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New and Updated Scenarios for 2018-base Population, Family and Household, and Labour Force Projections for the Waikato Region, 2018-2068

Michael P. Cameron [a,b]

[a] School of Accounting, Finance and Economics, University of Waikato

[b] Te Ngira – Institute for Population Research, University of Waikato

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Any queries regarding this report should be addressed to:

AProf. Michael P. Cameron
School of Accounting, Finance and Economics
University of Waikato
Private Bag 3105
Hamilton 3240
E-mail: mcam@waikato.ac.nz
Phone: +64 7 858 5082.

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Disclaimer

The projections discussed in this report are based on historical data and assumptions made by the authors. While the authors believe that the projections can provide plausible and indicative inputs into planning and policy formulation, the reported numbers cannot be relied upon as providing precise forecasts of future population levels. The University of Waikato will not be held liable for any loss suffered through the use, directly or indirectly, of the information contained in this report.

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Executive Summary

This brief report summarises the two new 2018-base demographic projection scenarios at the territorial authority (TA) level, detailing the changes in assumptions necessary to run the new scenarios, and presenting the results for the four FutureProof partner TAs (Waikato District, Matamata-Piako District, Hamilton City, and Waipā District). The projection model and assumptions are substantially the same as the high-variant projection from an earlier set of demographic projections. However, the two scenarios differ in important ways: (1) Scenario 1 updates the international migration flows assumptions to account for new data available since the previous projections (as the actual data show lower than projected international migration); and Scenario 2 combines the lower international migration flows with a higher assumed net internal migration outward from Auckland.

Overall, Scenario 1 results in projected populations that are only slightly lower than the original high-variant projection for all FutureProof partner TAs. In contrast, Scenario 2 is higher than the original high-variant projection over the entire projection period, as the additional net internal migration from Auckland more than offsets the reduction in net international migration.

Scenario 1 is likely to be slightly more plausible than Scenario 2, because the assumption of sustained higher out-migration from Auckland is unlikely to hold over the long term. Moreover, factors such as the extension of the Waikato Expressway, and spill-over growth from Auckland into the north of Waikato District and further afield, are already implicitly captured within the gravity model of internal migration, which was originally calibrated based on data from 2008 to 2018. Re-calibrating the model to drive additional migration out of Auckland likely overestimates the migration flows from Auckland.

At the SA2 level, the Scenario 1 projection is likely to be substantially similar to the original high-variant SA2 level projection. The Scenario 2 projection is likely to lead growth cells in each TA to fill out somewhat faster, and lead to greater infill development. Future population projections, following the release of data from the 2023 Census, will be better able to capture these and other new developments at the local level.

1. Introduction

In 2021, the University of Waikato developed new 2018-base demographic projections using a newly-developed multi-regional cohort component model that covers the whole of New Zealand (except the Chatham Islands Territory), and incorporates separate components of population change for internal migration flows (based on a gravity model) and international migration flows (immigration and emigration) (Cameron and Cochrane, 2021a). The new demographic projections model builds on a long stream of earlier projections by the same research team (Cameron and Cochrane, 2014; 2015; 2016; Cameron *et al*., 2007; 2008).

However, the original 2018-base demographic projections were based on data available at the time of their development, which was also a time of considerable demographic uncertainty, brought about by the coronavirus pandemic and associated border closures and local lockdowns. Subsequently, the Waikato Regional Council (WRC), on behalf of the FutureProof partner councils (Waikato District, Hamilton City, Waipā District, and Matamata-Piako District), approached the University of Waikato to develop two new demographic projection scenarios:

1. A scenario using the previous high projection assumptions, but updating the international migration flows assumptions to account for new data available since the previous projections (as the actual data show lower than projected international migration) (Scenario 1); and
2. A scenario combining the assumptions in Scenario 1 above, and assuming higher net internal migration outward from Auckland (which will include all other territorial authorities (TAs) but with a focus on the TAs in the Future Proof sub-region (Scenario 2).

This brief report summarises the two new demographic projection scenarios at the TA level, detailing the changes in assumptions necessary to run the new scenarios, and presenting the results for the four FutureProof partner TAs. The results for other TAs are reported in the associated Microsoft Excel appendix to this report, and are also available from the author on request. The new projection scenarios are compared, in terms of total population, with the latest Statistics New Zealand (SNZ) population estimates, the SNZ 2018-base subnational population projections, [1] and the previous set of projections developed by the University of Waikato.

[1] We note that SNZ is due to release updated subnational population projections in mid-December 2022. These are not included in this report, as they were unavailable at the time of its writing.

The remainder of the report is structured as follows:

- Section 2 briefly summarises the data and methodology used in preparing the new demographic projection scenarios, highlighting differences from the earlier 2018-base demographic projections;
- Section 3 presents and briefly discusses the TA level demographic (population, family and household, and labour force) projections for the four FutureProof partner TAs; and
- Section 4 concludes with a discussion of the plausibility of the new scenarios relative to the original suite of scenarios, and brief commentary on how the TA-level differences in the projections may translate to the SA2 level.

2. Data and Methods

Details on the data and methods employed in the original 2018-base demographic projections are outlined in the report on those projections (Cameron and Cochrane, 2021a). In the two new demographic projection scenarios, the model that is employed is identical – a cohort-component model with an embedded gravity model to determine directional internal migration flows (as separate from international migration flows).

The base populations are the same as those used in the original demographic projections scenarios, and there are no changes to fertility or mortality assumptions (in the new scenarios, both fertility and mortality are assumed to follow the high projection assumptions, i.e. high fertility and low mortality).

The internal migration gravity model is the same as that employed in the original demographic projections. However, in Scenario 2, the model was recalibrated in order to increase the size of total migration outflows from Auckland by approximately 16 percent. This represents an approximately one standard deviation increase in internal migration flows from Auckland to each of the FutureProof partner TAs. The resulting migration flows projected for 2022 are summarised in Table 1, for the original high-variant projection and the new Scenario 2. For Waikato District, the resulting internal migration flows from Auckland are projected to be 17 percent higher. For the other TAs, the internal migration flows from Auckland are projected to be 15.2 percent higher. We also note that the internal migration flows from Auckland are higher for *every* other TA in the country, due to the recalibration of the model. The age-specific

migration profile for each TA, which converts total migration into age-sex-specific migration flow, was assumed to be the same as for the original demographic projections.

Table 1: Projected internal migration flows from Auckland to each FutureProof partner TA, 2022

TA	Original High-Variant Projection	Scenario 2 Projection	Percentage Difference
Waikato	2730	3193	+17.0%
Matamata-Piako	544	626	+15.2%
Hamilton	2684	3092	+15.2%
Waipā	761	877	+15.2%

As noted in Cameron and Cochrane (2021a), international migration flows represent the most challenging component of population change to project, due to the extensive uncertainty over their future trajectory. This was exacerbated by additional uncertainty about the trajectory of international migration flows, continuing border closures, and long-term migration policy settings, at the time that the original demographic projections were produced. In the end, a fairly simple ARIMA(0,1,1) time series model (simple exponential smoothing) was adopted for projecting international migration flows (both emigration and immigration). In both of the new demographic projection scenarios, we use exactly the same model, but updated to account for two additional years of data on annual emigration and immigration flows.

Figure 1 illustrates the actual and projected national-level immigration flows, including the original projection scenarios and the new scenario (labelled "High Projection (Revised)"). Actual immigration flows did not drop nearly as much as originally projected in 2021. However, the difference between the revised high projection and the original high projection from 2022 onwards is almost imperceptible. Figure 2 shows the corresponding data for emigration (although the new scenario in this case is labelled "Low Projection (Revised)". For emigration, the decline in flows was much less than originally projected. Comparing the original low emigration projection with the revised projection, the difference is around 40,000 greater emigration than projected in 2021, and the projected emigration flows do not equalise between the original low projection and the revised low projection until the 2030s. Figure 4 shows the data for net international migration (immigration minus emigration). The combination of a very similar trajectory for immigration between the original scenario and the revised scenario, with

much greater emigration in the revised scenario, results in much lower net international migration than originally projected. Similar to the case for emigration, the revised projection does not converge to the original high net international migration scenario until the 2030s. We note that the projection for immigration and emigration flows are for New Zealand as a whole. These flows were apportioned between TAs in the same manner as for the original demographic projections. Also, similar to the case for internal migration, the age-specific migration profile for each TA, which converts total migration into age-sex-specific migration flow, was assumed to be the same as for the original demographic projections

Figure 1: Actual and projection national-level immigration flows, 2002-2068

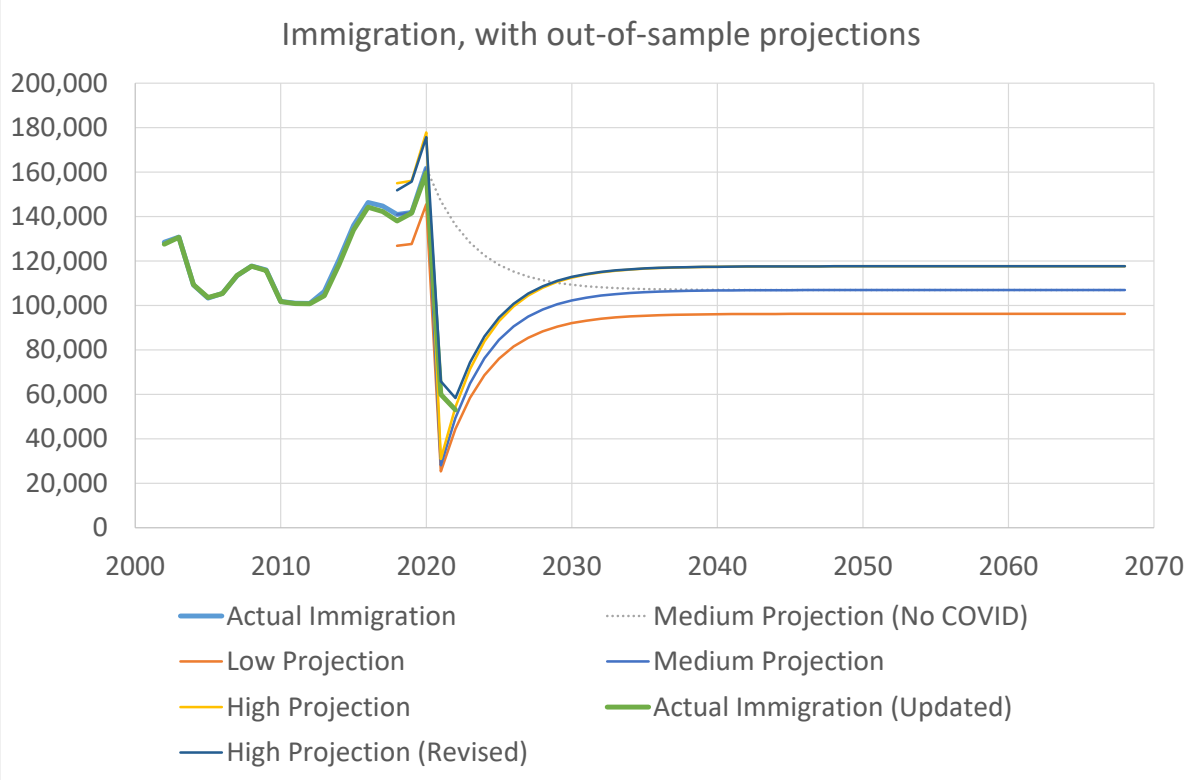


Figure 2: Actual and projection national-level emigration flows, 2002-2068

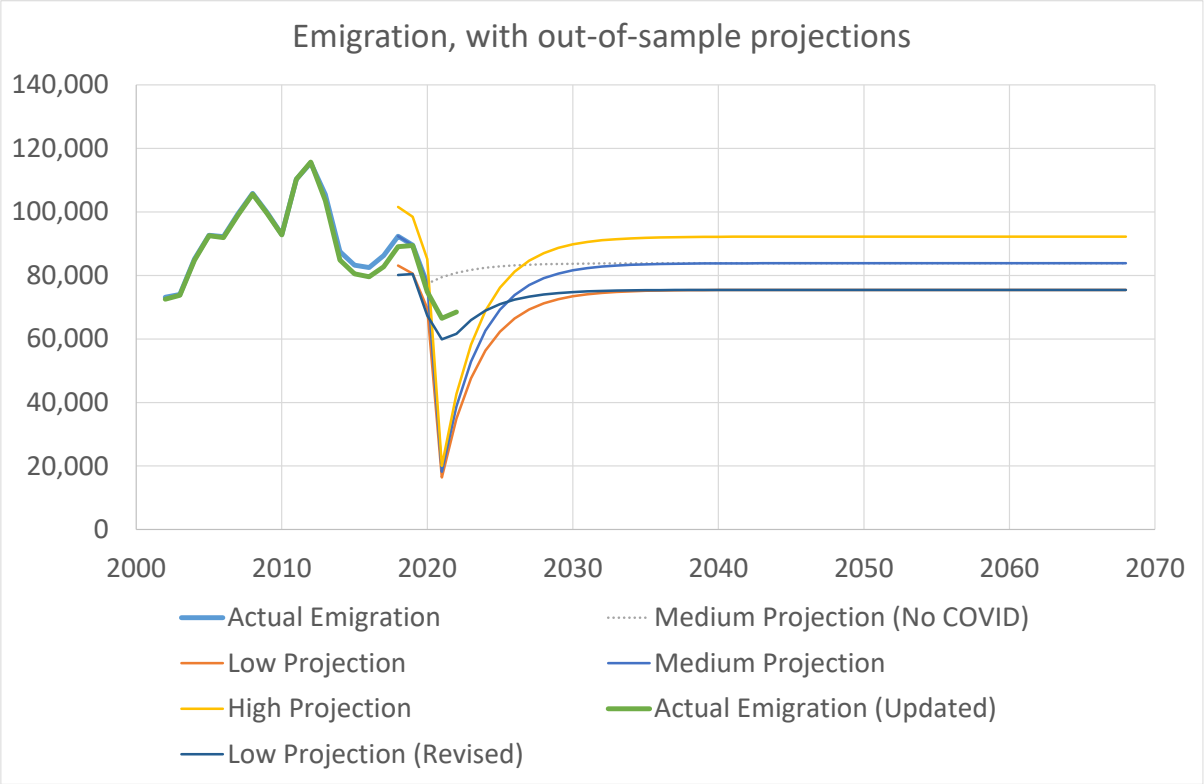
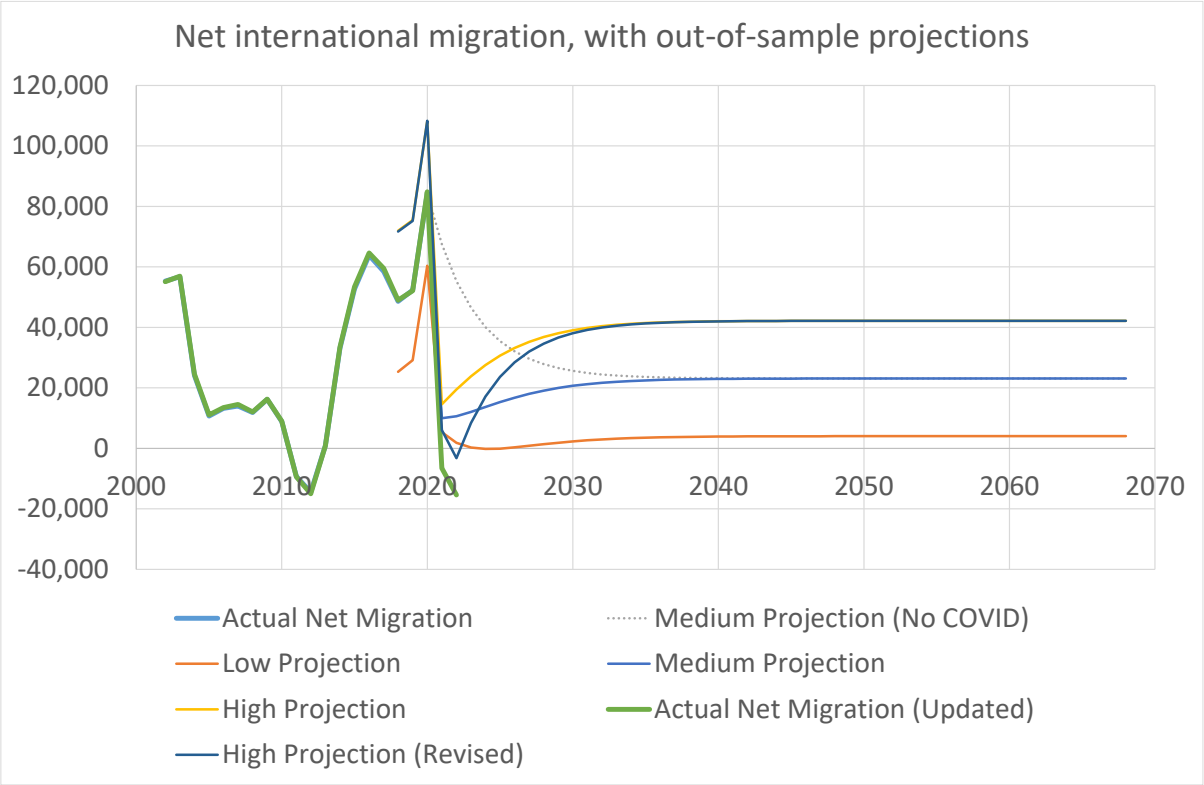


Figure 3: Actual and projection national-level net international migration flows, 2002-2068



The methods and assumptions used to convert the population projections into family and household projections, and labour force projections, are the same as for the original demographic projections (Cameron and Cochrane, 2021a). Thus, these projections simply incorporate the changes in net internal migration and net international migration flows applied at the level of the population projections.

To summarise, the changes in assumptions for the two new scenarios are: (1) higher net internal migration from Auckland in Scenario 2; and (2) lower net international migration (due to slightly lower immigration, and much higher emigration) in both Scenario 1 and Scenario 2.

3. Population Projections

This section briefly presents the population projections for each FutureProof partner TA. The family and household, and labour force, projections are not presented or discussed here, but are included in a Microsoft Excel appendix to this report. However, we note here that the difference between the original high-variant population projection and the new scenarios is replicated for both family and household, and labour force, projections. We also note that population projection scenarios should be viewed as *possible* futures, based on known assumptions about future fertility, mortality and net migration, and should not be interpreted as forecasts of future population.

All projections are presented in diagrammatic form – tables showing the population projections numerically are included in the Microsoft Excel appendix to the report. Each figure also includes a comparison with the latest Statistics New Zealand (SNZ) population estimates, the SNZ 2018-base subnational population projections, and the original projections developed by the University of Waikato. This report does not include breakdowns of population change by component, or figure representing the change in the age distribution of the population. For the new scenarios, these figures are similar to the original projections, which can be found in Cameron and Cochrane (2021a).

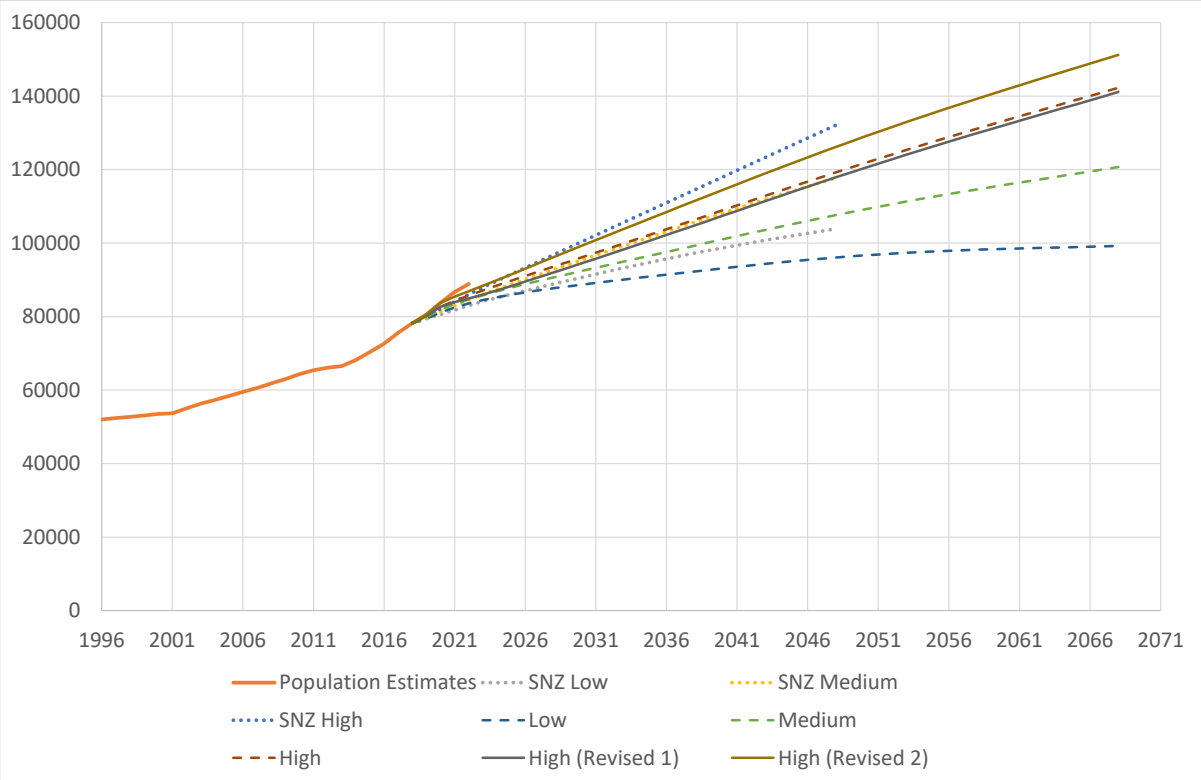
3.1 New Demographic Projection Scenarios for Waikato District

Figure 4 presents the 2018-base population projections and new projection scenarios for Waikato District to 2068, along with historical population estimates from Statistics New

Zealand back to 1996. The 2018-base Statistics New Zealand (SNZ) projections are also included for comparison.

The June 2018 population estimate (base population) for Waikato District is 78,200. Under the original high-variant scenario, the population increases throughout the projection period, reaching 142,269 in 2068. In Scenario 1 (lower net international migration only), the population increase is slightly lower than for the original high-variant scenario, with the population reaching 141,106 in 2068. In Scenario 2 (lower net international migration, with higher internal migration flows out of Auckland), the population increase is much higher, with the population reaching 151,211 in 2068. In comparison, the SNZ 2018-base medium-variant projection is similar to the Waikato high-variant projection and the Scenario 1 projection, with the SNZ high-variant somewhat higher than the Scenario 2 projection.

Figure 4: Population projections for Waikato District, 2018-2068

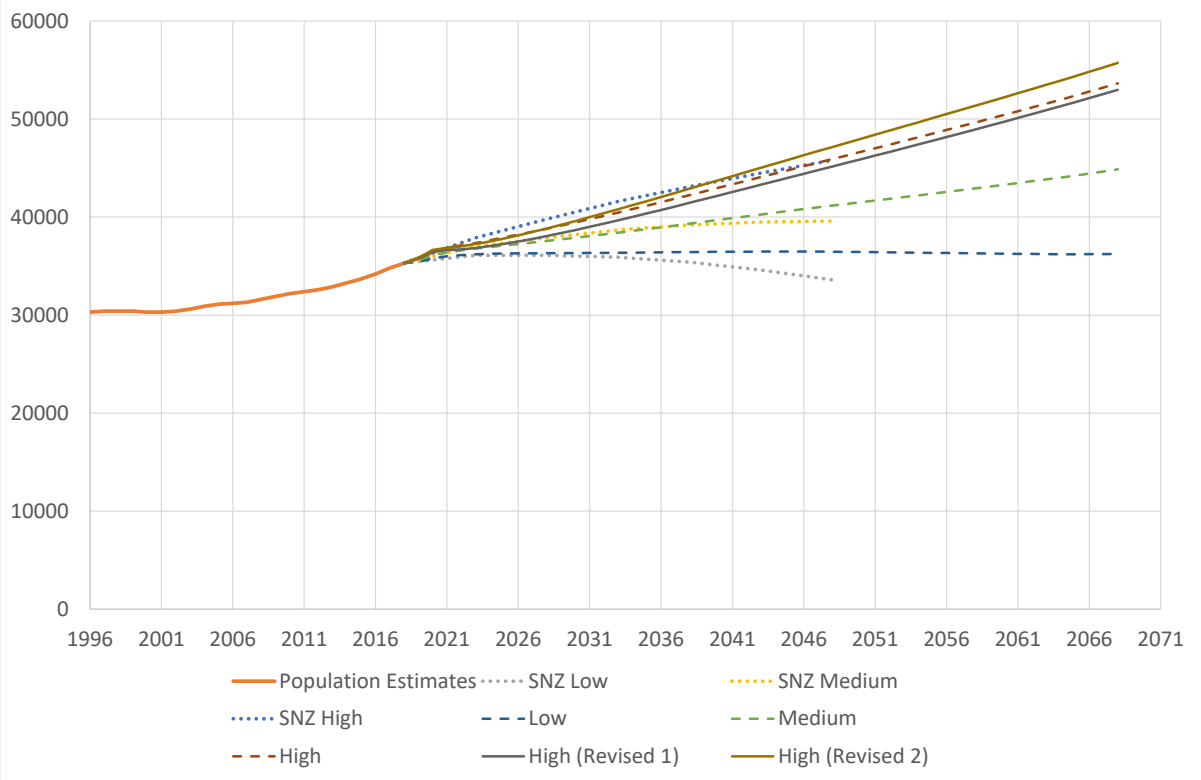


3.2 New Demographic Projection Scenarios for Matamata-Piako District

Figure 5 presents the 2018-base population projections and new projection scenarios for Matamata-Piako District to 2068, along with historical population estimates from Statistics New Zealand back to 1996. The 2018-base Statistics New Zealand (SNZ) projections are also included for comparison.

The June 2018 population estimate (base population) for Matamata-Piako District is 35,300. Under the original high-variant scenario, the population increases throughout the projection period, reaching 53,639 in 2068. In Scenario 1 (lower net international migration only), the population increase is slightly lower than for the original high-variant scenario, with the population reaching 52,990 in 2068. In Scenario 2 (lower net international migration, with higher internal migration flows out of Auckland), the population increase is much higher, with the population reaching 55,733 in 2068. In comparison, the SNZ 2018-base high-variant projection is initially slightly higher than the Scenario 2 projection, but then falls away and becomes more similar to the original high-variant projection and the Scenario 1 projection by the mid-2040s.

Figure 5: Population projections for Matamata-Piako District, 2018-2068

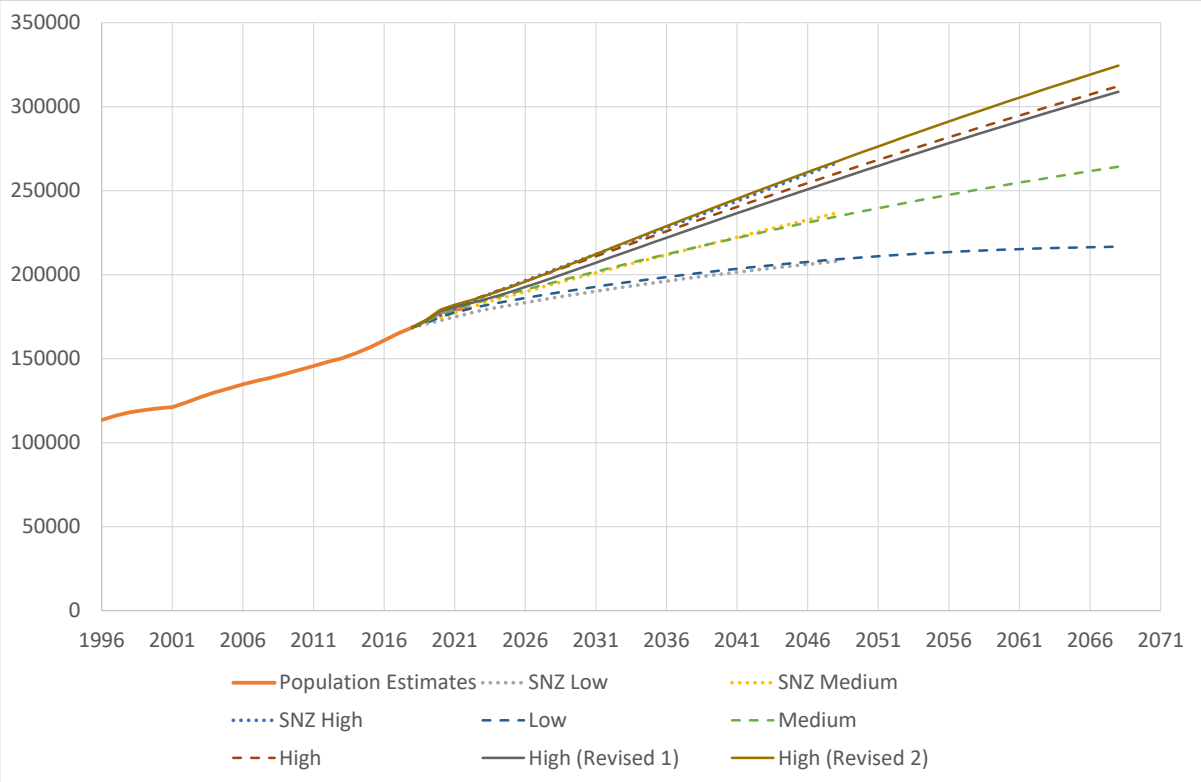


3.3 New Demographic Projection Scenarios for Hamilton City

Figure 6 presents the 2018-base population projections and new projection scenarios for Hamilton City to 2068, along with historical population estimates from Statistics New Zealand back to 1996. The 2018-base Statistics New Zealand (SNZ) projections are also included for comparison.

The June 2018 population estimate (base population) for Hamilton City is 168,600. Under the original high-variant scenario, the population increases throughout the projection period, reaching 312,161 in 2068. In Scenario 1 (lower net international migration only), the population increase is slightly lower than for the original high-variant scenario, with the population reaching 308,886 in 2068. In Scenario 2 (lower net international migration, with higher internal migration flows out of Auckland), the population increase is much higher, with the population reaching 324,392 in 2068. In comparison, the SNZ 2018-base high-variant projection is very similar to the Scenario 2 projection.

Figure 6: Population projections for Hamilton City, 2018-2068

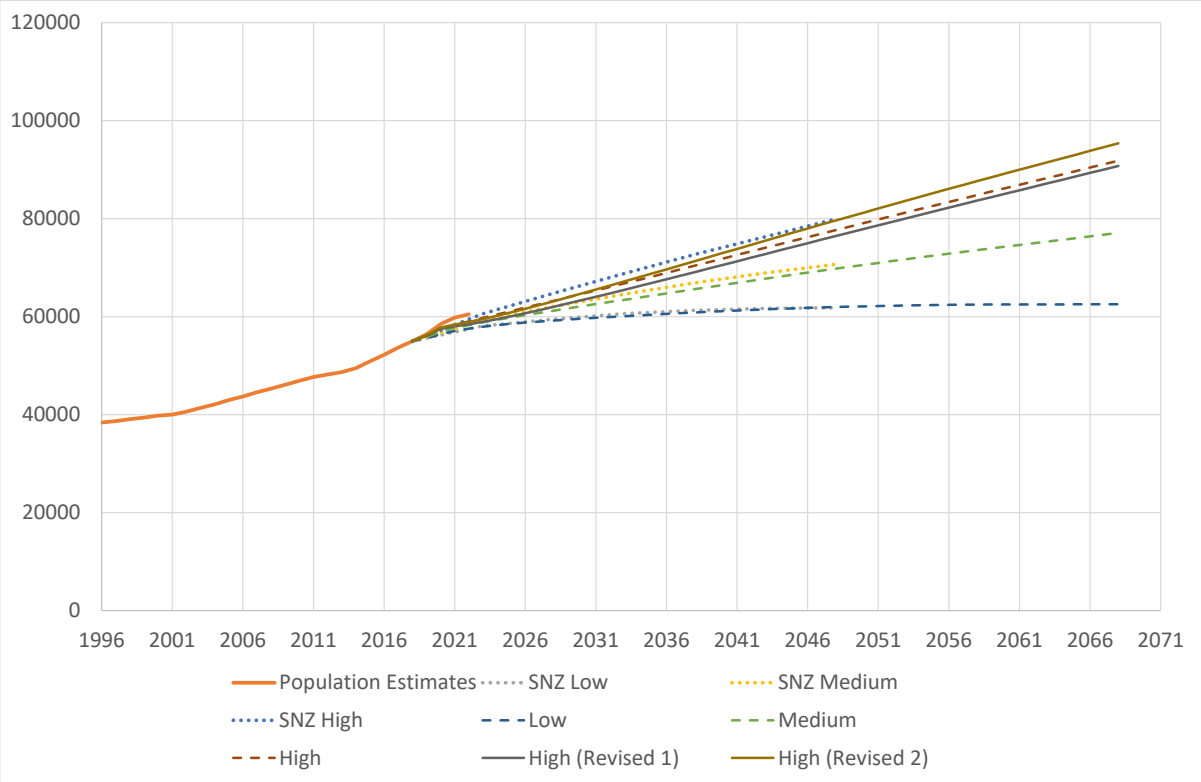


3.4 New Demographic Projection Scenarios for Waipā District

Figure 7 presents the 2018-base population projections and new projection scenarios for Waipā District to 2068, along with historical population estimates from Statistics New Zealand back to 1996. The 2018-base Statistics New Zealand (SNZ) projections are also included for comparison.

The June 2018 population estimate (base population) for Waipā District is 55,000. Under the original high-variant scenario, the population increases throughout the projection period, reaching 91,836 in 2068. In Scenario 1 (lower net international migration only), the population increase is slightly lower than for the original high-variant scenario, with the population reaching 90,770 in 2068. In Scenario 2 (lower net international migration, with higher internal migration flows out of Auckland), the population increase is much higher, with the population reaching 95,382 in 2068. In comparison, the SNZ 2018-base high-variant projection is slightly higher than the Scenario 2 projection.

Figure 7: Population projections for Waipā District, 2018-2068

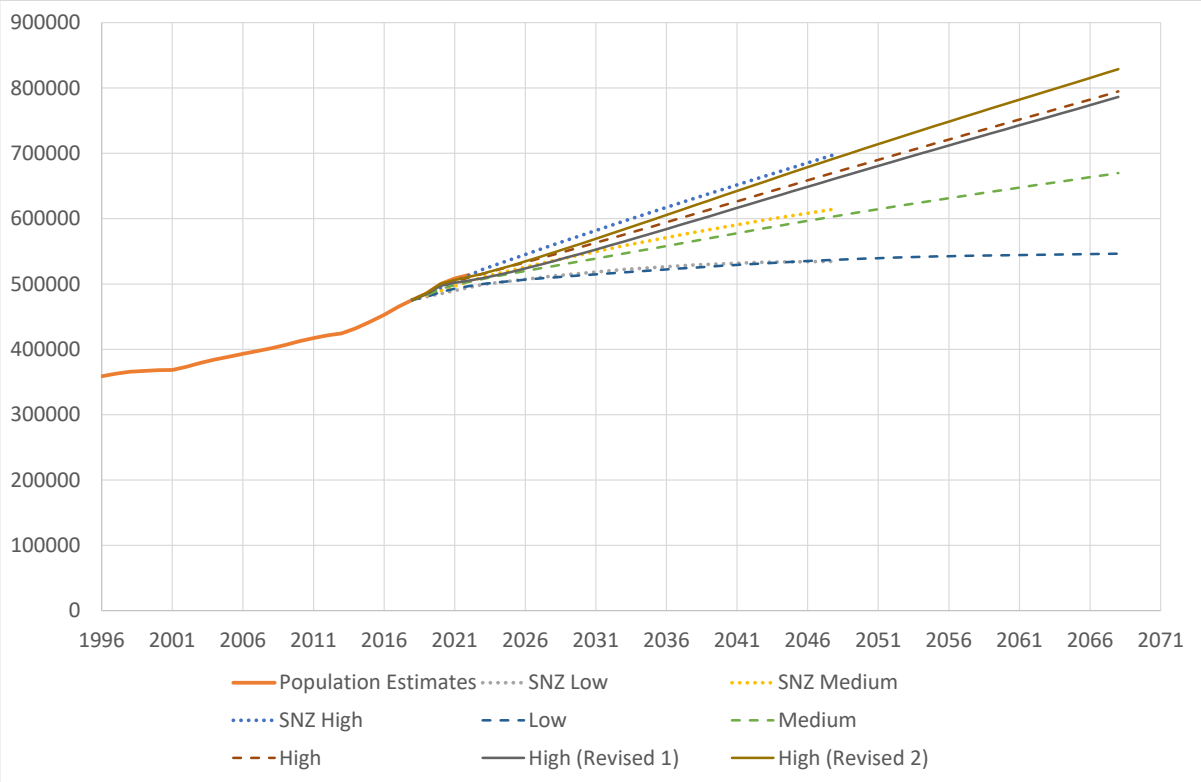


3.5 New Demographic Projection Scenarios for the Waikato Region in Total

Figure 8 presents the 2018-base population projections and new projection scenarios for the Waikato Region to 2068, along with historical population estimates from Statistics New Zealand back to 1996. The 2018-base Statistics New Zealand (SNZ) projections are also included for comparison.

The June 2018 population estimate (base population) for the Waikato Region is 475,600. Under the original high-variant scenario, the population increases throughout the projection period, reaching 794,638 in 2068. In Scenario 1 (lower net international migration only), the population increase is slightly lower than for the original high-variant scenario, with the population reaching 786,229 in 2068. In Scenario 2 (lower net international migration, with higher internal migration flows out of Auckland), the population increase is much higher, with the population reaching 828,700 in 2068. In comparison, the SNZ 2018-base high-variant projection is slightly higher than the Scenario 2 projection.

Figure 8: Population projections for the Waikato region, 2018-2068



4. Discussion and Conclusion

This report briefly summarised the two new demographic projections scenarios at the TA level, detailing the changes in assumptions necessary to run the new scenarios, and presenting the results for the four FutureProof partner TAs. The two new projection scenarios incorporated lower net international migration (Scenario 1), and lower net international migration coupled with higher internal outmigration from Auckland (Scenario 2).

In general, comparing the new scenarios with the original population projections, Scenario 1 is only slightly lower than the original high-variant projection. This is unsurprising given that, while there is a large initial difference in net international migration between the two scenarios, this difference dissipates over time as both projections converge to the same long-run annual immigration and emigration values. Moreover, the large initial difference in net international migration flows is spread across all TAs in New Zealand, and not specific to the FutureProof partner TAs, or the TAs in the wider Waikato Region. In contrast, Scenario 2 is higher than the original high-variant projection over the entire projection period. That is because the lower net international migration is more than offset by higher internal out-migration from Auckland to all other TAs, and in particular to Waikato District. However, it would be easy to overstate the significance of the difference in the scenarios. By 2068, the projected population of Waikato District is 6.3 percent higher in Scenario 2 than in the original high-variant projection. For all of the other FutureProof partner TAs, the difference is 3.9 percent.

All demographic projection scenarios are plausible, in the sense that there is a possibility (albeit vanishingly small) that the assumptions that a particular scenario is based on could be those that obtain in reality. A more useful approach though is to consider the whole suite of projection scenarios, within which each demographic projection scenario is interpreted as one from the many possible futures that could be realised for the population (and family and households, and the labour force). As noted in the report on the original projection scenarios (Cameron and Cochrane, 2021a), the original medium-variant scenario represents approximately the centre of the distribution of all potential scenarios generated with this model and within the plausible distribution of assumptions. The interval between the low-variant scenario and the high-variant scenario represents approximately a 67 percent projection interval of all potential scenarios generated with this model and within the plausible distribution of assumptions (Stoto, 1983; Alho et al., 2008; Cameron et al., 2021). That means that approximately 33 percent of the time, the actual future population can be expected to be either higher than the high-variant projection, or lower than the low-variant projection.

The Scenario 1 projection is within the interval between the original low-variant scenario and the original high-variant scenario, and likely remains very plausible. However, the Scenario 2 projection is outside of that interval. On its own, that doesn't necessarily mean that the scenario is implausible. However, a careful consideration of the assumptions that drive Scenario 2 is warranted. While 15 percent higher net internal migration out of Auckland is not extreme in any particular year, sustaining that high a level of out-migration over a long period, such as the fifty-year projection period for the current projections, reduces the plausibility of this scenario. The internal migration gravity model is already based on data from the periods 2008-13 and

2013-18, so already picks up the recent dynamics of internal migration movements within New Zealand. That includes the extension of the Waikato Expressway, and spill-over growth from Auckland into the north of Waikato District and further afield. These aspects of population change will already be implicitly captured by the parameters within the gravity model. Re-calibrating the model to drive additional migration out of Auckland likely overestimates the long-run inter-regional (and inter-TA) population dynamics. For that reason, Scenario 2 is likely to be less plausible on the whole than Scenario 1 or any of the original projection scenarios.

The projection scenarios summarised in this report were prepared at the TA level. The differences in the scenarios at the TA level will have implications at the SA2 level. At the SA2 level, the Scenario 1 projection is likely to be substantially similar to the original high-variant SA2 level projection, given their overall similarity. The Scenario 2 projection is likely to lead growth cells in each TA to fill out somewhat faster, and lead to greater infill development. Greater infill will also be consistent with the recent National Policy Statement on Urban Development, which enables greater urban residential redevelopment in Waikato District, Hamilton City, and Waipā District. This greater infill has not been captured in the earlier SA2-level projections (Cameron and Cochrane, 2021b), and thus the relative contributions of infill and new development to SA2-level populations cannot be determined with any certainty. Future population projections, following the release of data from the 2023 Census, will be better able to capture these and other new developments at the local level.

Demographic projections should be regularly re-calibrated to new and changing demographic drivers. In this case, the new projection scenarios summarised in this report capture actual and expected future changes in internal and international migration flows. Migration is the most volatile of the components of population change, and the one that is typically most sensitive to changes in demographic drivers, government policy changes, and unexpected economic shocks. Thus, because it is not possible to perfectly foresee all of the factors that might impact on future population, demographic projections should be regularly updated in order to provide policy-makers and other decision-makers to better understand the demographic changes that they are faced with, and the sources and factors that underlie those demographic changes. Additional scenarios, such as those summarised in this report, provide additional depth that will assist with decision-making.

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