Session 6: Data sources, details, and derivations (oh my!)

Cat Anderson

Outline

Data sources:

- Tongan data:
  - Census data
  - Births data
  - Deaths data
  - Migration data

$$P_{t+1} = P_t + \underbrace{B - D}_{\text{Natural increase}} + \underbrace{I - O}_{\text{Net migration}}$$

- 3rd party sources
- Open up for discussion

Tongan data sources

Tongan data sources – census data

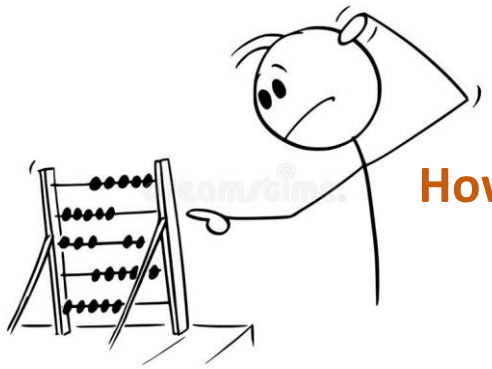
Census data is a count of the number of people where Tonga is their **place of usual residence.**

Census data is a good starting point for calculating the **base population.**

Census count is as at midnight of the census date, 30th November.

Base population counts can be:

- Annually
- Half-yearly
- Quarterly
- Monthly
- Lots of different dates!

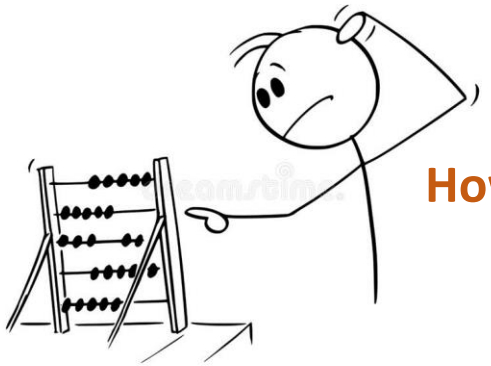


How do we derive the population at a different date?

Tongan data sources – births and deaths data

Births data can be grouped by **date of birth** OR **date of registration.**

Deaths data can be grouped by **date of death** OR **date of registration.**



Time between registration and occurrence varies

How do we account for a lag between occurrence and registration?

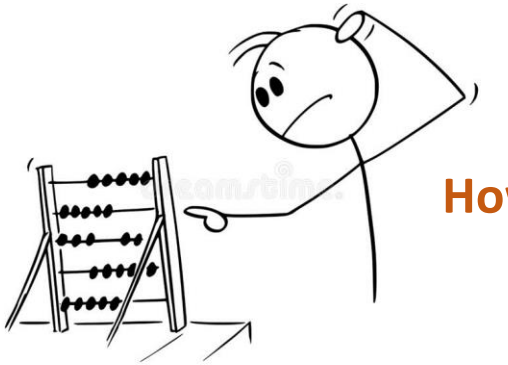
- Release data after complete
- Revise previous data
- Add x% to initial data

Tongan data sources – migration data

Net migration is comprised of two components: **arrivals** and **departures**.

Migration data for defined groups of travellers can follow different trends.

Migration data may need to be broken down into finer detail.



How do we derive data at a finer granularity?

- Applying trends/ratios
- Interpolation
- Modelling

Methods of Interpolation

Interpolation is often based on **mathematical formulae**, or the application of **coefficients**.

$$P^{2018}_{10\text{-}14} = P^{2013}_{5\text{-}9} + (M\text{-}D)^{2014}_{6\text{-}10} + (M\text{-}D)^{2015}_{7\text{-}11} + (M\text{-}D)^{2016}_{8\text{-}12} + (M\text{-}D)^{2017}_{9\text{-}13} + (M\text{-}D)^{2018}_{10\text{-}14}$$

where P = Population at 30 June
M = Net Migration for year ending 30 June
D = Deaths for year ending 30 June

Karup-King third-difference formula:

Karup-King splits the whole population into 3 “panels” (first, middle, last), and then applies a coefficient depending on the position of the single year in its group

- E.g. For the 5-9 year group, 5 is the first position, 6 is the second, 7 is the third etc.

	First panel		
Interpolated Subgroup	G1	G2	G3
1st	0.344	-0.208	0.064
2nd	0.248	-0.056	0.008
3rd	0.176	0.048	-0.024
4th	0.128	0.104	-0.032
5th	0.104	0.112	-0.016

	Middle panel		
Interpolated Subgroup	G1	G2	G3
1st	0.064	0.152	-0.016
2nd	0.008	0.224	-0.032
3rd	-0.024	0.248	-0.024
4th	-0.032	0.224	0.008
5th	-0.016	0.152	0.064

	Last panel		
Interpolated Subgroup	G1	G2	G3
1st	-0.016	0.112	0.104
2nd	-0.032	0.104	0.128
3rd	-0.024	0.048	0.176
4th	0.008	-0.056	0.248
5th	0.064	-0.208	0.344

Methods of Interpolation

Sprague fifth-difference formula:

Sprague splits the whole population into 5 “panels” (first, second from first, middle, second from last, last), and then applies a coefficient depending on the position of the single year in its group

- E.g. For the 5-9 year group, 5 is the first position, 6 is the second, 7 is the third etc.

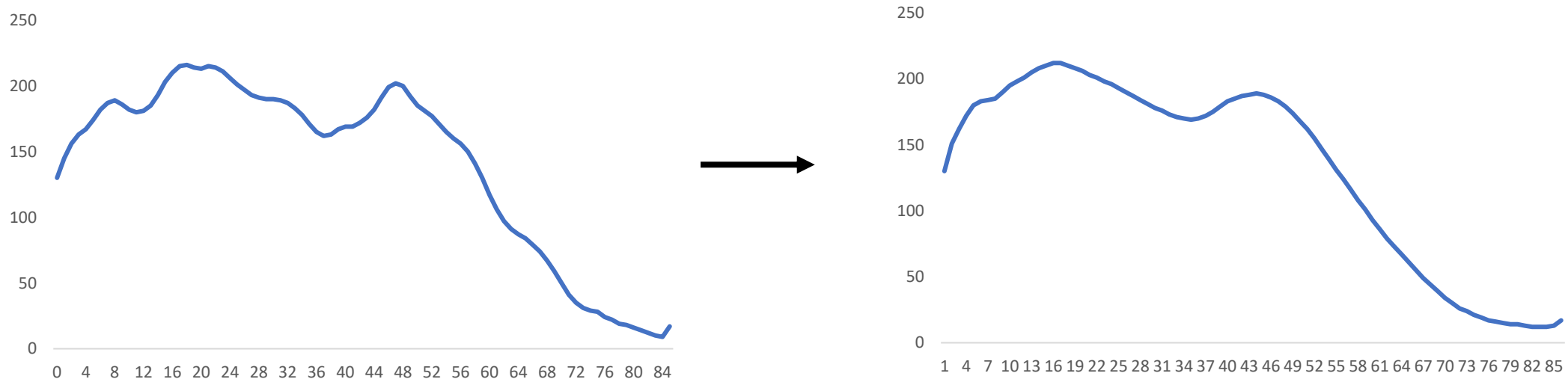
Other formulae:

- Beers Ordinary Formula
- Beers Modified Formula
- Grabill modification of Sprague formula
- And many more!

	First panel				
Interpolated Subgroup	G1	G2	G3	G4	G5
1st	0.3616	-0.2768	0.1488	-0.0336	
2nd	0.2640	-0.0960	0.0400	-0.0080	
3rd	0.1840	0.0400	-0.0320	0.0080	
4th	0.1200	0.1360	-0.0720	0.0160	
5th	0.0704	0.1968	-0.0848	0.0176	
	Second from first panel				
Interpolated Subgroup	G1	G2	G3	G4	G5
1st	0.0336	0.2272	-0.0752	0.0144	
2nd	0.008	0.232	-0.048	0.008	
3rd	-0.008	0.216	-0.008	0	
4th	-0.016	0.184	0.04	-0.008	
5th	-0.0176	0.1408	0.0912	-0.0144	
	Middle panel				
Interpolated Subgroup	G1	G2	G3	G4	G5
1st	-0.0128	0.0848	0.1504	-0.024	0.0016
2nd	-0.0016	0.0144	0.2224	-0.0416	0.0064
3rd	0.0064	-0.0336	0.2544	-0.0336	0.0064
4th	0.0064	-0.0416	0.2224	0.0144	-0.0016
5th	0.0016	-0.024	0.1504	0.0848	-0.0128
	Second from last panel				
Interpolated Subgroup	G1	G2	G3	G4	G5
1st		-0.0144	0.0912	0.1408	-0.0176
2nd		-0.008	0.04	0.184	-0.016
3rd		0	-0.008	0.216	-0.008
4th		0.008	-0.048	0.232	0.008
5th		0.0144	-0.0752	0.2272	0.0336
	Last panel				
Interpolated Subgroup	G1	G2	G3	G4	G5
1st		0.0176	-0.0848	0.1968	0.0704
2nd		0.016	-0.072	0.136	0.12
3rd		0.008	-0.032	0.04	0.184
4th		-0.008	0.04	-0.096	0.264
5th		-0.0336	0.1488	-0.2768	0.3616

Smoothing

Smoothing techniques can be used to make the data flow more smoothly from one age group to the next, and reducing random variation.



Smoothing techniques include:

- Rectangular smoothing
- Exponential smoothing
- Moving averages

Summary

- We are estimating the population at a point in time
- Our components may be incomplete
    - Base – some people may be missing from the census counts
    - Births – some may take a while to be registered or remain unregistered
    - Deaths – some may take a while to be registered or remain unregistered
    - Migration – some travellers may be missing from the data; migrants may be swamped in number by short-term travellers
- Our components may have errors
    - Respondent errors
    - Processing errors
    - Missing and incomplete responses
- All components of population estimation potentially need adjustment

Stats NZ
Tatauranga Aotearoa

www.stats.govt.nz

United Nations

population.un.org

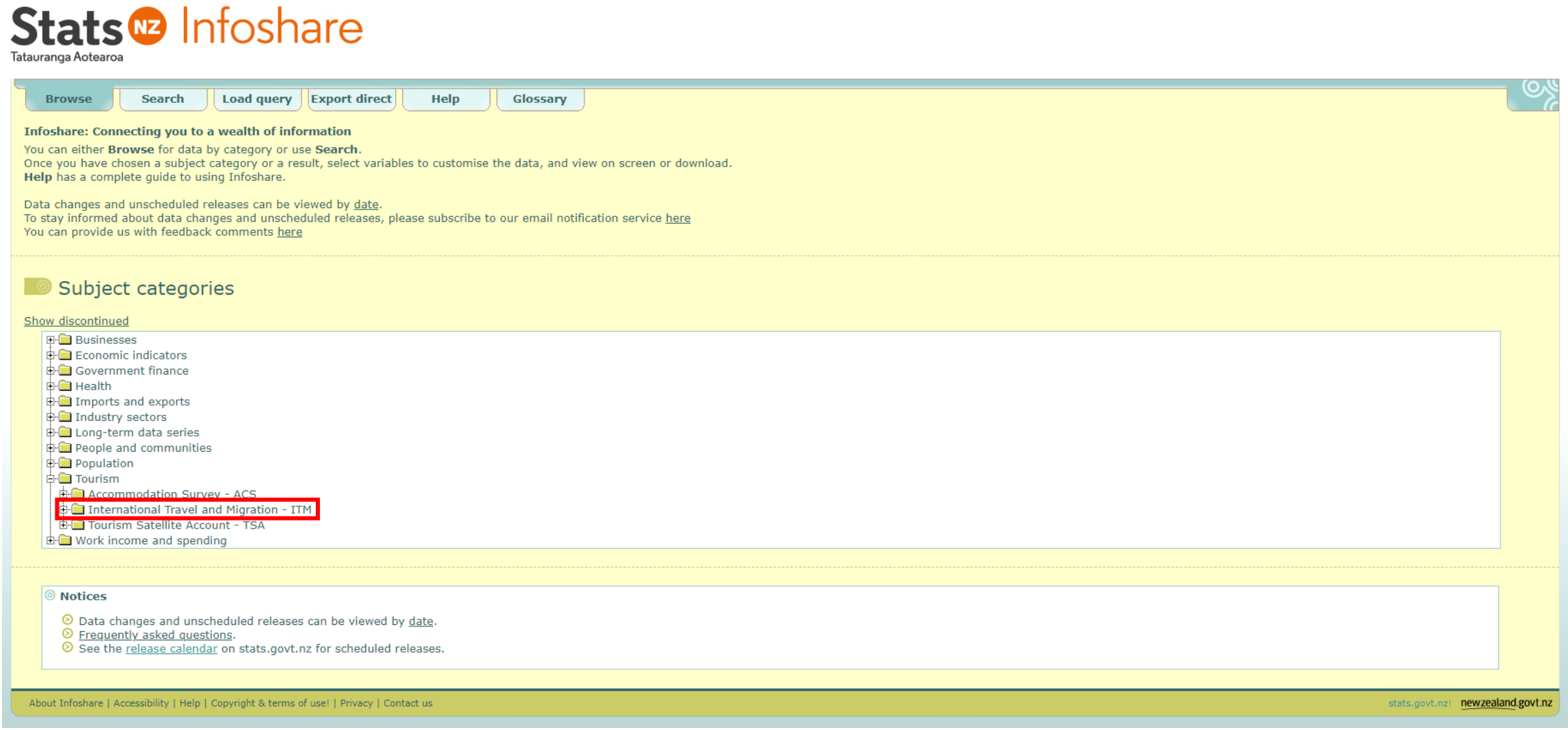
www.unescap.org/stat/data

Pacific Community
Communauté du Pacifique

www.spc.int

3rd party data sources

Extracting information from Infoshare (Stats NZ)



Extracting information from Infoshare (Stats NZ)

- International Travel and Migration - ITM
  - Estimated migrant arrivals by citizenship, visa type and CLPR, 12/16-month rule (Annual-Apr)
  - Estimated migrant arrivals by citizenship, visa type and CLPR, 12/16-month rule (Annual-Aug)
  - Estimated migrant arrivals by citizenship, visa type and CLPR, 12/16-month rule (Annual-Dec)
  - Estimated migrant arrivals by citizenship, visa type and CLPR, 12/16-month rule (Annual-Feb)
  - Estimated migrant arrivals by citizenship, visa type and CLPR, 12/16-month rule (Annual-Jan)
  - Estimated migrant arrivals by citizenship, visa type and CLPR, 12/16-month rule (Annual-Jul)
  - Estimated migrant arrivals by citizenship, visa type and CLPR, 12/16-month rule (Annual-Jun)
  - Estimated migrant arrivals by citizenship, visa type and CLPR, 12/16-month rule (Annual-Mar)
  - Estimated migrant arrivals by citizenship, visa type and CLPR, 12/16-month rule (Annual-May)
  - Estimated migrant arrivals by citizenship, visa type and CLPR, 12/16-month rule (Annual-Nov)
  - Estimated migrant arrivals by citizenship, visa type and CLPR, 12/16-month rule (Annual-Oct)
  - Estimated migrant arrivals by citizenship, visa type and CLPR, 12/16-month rule (Annual-Sep)
  - Estimated migrant arrivals by citizenship, visa type and CLPR, 12/16-month rule (Monthly)
  - Estimated migrant arrivals by citizenship, visa type and CLPR, 12/16-month rule (Qrtly-Mar/Jun/Sep/Dec)
  - Estimated migrant arrivals by visa type, 12/16-month rule (Annual-Apr)
  - Estimated migrant arrivals by visa type, 12/16-month rule (Annual-Aug)
  - Estimated migrant arrivals by visa type, 12/16-month rule (Annual-Dec)
  - Estimated migrant arrivals by visa type, 12/16-month rule (Annual-Feb)
  - Estimated migrant arrivals by visa type, 12/16-month rule (Annual-Jan)
  - Estimated migrant arrivals by visa type, 12/16-month rule (Annual-Jul)
  - Estimated migrant arrivals by visa type, 12/16-month rule (Annual-Jun)
  - Estimated migrant arrivals by visa type, 12/16-month rule (Annual-Mar)
  - Estimated migrant arrivals by visa type, 12/16-month rule (Annual-May)
  - Estimated migrant arrivals by visa type, 12/16-month rule (Annual-Nov)
  - Estimated migrant arrivals by visa type, 12/16-month rule (Annual-Oct)
  - Estimated migrant arrivals by visa type, 12/16-month rule (Annual-Sep)
  - Estimated migrant arrivals by visa type, 12/16-month rule (Monthly)
  - Estimated migrant arrivals by visa type, 12/16-month rule (Qrtly-Mar/Jun/Sep/Dec)
  - Estimated migrant arrivals to Australia by CLPR, citizenship and birthplace (Qrtly-Mar/Jun/Sep/Dec)
  - Estimated migration by direction and country of citizenship, 12/16-month rule (Annual-Apr)
  - Estimated migration by direction and country of citizenship, 12/16-month rule (Annual-Aug)
  - Estimated migration by direction and country of citizenship, 12/16-month rule (Annual-Dec)
  - Estimated migration by direction and country of citizenship, 12/16-month rule (Annual-Feb)
  - Estimated migration by direction and country of citizenship, 12/16-month rule (Annual-Jan)
  - Estimated migration by direction and country of citizenship, 12/16-month rule (Annual-Jul)
  - Estimated migration by direction and country of citizenship, 12/16-month rule (Annual-Jun)
  - Estimated migration by direction and country of citizenship, 12/16-month rule (Annual-Mar)
  - Estimated migration by direction and country of citizenship, 12/16-month rule (Annual-May)
  - Estimated migration by direction and country of citizenship, 12/16-month rule (Annual-Nov)
  - Estimated migration by direction and country of citizenship, 12/16-month rule (Annual-Oct)
  - Estimated migration by direction and country of citizenship, 12/16-month rule (Annual-Sep)
  - Estimated migration by direction and country of citizenship, 12/16-month rule (Monthly)
  - Estimated migration by direction and country of citizenship, 12/16-month rule (Qrtly-Mar/Jun/Sep/Dec)
  - Estimated migration by direction, 12/16-month rule (Annual-Apr)

Extracting information from Infoshare (Stats NZ)

Stats NZ Tatauranga Aotearoa

Stats NZ Tatauranga Aotearoa Infoshare

Browse | Search | Load query | Export direct | Help | Glossary

Select variables

Group: International Travel and Migration - ITM

Table: Estimated migration by direction and country of citizenship, 12/16-month rule (Annual-Dec)

Mark your selections and choose between table on screen and file format. Help
For variables marked you need to select at least one value.

Travel Direction
Select all | Clear selection |
Total: 3. Selected: 2
Arrivals
Departures
Net
Search Find Text start

Citizenship
Select all | Clear selection |
Total: 46. Selected: 1
New Zealand
Australia
Fiji
Tonga
Samoa
China, People's Republic of
Hong Kong (Special Administrative Region
Search Find Text start

Estimate, 12/16-month rule
Select all | Clear selection |
Total: 4. Selected: 1
Estimate
Seasonally adjusted
Trend
Standard error of estimate
Search Find Text start

Time
Select all | Clear selection |
Total: 21. Selected: 1
2021
2020
2019
2018
2017
2016
2015
Search Find Text start

Number of selected data rows 1
Number of selected data columns 2
Number of selected cells 2
Table on screen is limited to 50,000 cells.
Downloaded files are limited to 100,000 cells.

Options Help Table on screen Help Go

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Extracting information from Infoshare (Stats NZ)

Stats NZ Tatauranga Aotearoa

Stats NZ Tatauranga Aotearoa Infoshare

Browse | Search | Load query | Export direct | Help | Glossary

View table

Group: International Travel and Migration - ITM

Table: Estimated migration by direction and country of citizenship, 12/16-month rule (Annual-Dec)

Edit table: --Please select-- Save table: Table on screen

Footnotes | Information | Print table | Help | Status flags

Estimated migration by direction and country of citizenship, 12/16-month rule (Annual-Dec)		
	Estimate	
	2021	
	Arrivals	Departures
Tonga	276	687

Table information:
Units:
Number, Magnitude = Units

Footnotes:
The standard error indicates the uncertainty of the provisional migration estimate. For example, the 95 percent confidence interval is +/-1.96 standard errors.
These intervals reflect the model uncertainty, not the extent of future revisions to provisional data. Standard errors are non-additive.
Owing to rounding, individual figures may not sum to stated totals.

Symbols:
.. figure not available
C: Confidential
E: Early Estimate
P: Provisional
R: Revised
S: Suppressed

Status flags are not displayed

Table reference:
ITM454AA

Last updated:
20 January 2023 10:45am

Source: Statistics New Zealand
Contact: Information Centre
Telephone: 0508 525 525
Email:info@stats.govt.nz

Questions?

Malo ‘aupito!

Thanks for listening!

Session 6 (cont.): Practical exercises for deriving data

Cat Anderson & Kim Dunstan

Exercise 1: Deriving Births and Deaths Data

Time between registration and occurrence varies

→ Need to account for lag

Lag Data: "Workshop Materials – Births and Deaths lag data.xlsx"

- 2020H2 has incomplete data.
  1. Using the lag data, calculate a plausible births estimate for 2020H2, for males, females, and total sex.
  2. Do the same for deaths x sex x SYOA in 2021H1.

- No data is available for 2021.
  1. Using previous year and half-year trends, calculate plausible births estimates for 2021H1 and 2021H2.
  2. Do the same for deaths x sex x SYOA in 2021H2.

Exercise 2: Deriving SYOA from 5-year age groups

We have data for sex and SYOA for base population, births, and deaths.

We only have data for sex for migration.

- Derive SYOA data for arrivals and departures for each sex (male, female, total) using:
    1. Previous year trends for males, females, and total sex (“2019 SYOA data.xlsx”).
    2. The Karup-King method of interpolation (“Component Data.xlsx”, sheet = “Karup-King”).
    3. The Sprague method of interpolation (“Component Data.xlsx”, sheet = “Sprague”).

- Calculate net migration x sex x SYOA for all periods.