity; sum of area net migration may not equal assumed national net migration	By area: gross internal and international migration level by ethnicity through gravity model; assumed age-sex distribution; sum of area net internal migration equals zero
Inter-ethnic mobility	National net inter-ethnic mobility rates by age	By area: gross inter-ethnic mobility by age and sex (?)
Interdependence of assumptions	Low (high) projection = low (high) fertility, paternity, net migration, net inter-ethnic mobility; high (low) mortality	Rates are drawn from multivariate distributions with covariances estimated by past patterns

Where to from here?



- We need to determine a (final) set of ethnic groups (of single/multiple ethnicities) to include in the model
 - In part this will be determined by data constraints (small groups will not be able to be feasibly modelled)
- We will then be further developing the gravity modelling framework to consider inter-ethnic mobility
 - One of the main challenges in this is defining inter-ethnic ‘distance’ (as distance is a key parameter in gravity models)
- We expect to have produced prototype stochastic subnational ethnic projections sometime in 2017



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