Taylor Fry

Valuation of the Social Housing System

As at 30 June 2016

Appendices

This report has been produced for the Ministry of Social Development

APPENDIX A GUIDE TO APPENDICES

The Appendices provide much of the technical detail of our approach. The following table describes the various appendices supplied with the report.

#	Title	Description
A	Guide to Appendices	Describes appendices
B	Further background	Provides links to some background reading referred to in the report
C	Projection assumptions	Details on assumptions used, including inflation, discounting, and unemployment rate
D	Data supplied	Describes the datasets provided by MSD and used in the valuation
E	Valuation scope	Details the various payment types valued
F	Details on modelling approach	Provides further detail on the types of models used in the valuation and their explicit parameterisation
G	Model Coefficients *[Separate Excel file]*	Excel file of parameters for each of the models
H	Actual versus expected comparisons for 2015/16	Tables of actual versus expected experience for the year to 30 June 2016
I	Change in liability from the previous valuation	A segment level reconciliation of the changes from the 2015 to 2016 valuation results
J	Sensitivity analysis	A segment level detailing of sensitivity to key models, rental growth, unemployment, discounting and inflation rates
K	Other one-way tables	Showing current client liability across a number of different dimensions
L	Projected number of clients and payments *[Separate Excel file]*	Tables detailing the projected number of people in each state and their corresponding payments, over the duration of the projection

APPENDIX B FURTHER BACKGROUND

B.1 Benefit system valuations

The benefit system valuation is referred to extensively in the report, Taylor Fry has been working in partnership with MSD and the Treasury since June 2011 to help develop the investment approach in the benefit system. Further detail is provided in our initial report on the feasibility of an investment approach, and in the five following valuations of the benefit system. All six reports are publicly available on MSD's website.

- **Feasibility study:** http://www.msd.govt.nz/documents/about-msd-and-our-work/publications-resources/evaluation/taylor-fry-ia-feasibility/taylor-fry-feasibility-of-an-ia-for-welfare-report.pdf
- **2011 benefit system valuation:** http://www.msd.govt.nz/about-msd-and-our-work/newsroom/media-releases/2012/valuation-report.html
- **2012 benefit system valuation:** https://www.msd.govt.nz/about-msd-and-our-work/newsroom/media-releases/2013/taylor-fry-welfare-valuation.html
- **2013 benefit system valuation:** https://www.msd.govt.nz/about-msd-and-our-work/newsroom/media-releases/2014/taylor-fry-welfare-valuation.html
- **2014 benefit system valuation:** http://www.msd.govt.nz/about-msd-and-our-work/newsroom/media-releases/2015/reforms-succeed.html
- **2015 benefit system valuation:** https://www.msd.govt.nz/about-msd-and-our-work/newsroom/media-releases/2016/2015-valuation-of-the-benefit-system-for-working-age-adults.html

The 2016 benefit system valuation report, not public at the time of writing, is also particularly relevant; it covers the same valuation date as the housing valuation and the integrated nature of the models mean that many of the comments in that report are relevant to the housing valuation population.

B.2 Social housing and the Social Housing Reform Programme (SHRP)

The report forms part of the New Zealand Government's SHRP. Further background, including cabinet papers, is available at

http://www.socialhousing.govt.nz/

There are also a significant number of publications and statistics regarding the social housing system available on both the MSD and HNZC websites. Interested readers can visit:

- http://housing.msd.govt.nz/information-for-housing-providers/register/index.html
- http://www.hnzc.co.nz/publications/

B.3 Work and Income regions, and Territorial Local Authorities

MSD has 11 regions that it uses to manage its services. These are summarised in the figure below.

Figure B.1 Work and income regions

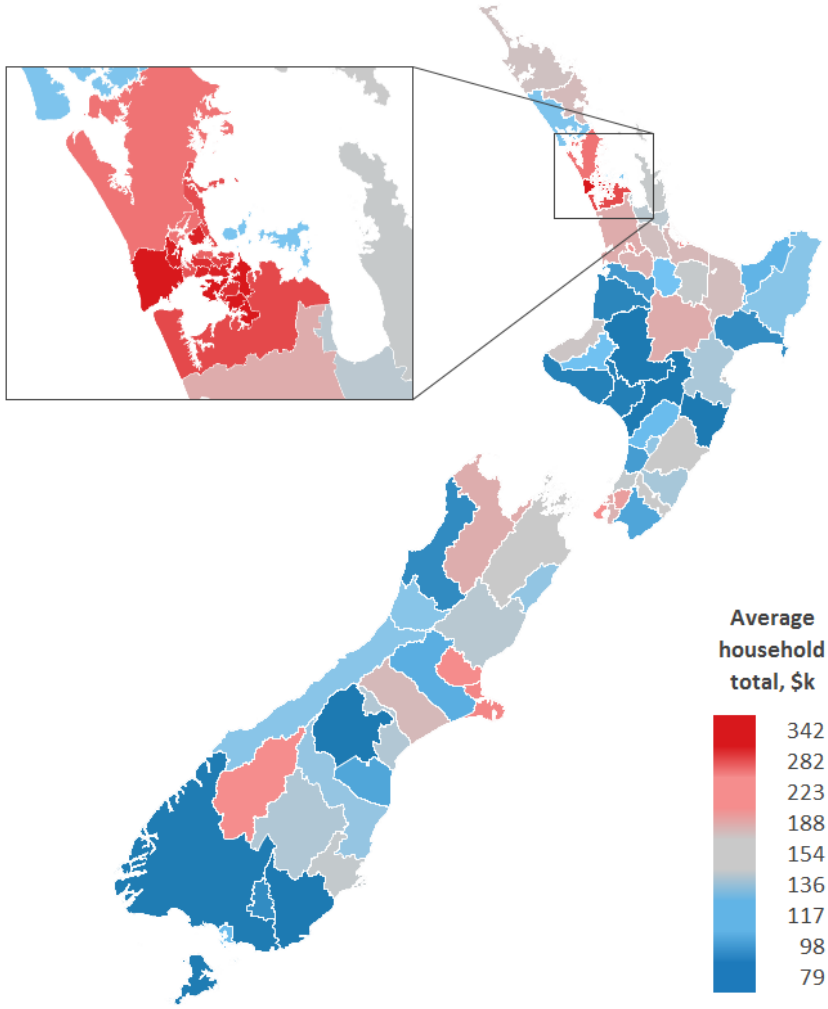
To give a more granular view of location, this valuation models at a Territorial Local Authority (TLA) level (65 of them, excluding Auckland). Auckland is a single TLA, and we split this into the 20 local boards. These are all listed in the table below with their associated Work and Income region. Note that these groupings are not entirely exact; some TLAs straddle more than one Work and Income region.

Table B.1 List of TLAs and Boards plus associated Work & Income region

Region	TLA/Board	Region	TLA/Board	Region	TLA/Board
Northland	Far North District	Central	Horowhenua District	Southern	Invercargill City
Northland	Kaipara District	Central	Kapiti Coast District	Southern	Mackenzie District
Northland	Whangarei District	Central	Manawatu District	Southern	Queenstown-Lakes District
Waikato	Hamilton City	Central	Masterton District	Southern	Southland District
Waikato	Hauraki District	Central	Palmerston North City	Southern	Timaru District
Waikato	Matamata-Piako District	Central	Rangitikei District	Southern	Waimate District
Waikato	Thames-Coromandel District	Central	Carterton District	Southern	Waitaki District
Waikato	Waikato District	Central	South Wairarapa District	Auckland	Albert-Eden Local Board Area
Waikato	Waipa District	Central	Tararua District	Auckland	Devonport-Takapuna Local Board Area
Bay of Plenty	Kawerau District	Wellington	Lower Hutt City	Auckland	Franklin Local Board Area
Bay of Plenty	Opotiki District	Wellington	Porirua City	Auckland	Henderson-Massey Local Board Area
Bay of Plenty	Rotorua District	Wellington	Upper Hutt City	Auckland	Hibiscus and Bays Local Board Area
Bay of Plenty	South Waikato District	Wellington	Wellington City	Auckland	Howick Local Board Area
Bay of Plenty	Taupo District	Nelson	Buller District	Auckland	Kaipatiki Local Board Area
Bay of Plenty	Tauranga City	Nelson	Grey District	Auckland	Mangere-Otahuhu Local Board Area
Bay of Plenty	Western Bay of Plenty District	Nelson	Kaikoura District	Auckland	Manurewa Local Board Area
Bay of Plenty	Whakatane District	Nelson	Marlborough District	Auckland	Maungakiekie-Tamaki Local Board Area
East Coast	Central Hawke's Bay District	Nelson	Nelson City	Auckland	Orakei Local Board Area
East Coast	Gisborne District	Nelson	Tasman District	Auckland	Otara-Papatoetoe Local Board Area
East Coast	Hastings District	Nelson	Westland District	Auckland	Papakura Local Board Area
East Coast	Napier City	Canterbury	Ashburton District	Auckland	Puketapapa Local Board Area
East Coast	Wairoa District	Canterbury	Christchurch City	Auckland	Rodney Local Board Area
Taranaki	New Plymouth District	Canterbury	Hurunui District	Auckland	Upper Harbour Local Board Area
Taranaki	Otorohanga District	Canterbury	Selwyn District	Auckland	Waiheke Local Board Area
Taranaki	Ruapehu District	Canterbury	Waimakariri District	Auckland	Waitakere Ranges Local Board Area
Taranaki	South Taranaki District	Southern	Central Otago District	Auckland	Waitemata Local Board Area
Taranaki	Stratford District	Southern	Clutha District	Auckland	Whau Local Board Area
Taranaki	Waitomo District	Southern	Dunedin City		
Taranaki	Wanganui District	Southern	Gore District		

The figure below shows the division of New Zealand into TLA and board.

Figure B.2 TLA and board boundaries, shading indicates average lifetime housing cost for those in social housing



APPENDIX C PROJECTION ASSUMPTIONS

C.1 Inflation assumptions

We model historical payments in June 2016 dollars. To do this, we inflate older payments to current levels using the historical Consumer Price Index (CPI) as shown in Table C.1.1 below (this is consistent with benefit rate increases). We also apply inflation to our projected payments in line with Treasury forecasts, presented in Table C.1.2. Superannuation payments to those aged over 65 are currently pegged to changes in average weekly earnings (AWE). Tables C.1.1 and C.1.2 also show the historical and projected AWE increases relative to CPI. As discussed the main body of the report we have assumed that growth in rents will be faster than AWE growth in the short to medium term. The historical and projected rental growth assumptions as a difference to CPI are also presented in Tables C.1.1 and C.1.2.

Table C.1.1 Historic CPI, AWE and rental growth increases

Date	CPI Yearly increase	CPI Scale up factor to June 2016	AWE yearly increase relative to CPI	Rental growth yearly increase (National), relative to CPI
01-Apr-95	4.0%	1.52	-1.5%	4.2%
01-Apr-96	2.2%	1.49	0.7%	5.8%
01-Apr-97	1.8%	1.46	2.1%	2.9%
01-Apr-98	1.3%	1.44	0.2%	-0.4%
01-Apr-99	-0.2%	1.45	2.2%	-1.3%
01-Apr-00	1.5%	1.42	-0.1%	-1.4%
01-Apr-01	3.2%	1.38	-0.8%	-2.5%
01-Apr-02	2.6%	1.35	3.1%	1.8%
01-Apr-03	2.6%	1.31	0.7%	4.4%
01-Apr-04	1.6%	1.29	2.0%	5.2%
01-Apr-05	2.8%	1.26	0.2%	1.0%
01-Apr-06	3.3%	1.22	1.1%	0.4%
01-Apr-07	2.4%	1.19	3.1%	3.5%
01-Apr-08	3.5%	1.15	1.2%	3.3%
01-Apr-09	2.9%	1.12	2.7%	-1.6%
01-Apr-10	1.9%	1.09	-1.2%	0.2%
01-Apr-11	4.5%	1.05	-0.4%	-0.7%
01-Apr-12	1.5%	1.03	2.2%	1.9%
01-Apr-13	0.9%	1.02	1.9%	2.2%
01-Apr-14	1.5%	1.01	1.8%	2.6%
01-Apr-15	0.3%	1.01	2.3%	4.4%
01-Apr-16	0.5%	1.00	1.6%	4.6%

Notes:
(a) Increases to CPI and AWE apply at the first of April each year, as done by Work and Income
(b) Increases to rent are applied quarterly.

Table C.1.2 Projected CPI, AWE and rental growth

Date	CPI Yearly increase	CPI Scale up factor	AWE yearly increase relative to CPI	Rental growth yearly increase (National), relative to CPI
01-Apr-16		1.00		
01-Apr-17	1.47%	1.01	-0.10%	0.87%
01-Apr-18	1.47%	1.03	0.13%	1.02%
01-Apr-19	1.47%	1.04	0.30%	1.10%
01-Apr-20	1.47%	1.06	0.78%	1.48%
01-Apr-21	1.47%	1.08	0.91%	1.51%
01-Apr-22	1.47%	1.09	1.35%	1.84%
01-Apr-23	1.47%	1.11	1.49%	1.89%
01-Apr-24	1.47%	1.12	1.49%	1.79%
01-Apr-25	1.47%	1.14	1.49%	1.69%
01-Apr-26	1.47%	1.16	1.49%	1.58%
01-Apr-27	1.47%	1.17	1.49%	1.50%
01-Apr-28	1.47%	1.19	1.49%	1.49%
01-Apr-29	1.47%	1.21	1.49%	1.49%
01-Apr-30	1.47%	1.23	1.49%	1.49%
01-Apr-31	1.47%	1.24	1.49%	1.49%
01-Apr-32	1.47%	1.26	1.49%	1.49%
01-Apr-33	1.47%	1.28	1.49%	1.49%
01-Apr-34	1.49%	1.30	1.47%	1.47%
01-Apr-35	1.51%	1.32	1.47%	1.47%
01-Apr-36	1.54%	1.34	1.46%	1.46%
01-Apr-37	1.56%	1.36	1.47%	1.47%
01-Apr-38	1.59%	1.38	1.47%	1.47%
01-Apr-39	1.61%	1.41	1.48%	1.48%
01-Apr-40	1.64%	1.43	1.47%	1.47%
01-Apr-41	1.66%	1.45	1.48%	1.48%
01-Apr-42	1.69%	1.48	1.47%	1.47%
01-Apr-43	1.71%	1.50	1.48%	1.48%
01-Apr-44	1.73%	1.53	1.48%	1.48%
01-Apr-45	1.76%	1.55	1.47%	1.47%
01-Apr-46	1.78%	1.58	1.48%	1.48%
01-Apr-47	1.81%	1.61	1.47%	1.47%
01-Apr-48	1.83%	1.64	1.48%	1.48%
01-Apr-49	1.86%	1.67	1.47%	1.47%
01-Apr-50	1.88%	1.70	1.48%	1.48%
01-Apr-51	1.91%	1.74	1.47%	1.47%
01-Apr-52	1.93%	1.77	1.48%	1.48%
01-Apr-53	1.96%	1.80	1.47%	1.47%
01-Apr-54	1.98%	1.84	1.48%	1.48%
01-Apr-55	2.00%	1.88	1.48%	1.48%
01-Apr-56	2.00%	1.91	1.50%	1.50%
01-Apr-57	2.00%	1.95	1.50%	1.50%
Later	2.00%		1.50%	1.50%

Notes:
(a) CPI and AWE increases assumed to apply at 1 April, consistent with current practice.
(b) Rent increases applied quarterly.
(c) CPI assumptions based on Treasury projections of CPI as at Jun-16, in provided spreadsheet *disc-rates-jun16.xls*

Table C.1.3 Historical regional rental growth rates (3 bedrooms) by region

Date	Yearly 3 bedroom rental growth rate					
	Northland	Auckland	Waikato	Bay of Plenty	East coast	Taranaki
30-Jun-94	11.0%	7.3%	3.7%	6.2%	2.6%	3.9%
30-Jun-95	4.9%	12.7%	8.8%	5.9%	5.8%	4.9%
30-Jun-96	3.6%	10.0%	5.0%	3.7%	4.7%	1.1%
30-Jun-97	8.4%	2.3%	7.0%	2.0%	8.4%	-0.3%
30-Jun-98	4.0%	-3.2%	-0.9%	2.8%	-1.1%	0.8%
30-Jun-99	-3.2%	-3.4%	-0.2%	-0.9%	-0.7%	-0.2%
30-Jun-00	0.4%	0.8%	-1.7%	0.7%	-0.6%	-1.6%
30-Jun-01	0.5%	0.2%	-0.2%	1.6%	0.4%	-0.6%
30-Jun-02	1.9%	7.1%	4.5%	2.8%	3.4%	4.9%
30-Jun-03	3.5%	7.3%	4.4%	1.3%	5.9%	8.1%
30-Jun-04	10.4%	4.7%	10.6%	12.4%	8.3%	6.9%
30-Jun-05	8.7%	2.1%	6.8%	6.7%	6.1%	9.4%
30-Jun-06	11.9%	1.3%	7.2%	8.1%	5.6%	8.8%
30-Jun-07	7.4%	5.5%	6.6%	7.3%	6.0%	7.5%
30-Jun-08	4.2%	5.5%	4.7%	4.2%	5.2%	8.8%
30-Jun-09	-0.9%	0.2%	0.5%	-0.2%	0.4%	2.5%
30-Jun-10	2.0%	3.6%	2.1%	4.6%	2.4%	1.7%
30-Jun-11	1.7%	5.4%	3.3%	2.0%	2.5%	1.9%
30-Jun-12	2.5%	4.1%	1.6%	0.9%	3.1%	3.2%
30-Jun-13	0.4%	3.6%	3.4%	1.5%	0.6%	2.2%
30-Jun-14	1.9%	5.2%	2.5%	2.2%	3.9%	1.0%
30-Jun-15	6.9%	5.2%	4.5%	1.3%	4.9%	4.1%
30-Jun-16	6.2%	5.1%	6.9%	4.4%	9.7%	0.9%

Date	Yearly 3 bedroom rental growth rate					
	Central	Wellington	Nelson	Canterbury	Southern	National
30-Jun-94	3.3%	3.1%	7.0%	3.4%	4.8%	5.6%
30-Jun-95	2.5%	7.0%	3.8%	7.4%	8.5%	9.1%
30-Jun-96	2.9%	5.9%	1.7%	3.9%	-2.5%	7.2%
30-Jun-97	2.2%	4.3%	2.3%	3.9%	-3.5%	3.9%
30-Jun-98	2.0%	7.5%	3.9%	-0.4%	-0.5%	-0.1%
30-Jun-99	2.6%	2.5%	1.5%	-2.4%	4.4%	-1.1%
30-Jun-00	0.3%	0.6%	-1.4%	0.5%	0.7%	0.4%
30-Jun-01	2.2%	2.0%	4.8%	0.4%	6.3%	1.1%
30-Jun-02	2.6%	1.9%	6.2%	6.6%	7.3%	5.6%
30-Jun-03	4.8%	3.9%	12.2%	9.2%	9.5%	6.4%
30-Jun-04	4.0%	2.7%	6.0%	10.1%	14.0%	6.3%
30-Jun-05	2.8%	4.9%	4.6%	4.6%	4.0%	3.7%
30-Jun-06	8.5%	5.8%	4.1%	5.4%	2.8%	4.1%
30-Jun-07	6.8%	10.0%	7.9%	6.2%	4.5%	6.2%
30-Jun-08	8.5%	7.5%	5.2%	4.8%	8.8%	5.8%
30-Jun-09	1.7%	5.0%	1.7%	-1.3%	-0.8%	0.5%
30-Jun-10	2.7%	2.0%	3.3%	2.9%	3.6%	2.9%
30-Jun-11	3.6%	2.6%	2.0%	4.0%	3.8%	3.7%
30-Jun-12	2.0%	1.8%	2.4%	8.6%	1.9%	3.6%
30-Jun-13	0.1%	1.4%	2.5%	10.0%	3.4%	3.1%
30-Jun-14	3.7%	3.7%	1.3%	7.9%	5.4%	4.7%
30-Jun-15	3.5%	2.1%	2.2%	2.2%	6.0%	4.1%
30-Jun-16	5.6%	6.2%	2.5%	-2.9%	8.3%	5.2%

Notes:

(a) Historical rental increases based on MBIE data from http://www.mbie.govt.nz/info-services/housing-property/sector-information-and-statistics/rental-bond-data

Table C.1.4 Projected regional rental growth rates by region

Date	Quarterly rental growth rate					
	Northland	Auckland	Waikato	Bay of Plenty	East coast	Taranaki
30-Sep-16	3.62%	2.35%	2.82%	0.23%	4.28%	-0.06%
31-Dec-16	3.40%	2.28%	2.69%	0.39%	3.99%	0.13%
31-Mar-17	3.18%	2.20%	2.56%	0.55%	3.70%	0.32%
30-Jun-17	4.06%	3.21%	3.52%	1.78%	4.50%	1.59%
30-Sep-17	3.29%	2.62%	2.87%	1.48%	3.65%	1.32%
31-Dec-17	3.04%	2.53%	2.72%	1.68%	3.30%	1.56%
31-Mar-18	2.78%	2.45%	2.57%	1.88%	2.96%	1.80%
30-Jun-18	2.53%	2.36%	2.42%	2.08%	2.62%	2.04%
30-Sep-18	2.69%	2.69%	2.69%	2.69%	2.69%	2.69%
31-Dec-18	2.66%	2.66%	2.66%	2.66%	2.66%	2.66%
31-Mar-19	2.63%	2.63%	2.63%	2.63%	2.63%	2.63%
30-Jun-19	2.61%	2.61%	2.61%	2.61%	2.61%	2.61%
30-Sep-19	3.09%	3.09%	3.09%	3.09%	3.09%	3.09%
31-Dec-19	3.07%	3.07%	3.07%	3.07%	3.07%	3.07%
31-Mar-20	3.04%	3.04%	3.04%	3.04%	3.04%	3.04%
30-Jun-20	3.02%	3.02%	3.02%	3.02%	3.02%	3.02%
30-Sep-20	2.99%	2.99%	2.99%	2.99%	2.99%	2.99%
31-Dec-20	2.96%	2.96%	2.96%	2.96%	2.96%	2.96%
31-Mar-21	2.94%	2.94%	2.94%	2.94%	2.94%	2.94%
30-Jun-21	2.91%	2.91%	2.91%	2.91%	2.91%	2.91%

Date	Quarterly rental growth rate					
	Central	Wellington	Nelson	Canterbury	Southern	National
30-Sep-16	1.78%	1.40%	-0.22%	-2.69%	4.14%	1.91%
31-Dec-16	1.77%	1.43%	-0.01%	-2.22%	3.87%	1.88%
31-Mar-17	1.76%	1.46%	0.20%	-1.73%	3.59%	1.86%
30-Jun-17	2.83%	2.57%	1.48%	-0.20%	4.41%	2.91%
30-Sep-17	2.31%	2.11%	1.23%	-0.10%	3.57%	2.38%
31-Dec-17	2.30%	2.15%	1.49%	0.49%	3.25%	2.35%
31-Mar-18	2.30%	2.19%	1.76%	1.08%	2.92%	2.33%
30-Jun-18	2.29%	2.24%	2.02%	1.68%	2.60%	2.30%
30-Sep-18	2.69%	2.69%	2.69%	2.69%	2.69%	2.69%
31-Dec-18	2.66%	2.66%	2.66%	2.66%	2.66%	2.66%
31-Mar-19	2.63%	2.63%	2.63%	2.63%	2.63%	2.63%
30-Jun-19	2.61%	2.61%	2.61%	2.61%	2.61%	2.61%
30-Sep-19	3.09%	3.09%	3.09%	3.09%	3.09%	3.09%
31-Dec-19	3.07%	3.07%	3.07%	3.07%	3.07%	3.07%
31-Mar-20	3.04%	3.04%	3.04%	3.04%	3.04%	3.04%
30-Jun-20	3.02%	3.02%	3.02%	3.02%	3.02%	3.02%
30-Sep-20	2.99%	2.99%	2.99%	2.99%	2.99%	2.99%
31-Dec-20	2.96%	2.96%	2.96%	2.96%	2.96%	2.96%
31-Mar-21	2.94%	2.94%	2.94%	2.94%	2.94%	2.94%
30-Jun-21	2.91%	2.91%	2.91%	2.91%	2.91%	2.91%

C.2 Discounting

Future cash flows are discounted to present value using the risk-free rate. This is taken to be the New Zealand government bond rate, as published by Treasury.

Table C.2.1 Discounting assumptions

Quarter	Treasury forward rate (end of qtr)	Discount factor applied to cashflows (middle of qtr)
Jun-17	2.12%	98.2%
Jun-18	1.95%	96.3%
Jun-19	1.93%	94.5%
Jun-20	2.03%	92.6%
Jun-21	2.16%	90.7%
Jun-22	2.30%	88.6%
Jun-23	2.46%	86.5%
Jun-24	2.63%	84.3%
Jun-25	2.80%	82.0%
Jun-26	2.98%	79.7%
Jun-27	3.14%	77.3%
Jun-28	3.27%	74.8%
Jun-29	3.39%	72.4%
Jun-30	3.49%	70.0%
Jun-31	3.57%	67.5%
Jun-32	3.63%	65.2%
Jun-33	3.67%	62.9%
Jun-34	3.71%	60.6%
Jun-35	3.76%	58.4%
Jun-36	3.81%	56.3%
Jun-37	3.86%	54.2%
Jun-38	3.91%	52.2%
Jun-39	3.96%	50.2%
Jun-40	4.01%	48.3%
Jun-41	4.06%	46.4%
Jun-42	4.11%	44.5%
Jun-43	4.16%	42.8%
Jun-44	4.21%	41.0%
Jun-45	4.26%	39.4%
Jun-46	4.31%	37.7%
Jun-47	4.36%	36.2%
Jun-48	4.41%	34.6%
Jun-49	4.46%	33.2%
Jun-50	4.51%	31.7%
Jun-51	4.56%	30.3%
Jun-52	4.61%	29.0%
Jun-53	4.66%	27.7%
Jun-54	4.71%	26.5%
Jun-55	4.75%	25.3%
Later	4.75%	

Notes:

(a) Discounting assumptions apply to the middle of each quarter. Although the table only shows the discount factor for each June quarter, in practice, separate discount factors are calculated for each quarter.

(b) Assumptions based on Treasury projections of monthly forward rates as at Jun-16, in spreadsheet titled *disc-rates-jun16.xls*. Forward rates are as provided by Treasury.

C.3 Unemployment rate

The unemployment rate is built into the state transition models, and thus influences the valuation result. We use the new definitions of unemployment adopted by Statistics New Zealand in June 2016. We apply rates at a regional level.

Table C.3.1 Historic national unemployment rate

	Unemployment rate			
Year	31-Mar	30-Jun	30-Sep	31-Dec
1991	9.8%	10.5%	11.2%	11.0%
1992	11.0%	10.4%	10.6%	10.6%
1993	10.1%	10.2%	9.6%	9.4%
1994	9.3%	8.5%	8.0%	7.6%
1995	6.8%	6.4%	6.3%	6.4%
1996	6.4%	6.1%	6.5%	6.2%
1997	6.7%	6.8%	7.0%	7.0%
1998	7.4%	7.9%	7.7%	8.0%
1999	7.5%	7.3%	7.0%	6.4%
2000	6.4%	6.3%	6.0%	5.8%
2001	5.5%	5.4%	5.4%	5.6%
2002	5.3%	5.3%	5.6%	5.0%
2003	5.0%	4.8%	4.5%	4.7%
2004	4.3%	4.2%	3.9%	3.7%
2005	3.9%	3.9%	3.8%	3.8%
2006	4.1%	3.7%	3.9%	3.8%
2007	3.9%	3.6%	3.6%	3.3%
2008	3.7%	3.8%	4.0%	4.4%
2009	5.0%	5.7%	6.1%	6.5%
2010	5.9%	6.5%	6.0%	6.2%
2011	6.0%	6.0%	5.9%	6.0%
2012	6.3%	6.4%	6.7%	6.3%
2013	5.7%	6.0%	5.7%	5.6%
2014	5.5%	5.3%	5.2%	5.5%
2015	5.4%	5.5%	5.5%	5.0%
2016	5.2%	5.1%		

Notes:
(a) Rates supplied by Treasury, sourced from Infoshare, table reference HLF097AA. Figures are seasonally adjusted.

Table C.3.2 Projected national unemployment rate

	Unemployment rate			
Year	31-Mar	30-Jun	30-Sep	31-Dec
2016			5.0%	4.9%
2017	4.9%	4.8%	4.8%	4.8%
2018	4.7%	4.6%	4.5%	4.4%
2019	4.3%	4.3%	4.3%	4.3%
2020	4.3%	4.3%	4.3%	4.3%
Later	4.3%	4.3%	4.3%	4.3%

Notes:
(a) Annual unemployment forecasts based on those provided by Treasury in their HYEFU 2016 economic forecasts to June 2021.

Table C.3.3.1 Historical regional unemployment rates in Northland

	Unemployment rate in Northland			
Year	31-Mar	30-Jun	30-Sep	31-Dec
1991	13.1%	13.6%	13.6%	14.8%
1992	16.3%	12.3%	12.7%	12.1%
1993	10.0%	16.0%	15.8%	14.3%
1994	12.7%	12.9%	14.8%	14.3%
1995	13.6%	10.0%	10.1%	11.7%
1996	12.0%	11.4%	9.2%	6.9%
1997	8.7%	10.4%	9.3%	10.1%
1998	12.7%	11.5%	11.5%	14.2%
1999	13.3%	14.1%	9.2%	9.7%
2000	9.7%	8.9%	9.2%	9.1%
2001	7.9%	6.9%	8.5%	9.6%
2002	11.1%	8.9%	8.8%	8.8%
2003	10.2%	7.6%	8.7%	7.2%
2004	4.4%	5.0%	5.4%	4.4%
2005	4.4%	7.4%	5.9%	5.0%
2006	5.7%	6.0%	5.7%	3.6%
2007	5.2%	3.5%	5.5%	2.7%
2008	4.7%	4.1%	7.1%	6.5%
2009	8.5%	7.7%	8.9%	9.0%
2010	8.8%	8.9%	7.8%	8.2%
2011	9.3%	7.2%	8.2%	7.8%
2012	8.1%	8.7%	9.0%	9.0%
2013	9.3%	6.8%	9.0%	8.2%
2014	7.5%	7.3%	8.3%	7.8%
2015	8.8%	7.4%	8.1%	6.0%
2016	8.4%	10.6%		

Table C.3.3.2 Historical regional unemployment rates in Auckland

	Unemployment rate in Auckland			
Year	31-Mar	30-Jun	30-Sep	31-Dec
1991	10.9%	11.3%	12.3%	11.9%
1992	13.0%	12.0%	10.9%	10.9%
1993	10.8%	10.6%	9.9%	8.7%
1994	10.1%	8.0%	7.3%	6.7%
1995	5.9%	5.8%	5.4%	5.2%
1996	5.1%	5.3%	5.7%	5.1%
1997	6.4%	7.0%	7.3%	7.0%
1998	7.7%	7.8%	6.7%	6.7%
1999	7.0%	6.3%	6.3%	5.0%
2000	6.5%	6.0%	5.2%	5.1%
2001	5.4%	5.7%	4.3%	4.7%
2002	5.0%	5.2%	5.0%	4.1%
2003	4.6%	4.1%	3.5%	3.9%
2004	4.5%	3.9%	3.9%	3.4%
2005	4.3%	3.4%	3.5%	3.7%
2006	3.9%	3.2%	3.8%	3.9%
2007	4.6%	3.3%	3.6%	3.6%
2008	4.6%	4.1%	4.1%	5.0%
2009	6.3%	6.1%	6.2%	7.2%
2010	7.5%	8.1%	6.7%	6.9%
2011	7.0%	6.6%	6.2%	6.1%
2012	7.2%	6.8%	7.7%	6.4%
2013	6.7%	6.3%	5.9%	5.6%
2014	6.6%	5.8%	5.7%	5.6%
2015	6.5%	5.9%	5.6%	5.1%
2016	6.1%	4.7%		

Table C.3.3.3 Historical regional unemployment rates in Waikato

	Unemployment rate in Waikato			
Year	31-Mar	30-Jun	30-Sep	31-Dec
1991	10.7%	10.8%	11.6%	10.9%
1992	12.1%	11.2%	11.0%	10.5%
1993	12.1%	12.1%	9.6%	9.7%
1994	9.8%	9.4%	7.7%	7.8%
1995	8.8%	6.8%	6.3%	6.6%
1996	8.2%	6.5%	7.5%	6.5%
1997	8.3%	7.5%	6.7%	7.4%
1998	8.3%	8.4%	8.4%	9.2%
1999	10.3%	8.7%	7.6%	6.4%
2000	7.9%	5.9%	6.2%	6.1%
2001	6.6%	6.0%	5.9%	6.3%
2002	6.3%	5.0%	5.6%	5.6%
2003	5.7%	5.2%	3.3%	4.4%
2004	4.0%	3.1%	2.9%	3.2%
2005	4.2%	4.9%	3.9%	4.2%
2006	4.5%	2.9%	3.7%	2.8%
2007	4.4%	3.7%	3.3%	3.3%
2008	4.1%	3.9%	4.3%	4.4%
2009	5.6%	6.5%	6.0%	5.7%
2010	5.2%	5.7%	6.5%	5.5%
2011	6.7%	5.7%	6.6%	6.0%
2012	8.0%	6.5%	5.8%	5.4%
2013	5.4%	5.4%	5.7%	6.3%
2014	6.2%	6.1%	5.6%	5.4%
2015	6.0%	4.6%	6.2%	4.9%
2016	5.4%	4.8%		

Table C.3.3.4 Historical regional unemployment rates in Bay of Plenty

	Unemployment rate in Bay of Plenty			
Year	31-Mar	30-Jun	30-Sep	31-Dec
1991	13.5%	11.4%	12.9%	13.3%
1992	13.5%	12.8%	12.9%	12.6%
1993	13.5%	10.6%	9.6%	11.8%
1994	13.2%	10.7%	10.1%	9.7%
1995	10.1%	9.6%	7.0%	8.3%
1996	9.3%	6.6%	8.1%	9.2%
1997	10.6%	9.1%	8.3%	9.1%
1998	9.9%	12.2%	11.2%	11.7%
1999	11.9%	10.9%	9.2%	8.6%
2000	7.5%	8.9%	8.4%	6.7%
2001	9.0%	7.9%	8.6%	8.2%
2002	7.5%	8.3%	7.4%	6.9%
2003	7.9%	7.0%	5.3%	6.2%
2004	7.0%	5.3%	3.2%	4.5%
2005	4.7%	3.1%	4.3%	4.2%
2006	5.1%	3.9%	4.2%	3.6%
2007	4.0%	2.9%	3.4%	3.7%
2008	4.9%	3.8%	4.1%	4.3%
2009	5.9%	5.7%	7.6%	6.9%
2010	7.7%	7.7%	8.3%	6.8%
2011	7.1%	6.6%	7.3%	7.8%
2012	8.1%	5.8%	6.8%	8.2%
2013	7.7%	5.8%	6.8%	8.8%
2014	6.7%	5.4%	6.3%	5.4%
2015	7.5%	6.3%	5.8%	5.9%
2016	4.7%	5.1%		

Table C.3.3.5 Historical regional unemployment rates in East Coast

	Unemployment rate in East Coast			
Year	31-Mar	30-Jun	30-Sep	31-Dec
1991	12.1%	12.5%	11.3%	9.7%
1992	11.4%	10.0%	11.3%	13.6%
1993	9.9%	11.8%	10.3%	12.8%
1994	12.7%	8.8%	8.9%	9.4%
1995	9.2%	7.1%	7.7%	6.3%
1996	7.0%	7.4%	9.1%	7.9%
1997	8.9%	8.1%	10.2%	8.2%
1998	9.3%	9.2%	10.7%	8.1%
1999	7.0%	7.4%	7.6%	9.3%
2000	7.3%	6.3%	7.7%	8.0%
2001	7.0%	6.6%	6.0%	7.3%
2002	4.9%	5.0%	5.2%	6.0%
2003	6.3%	4.3%	5.3%	5.7%
2004	6.1%	4.4%	5.5%	5.0%
2005	4.7%	4.8%	7.0%	4.9%
2006	3.9%	3.8%	4.9%	4.8%
2007	4.8%	5.0%	4.2%	4.7%
2008	5.8%	4.4%	6.7%	6.3%
2009	6.8%	7.2%	9.7%	8.2%
2010	6.5%	8.2%	7.0%	6.9%
2011	7.8%	6.8%	7.0%	6.7%
2012	7.8%	6.0%	8.7%	8.4%
2013	8.0%	7.3%	8.1%	7.1%
2014	7.9%	6.5%	6.8%	7.8%
2015	7.2%	7.7%	6.9%	6.6%
2016	8.0%	5.0%		

Table C.3.3.6 Historical regional unemployment rates in Taranaki

	Unemployment rate in Taranaki			
Year	31 Mar	30 Jun	30-Sep	31-Dec
1991	9.6%	11.4%	13.2%	14.6%
1992	13.6%	10.1%	10.3%	12.2%
1993	13.4%	8.6%	11.2%	10.0%
1994	10.0%	8.2%	8.1%	7.8%
1995	7.8%	6.3%	8.2%	6.5%
1996	7.6%	6.4%	8.1%	7.4%
1997	8.3%	7.0%	8.0%	6.5%
1998	6.6%	8.1%	6.9%	7.3%
1999	6.9%	6.2%	6.8%	8.9%
2000	10.2%	8.2%	6.3%	5.3%
2001	6.2%	4.8%	5.9%	6.1%
2002	5.1%	4.6%	5.8%	5.7%
2003	5.1%	5.6%	5.1%	4.5%
2004	5.3%	3.8%	4.3%	4.4%
2005	3.9%	2.9%	3.4%	4.2%
2006	5.1%	2.3%	3.6%	2.7%
2007	4.1%	4.0%	2.6%	2.6%
2008	3.5%	3.0%	3.3%	3.1%
2009	2.7%	4.3%	3.7%	5.9%
2010	4.8%	4.5%	4.8%	4.8%
2011	4.6%	5.1%	5.0%	3.5%
2012	4.5%	3.5%	4.4%	5.0%
2013	5.1%	5.1%	5.1%	5.6%
2014	6.3%	5.0%	4.4%	4.8%
2015	6.0%	7.3%	4.6%	3.9%
2016	5.7%	4.9%		

Table C.3.3.7 Historical regional unemployment rates in Central

	Unemployment rate in Central			
Year	31-Mar	30-Jun	30-Sep	31-Dec
1991	11.8%	11.4%	11.8%	11.1%
1992	12.4%	10.4%	12.0%	13.0%
1993	12.1%	11.3%	9.3%	9.6%
1994	9.5%	8.9%	9.2%	8.7%
1995	6.0%	6.2%	8.2%	8.0%
1996	7.5%	6.3%	6.3%	6.1%
1997	6.0%	5.9%	5.5%	5.7%
1998	8.0%	6.9%	8.3%	5.6%
1999	7.5%	5.7%	7.3%	7.9%
2000	6.8%	6.8%	6.8%	5.5%
2001	6.7%	4.6%	4.3%	5.4%
2002	6.2%	5.4%	5.3%	4.0%
2003	4.8%	5.3%	5.4%	3.8%
2004	5.9%	4.3%	3.0%	4.3%
2005	4.8%	4.2%	4.5%	4.3%
2006	5.4%	4.8%	4.0%	4.4%
2007	5.0%	5.2%	5.1%	5.3%
2008	5.0%	4.4%	3.6%	3.7%
2009	4.7%	4.6%	5.4%	7.8%
2010	6.9%	6.8%	6.2%	6.5%
2011	6.5%	6.7%	6.1%	6.1%
2012	8.7%	6.9%	7.7%	8.0%
2013	7.0%	8.3%	7.1%	5.1%
2014	7.4%	6.7%	6.5%	8.8%
2015	7.2%	6.5%	6.3%	6.1%
2016	6.9%	5.6%		

Table C.3.3.8 Historical regional unemployment rates in Wellington

	Unemployment rate in Wellington			
Year	31-Mar	30-Jun	30-Sep	31-Dec
1991	8.7%	8.4%	8.2%	8.3%
1992	10.1%	8.0%	9.6%	10.0%
1993	10.0%	8.9%	9.2%	9.5%
1994	9.3%	9.3%	8.0%	7.7%
1995	7.6%	6.4%	6.5%	6.9%
1996	7.6%	6.4%	5.4%	6.0%
1997	6.6%	5.3%	5.0%	5.8%
1998	5.8%	5.4%	5.7%	7.1%
1999	6.7%	6.7%	5.1%	4.2%
2000	6.4%	5.4%	5.1%	4.8%
2001	4.5%	3.3%	4.7%	4.8%
2002	5.9%	4.6%	4.9%	5.0%
2003	6.2%	4.9%	4.8%	5.6%
2004	4.8%	4.8%	4.0%	4.0%
2005	4.7%	4.2%	3.2%	3.1%
2006	5.8%	5.9%	3.7%	4.5%
2007	4.7%	3.4%	3.3%	2.4%
2008	5.0%	3.1%	3.4%	3.5%
2009	4.7%	5.3%	5.6%	6.0%
2010	5.1%	4.8%	4.5%	4.8%
2011	6.4%	4.8%	5.0%	6.6%
2012	5.6%	5.9%	6.4%	7.1%
2013	6.2%	5.8%	5.4%	6.0%
2014	5.1%	5.0%	5.2%	5.5%
2015	5.7%	5.1%	6.2%	5.3%
2016	5.9%	5.3%		

Table C.3.3.9 Historical regional unemployment rates in Nelson

	Unemployment rate in Nelson			
Year	31-Mar	30-Jun	30-Sep	31-Dec
1991	9.3%	8.0%	7.1%	9.7%
1992	9.4%	6.1%	7.3%	9.1%
1993	8.3%	9.4%	7.9%	9.4%
1994	9.9%	6.8%	6.0%	6.5%
1995	7.7%	4.2%	5.5%	4.2%
1996	4.9%	5.9%	6.1%	7.2%
1997	5.2%	5.9%	4.8%	4.8%
1998	5.5%	7.3%	5.9%	5.3%
1999	6.2%	5.7%	6.8%	6.3%
2000	4.9%	5.4%	4.6%	4.7%
2001	3.0%	2.5%	4.6%	4.1%
2002	3.5%	4.0%	2.3%	4.3%
2003	3.5%	3.0%	3.8%	3.6%
2004	2.8%	3.3%	1.9%	2.2%
2005	2.8%	2.4%	2.6%	3.3%
2006	4.2%	2.1%	3.2%	3.2%
2007	2.3%	3.4%	2.5%	2.6%
2008	3.3%	2.9%	3.2%	3.3%
2009	2.9%	3.2%	4.0%	4.4%
2010	4.7%	3.2%	3.7%	4.4%
2011	5.0%	4.0%	3.7%	4.6%
2012	5.5%	4.3%	4.3%	5.7%
2013	4.6%	4.0%	3.8%	4.1%
2014	4.9%	3.9%	3.2%	6.1%
2015	4.3%	4.4%	5.0%	4.0%
2016	5.0%	5.8%		

Table C.3.3.10 Historical regional unemployment rates in Canterbury

	Unemployment rate in Canterbury			
Year	31-Mar	30-Jun	30-Sep	31-Dec
1991	8.7%	9.0%	9.8%	9.8%
1992	8.8%	9.3%	8.9%	8.5%
1993	9.7%	7.4%	6.6%	8.0%
1994	8.2%	7.2%	5.9%	6.5%
1995	6.0%	5.9%	5.2%	6.0%
1996	6.8%	6.0%	5.6%	6.3%
1997	7.2%	6.1%	6.8%	6.2%
1998	8.0%	7.6%	7.1%	8.5%
1999	7.8%	7.2%	7.1%	6.7%
2000	5.9%	6.2%	5.5%	5.4%
2001	6.0%	5.8%	5.2%	5.0%
2002	5.5%	4.7%	5.6%	4.2%
2003	4.4%	4.3%	4.4%	3.7%
2004	4.4%	4.0%	3.6%	3.1%
2005	4.0%	2.6%	3.0%	2.4%
2006	3.8%	2.7%	2.9%	2.9%
2007	3.3%	3.1%	2.7%	2.4%
2008	2.6%	3.1%	3.0%	3.3%
2009	4.5%	4.7%	5.2%	4.9%
2010	5.3%	4.5%	4.8%	5.4%
2011	4.9%	5.3%	4.9%	4.4%
2012	4.8%	6.0%	4.8%	4.4%
2013	4.0%	4.0%	3.9%	3.1%
2014	3.2%	2.7%	3.1%	3.4%
2015	2.8%	3.0%	3.5%	3.3%
2016	2.7%	3.2%		

Table C.3.3.11 Historical regional unemployment rates in Southern region

	Unemployment rate in Southern			
Year	31-Mar	30-Jun	30-Sep	31-Dec
1991	7.2%	7.9%	9.6%	9.7%
1992	7.8%	8.6%	8.6%	7.6%
1993	7.2%	7.1%	8.0%	7.1%
1994	5.6%	6.5%	6.5%	6.0%
1995	4.9%	5.1%	3.8%	6.3%
1996	4.9%	5.5%	4.9%	4.7%
1997	4.8%	5.1%	5.4%	6.2%
1998	6.7%	6.6%	7.6%	7.3%
1999	7.1%	6.7%	6.5%	6.1%
2000	6.7%	5.8%	5.1%	5.7%
2001	4.5%	5.1%	5.4%	4.3%
2002	5.5%	4.7%	5.6%	4.9%
2003	5.1%	4.9%	4.9%	5.1%
2004	3.9%	3.9%	4.2%	3.4%
2005	4.2%	3.5%	2.6%	3.1%
2006	4.7%	2.9%	3.2%	3.2%
2007	3.2%	3.3%	2.9%	2.7%
2008	2.3%	3.6%	2.8%	2.8%
2009	3.6%	4.5%	4.7%	3.9%
2010	5.0%	4.3%	3.7%	4.6%
2011	4.0%	4.3%	4.2%	4.5%
2012	4.5%	4.1%	4.8%	4.1%
2013	3.9%	5.3%	4.8%	4.6%
2014	4.4%	3.1%	3.3%	3.6%
2015	3.5%	4.3%	4.3%	4.1%
2016	4.5%	4.7%		

Notes:

(a) Regional unemployment rates sourced from Statistics New Zealand. Figures are not seasonally adjusted.

(b) Southern region rates are the population weighted average of two Statistics New Zealand regions; Southland and Otago.

C.4 Methodology for projecting regional unemployment rates

C.4.1 Regional unemployment rate approach – historical series

Our valuation models use a seasonally adjusted unemployment rate for New Zealand and its regions. Regional rates are only available in raw form, i.e. not seasonally adjusted. Therefore, for consistency in our modelling process, it is necessary to first produce seasonally-adjusted series of regional unemployment rates. We also remove some of the quarterly volatility via smoothing.

Our approach to producing adjusted regional unemployment rate series is as follows:

- Source raw data from Statistics New Zealand
- Calculate de-seasonalisation factors, taken as the average amount that quarter of year is above or below the average for a five year moving window centred at that date. For example the 1991Q2 de-seasonalisation factor is the average unemployment rate for Q2 in '89, '90, '91, '92, and '93 compared to the overall average in those five years
- Centre the de-seasonalisation factors so that each rolling year of factors is centred at 100%
- Use these centred de-seasonalisation factors to produce seasonally adjusted time series
- Smooth the time series by using neighbouring quarters:

$$UE(t) = 0.25\,UE(t-1) + 0.5\,UE(t) + 0.25\,UE(t+1)$$

C.4.2 Regional unemployment rate approach – projection series

The following approach is used to derive regional forecasts:

- Find regional weights using the average total labour force over 2015/16.
- Assume the quarters from 2005Q3 through to 2008Q2 represent a period of 'full employment', and calculate the average unemployment in each region over this time period.
- Calculate the difference between the regional average and national average over that period. These differentials are used in the regional long term rate assumption.
    - Currently Treasury uses 4.3% as the national long term unemployment rate. So for example a differential of +1.1% was calculated for Northland (over 2005-2008), so the Northland long term rate is 5.4%.
- Mirror the Treasury projection shape for each region, taking the unemployment rate from the current level to the long term average rate over 5 years.
    - Manual adjustment was made to the Canterbury projection; Canterbury's rate was judged to be lower than full employment, and a slow increase to 3.3% was assumed.
- Add a correction factor to each future quarter, to ensure that the weighted average unemployment rate equals that used at the national level.

The forecast regional unemployment rates are shown below.

Table C.4.1 Projected regional unemployment rates

Date	Unemployment rate					
	Northland	Auckland	Waikato	Plenty	East coast	Taranaki
30-Sep-16	8.9%	5.0%	5.0%	5.0%	5.9%	4.7%
31-Dec-16	8.6%	4.9%	4.9%	5.0%	5.9%	4.7%
31-Mar-17	8.4%	4.9%	4.9%	4.9%	5.8%	4.6%
30-Jun-17	8.3%	4.9%	4.9%	4.9%	5.8%	4.6%
30-Sep-17	8.3%	4.9%	4.9%	4.9%	5.8%	4.6%
31-Dec-17	8.0%	4.8%	4.8%	4.9%	5.8%	4.5%
31-Mar-18	7.5%	4.8%	4.7%	4.8%	5.7%	4.4%
30-Jun-18	7.2%	4.7%	4.6%	4.8%	5.7%	4.4%
30-Sep-18	6.4%	4.6%	4.5%	4.6%	5.6%	4.2%
31-Dec-18	5.8%	4.5%	4.4%	4.6%	5.5%	4.1%
31-Mar-19	5.5%	4.4%	4.3%	4.5%	5.4%	4.0%
30-Jun-19	5.2%	4.4%	4.3%	4.5%	5.4%	4.0%
30-Sep-19	5.2%	4.4%	4.3%	4.5%	5.4%	4.0%
31-Dec-19	5.2%	4.4%	4.3%	4.5%	5.4%	4.0%
31-Mar-20	5.4%	4.4%	4.3%	4.5%	5.4%	4.0%
30-Jun-20	5.4%	4.4%	4.3%	4.5%	5.4%	4.0%
30-Sep-20	5.4%	4.4%	4.3%	4.5%	5.4%	4.0%
31-Dec-20	5.4%	4.4%	4.3%	4.5%	5.4%	4.0%
31-Mar-21	5.4%	4.4%	4.3%	4.5%	5.4%	4.0%
Later	5.4%	4.4%	4.3%	4.5%	5.4%	4.0%

Date	Unemployment rate					
	Central	Wellington	Nelson	Canterbury	Southern	Total
30-Sep-16	5.9%	5.4%	5.2%	3.1%	4.4%	5.0%
31-Dec-16	5.9%	5.3%	5.1%	3.1%	4.4%	4.9%
31-Mar-17	5.8%	5.3%	5.0%	3.1%	4.3%	4.9%
30-Jun-17	5.8%	5.3%	5.0%	3.1%	4.3%	4.8%
30-Sep-17	5.8%	5.3%	4.9%	3.1%	4.3%	4.8%
31-Dec-17	5.8%	5.2%	4.8%	3.1%	4.3%	4.8%
31-Mar-18	5.7%	5.1%	4.5%	3.2%	4.1%	4.7%
30-Jun-18	5.6%	5.0%	4.4%	3.2%	4.1%	4.6%
30-Sep-18	5.5%	4.8%	4.0%	3.2%	3.9%	4.5%
31-Dec-18	5.4%	4.7%	3.7%	3.3%	3.8%	4.4%
31-Mar-19	5.3%	4.6%	3.6%	3.3%	3.7%	4.3%
30-Jun-19	5.3%	4.6%	3.4%	3.3%	3.7%	4.3%
30-Sep-19	5.3%	4.6%	3.4%	3.3%	3.7%	4.3%
31-Dec-19	5.3%	4.6%	3.4%	3.3%	3.7%	4.3%
31-Mar-20	5.3%	4.6%	3.5%	3.3%	3.7%	4.3%
30-Jun-20	5.3%	4.6%	3.5%	3.3%	3.7%	4.3%
30-Sep-20	5.3%	4.6%	3.5%	3.3%	3.7%	4.3%
31-Dec-20	5.3%	4.6%	3.5%	3.3%	3.7%	4.3%
31-Mar-21	5.3%	4.6%	3.5%	3.3%	3.7%	4.3%
Later	5.3%	4.6%	3.5%	3.3%	3.7%	4.3%

Notes:
(a) The "Total" column in the table above represents the national unemployment rate, consistent with Appendix C.3.2

C.5 Expense rates

As discussed in Section 7 we have made a percentage loading to cover the cost of Administrative expenses incurred by MSD. Table C.5.1 presents this as a percentage of all IRRS, AS and TAS paid to or on behalf of all clients in a year.

Table C.5.1 Projected expense rate

Year	Expense rate
2017	1.9%
2018	1.8%
2019	1.7%
2020	1.6%
2021	1.5%
2022	1.5%
2023	1.4%
2024	1.4%
2025	1.3%
2026	1.3%
2027	1.2%
2028	1.2%
2029	1.2%
2030	1.1%
2031	1.1%
2032	1.0%
2033	1.0%
2034	1.0%
2035	0.9%
2036	0.9%
2037	0.9%
2038	0.8%
2039	0.8%
2040	0.8%

Notes:
(a) Expense rate is expressed as a percentage of total future payments

APPENDIX D DATA SUPPLIED

D.1 Social Housing SAS datasets

Responsibility for all social housing data moved from Housing New Zealand to MSD in August 2015. Data was provided by MSD to cover the period since the transition. These newly supplied datasets are described below. This was combined together with data used in the previous valuation which covers the period prior to the transition.

- **Tenancy_snapshot.sas7bdat:** File with one record per social house tenancy per end-of-month snapshot date that contains:
  - Snapshot date
  - Anonymised identification number of the application
  - Anonymised identification number of the primary householder
  - Social house entry date
  - Household size
  - Household type
  - Household weekly income
  - Income related rent
  - Income related rent subsidy
  - Market rent
  - Number of bedrooms
  - Location details including meshblock ID
  - Social housing provider type
- **Tenancy_hh_snapshot.sas7bdat:** File with one record per household member in a social house tenancy per end-of-month snapshot date that contains:
  - Snapshot date
  - Anonymised identification number of the application
  - Anonymised identification number of the household member
  - Relationship to the primary householder
  - Date of birth
  - Gender
  - Ethnicity
  - Application signatory flag
- **Evidence_items.sas7bdat:** File with one record per household member in a social house tenancy in addition to those in tenancy_hh_snapshot.sas7bdat that contains:
  - Anonymised identification number of the application
  - Anonymised identification number of the household member
  - Source of evidence indicating they are a member of the household
  - Evidence start and end dates
  - Gender
  - Year and month of birth
- **Register_snapshot.sas7bdat:** File with one record per application on the social housing register per end-of-month snapshot date that contains:
  - Snapshot date
  - Anonymised identification number of the application
  - Anonymised identification number of the primary applicant
  - Analysis scores for affordability, adequacy, suitability, sustainability, accessibility and total
  - Main reason for application
  - Household size

    - Number of required bedrooms
    - Current location
    - Stated location preference
    - No particular location preference flag
    - Household type
    - Application status
    - Transfer register status
    - Start and end dates
- **Register_hh_snapshot.sas7bdat:** File with one record per household member on the social housing register per end-of-month snapshot date that contains:
    - Snapshot date
    - Anonymised identification number of the application
    - Anonymised identification number of the household member
    - Relationship to the primary applicant
    - Date of birth
    - Gender
    - Ethnicity
    - Application signatory flag
- **Houses_snapshot_cid_tr.sas7bdat:** File with one record per social house per end-of-month snapshot date that contains:
    - Snapshot date
    - Legacy and new system identification numbers for the social house
    - Location details including meshblock ID, suburb and postcode
    - Number of bedrooms
    - Weekly market rent
    - Rent date
    - House characteristics including building year, bathroom status, kitchen status, carpeting, heating, parking and access description
    - Occupancy status and status and expiry date of the current lease
    - Anonymised identification number of the application for occupied houses
- **Mig_map_tenancy.sas7bdat:** File with a mapping of pre data migration to post data migration anonymised application identification numbers for social house tenancies that contains:
    - Legacy anonymised identification number of the application
    - Current anonymised identification number of the application
    - Variables flagging potential duplication
- **Mig_map_tenancy_hh.sas7bdat:** File with a mapping of pre data migration to post data migration anonymised household member identification numbers for social house tenancies that contains:
    - Legacy anonymised identification number of the household member
    - Current anonymised identification number of the household member
    - Match type
- **Mig_map_register.sas7bdat:** File with a mapping of pre data migration to post data migration anonymised application identification numbers for the social housing register that contains:
    - Legacy anonymised identification number of the application
    - Current anonymised identification number of the application
    - Match type
- **Mig_map_register_hh.sas7bdat:** File with a mapping of pre data migration to post data migration anonymised household member identification numbers for the social housing register that contains:
    - Legacy anonymised identification number of the household member
    - Current anonymised identification number of the household member
    - Match type

D.2 Social Welfare SAS datasets

The following social welfare SAS datasets supplied by MSD were used to conduct the valuation. All data is up to 30 June 2016 but extracted as at 31 July 2016:

» **rate_period_20160630.sas7bdat:** Rate file with one record per client and benefit spell that contains:
  - Client identification number
  - Benefit type code (plus codes for supplementary benefits)
  - Gross and net payment amounts for primary benefit
  - Payment amounts for any supplementary benefits
  - Spell start and end dates

  The dataset covered spells from March 1993 through to 30 June 2016. It also included Accommodation Supplement payments to pensioners.

» **ahpy_lumpsum1_20160630.sas7bdat:** Lump sum file which covers those payment types recorded on system in a lump sum fashion (single date, rather than spell start and end dates). Fields include:
  - Client identification number
  - Benefit type code
  - Gross and net payment amounts
  - Input date

» **ahpy_ccs_20160630.sas7bdat:** Similar to the ahpy_lumpsum1 file, except specific to the child care subsidy benefit, which was not included in the original lump sum file.

» **rate_cda_20160630.sas7bdat:** Similar to the rate_period file, but specific to the child disability allowance benefit, which was not included in the original rate_period file.

» **spel_20160630.sas7bdat:** File with one row per spell per client, containing a variety of fields related to the spell. In particular, the "oldcomdt" field contained the first payment date for the spell, which was used to overwrite spell commencement dates before the 1993 system change.

» **swn_20160630.sas7bdat:** File with one row per client, with a range of static variables. This dataset was used to determine date of birth, gender, education level and ethnicity for each client.

» **swns_with_dob_eth_20160630.sas7bdat:** File with one row per client, containing client ID and age for all clients. This data set was used to fill in this information for those clients where it was not included in swn_20160630.sas7bdat.

» **chd_20160630.sas7bdat:** File containing one record for every 'child spell' per client. This effectively provides child records to attach to all benefit spells which depend on the age and number of children. Child age is also included.

» **dist_20160630.sas7bdat**: File containing one record for every district per spell per client. This allows the assignment of each client spell to their district and region.

» **dist_changes_20160801.sas7bdat:** File containing further records on districts by client and spell. Used to fill in information for client spells where it was not included in dist_20160630.sas7bdat.

» **yp_ypp_regions_20160801.sas7bdat**: File similar in structure to the rate file, but only for clients in the new youth payment or young parent payment. An additional field indicates which of the two payments the client received.

» **ptnr_20160630.sas7bdat:** File containing one record for every 'partner spell' per client. This allows the assignment of each client's partner details on the historical data. The partner's identification number is also included.

- **incp_20160630.sas7bdat:** File containing one record for every 'incapacity spell' per client. This allows the assignment of incapacity details such as type and number of incapacities to JS-HCD and SLP-HCD clients.

- **cyf_summary_20160630.sas7bdat:** File containing one record per client per child protection or youth justice spell. This allowed the calculation of CP and YJ related variables for each client including the age of first entry into the CP and YJ system and total number of CP and YJ events.

- **mmc_period_20160630.sas7bdat:** File containing one record per client per corrections sentence served. This allowed the calculation of criminal history related variables for each client including the percentage of time spent in prison over the last year and the percentage of time serving sentences over the last ten years excluding those for driving offences.

- **dmatch_id_20160921.sas7bdat:** File linking anonymous identities from different sources including children registered to parents while on benefits, corrections identities, CP/YJ identities and social housing identities. The matches in this file were used to attach CP/YJ, criminal history, intergenerational and social housing related variables to beneficiaries.

D.3 Benefit rates

Our analysis requires the conversion of historical payments to "current values". A series of pdf documents **BenefitRateSummary_1999-04-01.pdf**, **BenefitRateSummary_2000-04-01.pdf** etc. has previously been provided showing all benefit rates whenever they were updated (typically 1 April, and occasionally 1 September, each year). A spreadsheet **Benefit Rates pre 1999.xls** has also previously been provided with values applicable before 1999. All but the most recent benefit rate information was carried across from the previous welfare valuation. The most recent information was provided in **benefit-rates-april-2016.pdf**.

D.4 Historical and forecast economic variables

- **hyefu16-charts-data.xls**: Treasury fiscal strategy model, 2016 version. Excel spreadsheet containing historical quarterly values as well as Treasury forecasts for the next five years for each of:
    - Population
    - Employment and unemployment rates.

- **disc-rates-jun16.xls**: Excel spreadsheet containing Treasury assumptions for government accounts for future discount and inflation rates as at June 2016.

D.5 Miscellaneous files

A number of other files were either supplied or carried across from the prior valuations that aided investigation and interpretation, but did not directly feed into the valuation:

- **benefit_cancellations.sas7bdat**: SAS dataset key containing identifiers for codes related to reasons why people leave benefit
- **benefit_codes.sas7bdat**: SAS dataset with identifiers for different benefit codes
- **district_codes.sas7bdat**: SAS dataset identifying district codes and corresponding regions

Various other summary files, file descriptors and overviews were also provided on an ad hoc basis.

APPENDIX E VALUATION SCOPE

The aggregate estimate of lifetime housing cost comprises of a number of different types of payments and costs. These are:

- IRRS payments
- AS payments
- TAS payments
- MSD expenses

Future IRRS payments related to households with CHPs are included in the above list. The table below gives further details on this categorisation, with much of the detail provided by MSD. In this table we have attempted consistency with Treasury appropriations[1].

Multi-Category Expenses and Capital Expenditure	Allocation
Social Housing Outcomes Support MCA The single overarching purpose of this appropriation is to operate the social housing register and associated interventions in such a way as to support more people with the greatest housing need into housing, and to move those who are capable of housing independence closer towards that.	MSD expenses
Emergency Housing Response This appropriation is limited to activities relating to the provision of emergency housing support for eligible families and individuals.	MSD expenses

Non-Departmental Output Expenses	Allocation
Part Payment of Rent to Social Housing Providers This appropriation is limited to the part purchase of social housing tenancies for individuals who have both been allocated a social house and had their income-related rent calculated by the social housing agency.	IRRS payments
Accommodation Assistance This appropriation is limited to the Accommodation Supplement, Special Transfer Allowance, and Away From Home Allowance to persons to cover accommodation costs, paid in accordance with the criteria set out in the Social Security Act 1964 and delegated legislation issued under that Act. Benefit codes 471, 470, 472, 473, 474 and 832.	AS payments
Temporary Additional Support This appropriation is limited to Temporary Additional Support to provide means-tested temporary financial assistance to persons with emergency or essential costs, paid in accordance with the criteria set out in the Social Security Act 1964 and delegated legislation issued under that Act. Benefit code 450.	TAS payments

[1] For example, the most recent appropriations are http://www.treasury.govt.nz/budget/2016/estimates/v10/est16-v10-socdev.pdf

Some programme expenses are difficult to isolate and have not been included in the valuation scope. Subject to availability, they will be added to future valuations. This includes social housing rent debt write-downs and some types of recoverable assistance.

Expenses relating to emergency housing are **not** included in scope as these expenses largely relate to people currently outside the social housing system.

One other set of payments **not** included in scope are maintenance and administrative costs incurred by HNZ. In the private sector, these costs are generally borne by the landlord and are implicitly included in the market rent of a property. By analogy the IRRS includes these costs, and including them would be double-counting. In reality, management costs relating to social housing places may be higher than in the private rental market; we have not attempted to measure this difference.

APPENDIX F DETAILS ON MODELLING APPROACH

F.1 Generalised linear models

Most of the models used in the valuation are generalised linear models so we give a brief overview of the theory behind these models here.

F.1.1 Overview

A generalised linear model ('GLM') is a generalisation of ordinary least squares regression that is able to deal with non-normally distributed response variables. Given a response variable *y* and a set of independent variables or predictors $x_1, x_2, \ldots, x_n$, a GLM models the dependency as:

$$y = h^{-1}\left(\sum_{i=1}^{n} \beta_i x_i\right) + \varepsilon_i \qquad \text{(F.1)}$$

And

$$E(y) = \mu = h^{-1}\left(\sum_{i=1}^{n} \beta_i x_i\right) \qquad \text{(F.2)}$$

Where

$h^{-1}()$ is the **link function**
β_i (i=1, 2, …, n) is the **parameter** corresponding to the dependent variable x_i
ε_i is an **error** term.

Note that

$$\eta = \sum_{i=1}^{n} \beta_i x_i \qquad \text{(F.3)}$$

is referred to as the **linear predictor** and that the GLM may be written as:

$$y = h^{-1}(\eta) + \varepsilon_i \qquad \text{(F.4)}$$

Thus, a GLM consists of three components:

- A probability distribution
- A link function
- A linear predictor

F.1.2 Further detail

Probability distribution

In the equations (F.1) and (F.4) above, the error term ε_i is determined by the probability distribution of the response variable. Common distributions that may be used include:

- Normal
- Poisson
- Gamma
- Inverse Gaussian
- Binomial

The choice of distribution is informed by the response variable. For example, counts are naturally modelled by a Poisson distribution while strictly positive continuous quantities may be appropriately handled by a Gamma or Inverse Gaussian distribution depending on the distribution of the response values. Probabilities may be modelled using a Binomial distribution.

Link function

The link function $h^{-1}()$ gives the relationship between the mean of the distribution and the linear predictor. There are many possibilities for the link function including (but not limited to):

- Identity link: $h^{-1}(\eta) = \eta$
- Log link: $h^{-1}(\eta) = \exp(\eta)$
- Logit link: $h^{-1}(\eta) = \exp(\eta)/(1 + \exp(\eta))$

It is usually convenient to choose a link function which matches the domain of the link function to the range of the response variable's mean. In other words, if a response must be positive (for example, an average benefit payment), then a log link will ensure that the fitted value μ in equation (F.2) is positive. If the modelled quantity is a probability (for example, the probability of transitioning off benefit in the next quarter), then the logit link ensures that the fitted value lies between 0 and 1, as probabilities must.

Linear predictor

The linear predictor (equation F.3) is the quantity which incorporates the information about the independent variables into the model and is typically denoted by η. η is expressed as a linear combination of unknown parameters β_i and independent variables x_i (i=1, 2, …), which are known.

In all cases, once the probability distribution and the link function have been selected, the linear predictor (F.3) needs to be constructed. The steps to doing this include:

- Identify the list of independent variables or predictors (x_i) to be considered.
- Using data exploration, modelling techniques, statistical tests and prior knowledge, identify those x_i that are useful for predicting the response variable. Note that this may include functions of the predictors, rather than the raw predictors themselves.
- Estimate the parameters β_i using GLM software.

The list of variables considered for the key benefits is given in Section F.5.

Functions of the predictors

The predictors or independent variables may be used as follows.

- In their raw forms: For example, gender with two levels F and M.

» As categorical groupings of the original variable: For example, age may be banded into a number of groups (<18, 18-29, 30-39 etc).

» As indicator functions depending on the value of the original variable where one condition is assigned the value 1 and the complementary position 0: For example, letting I(age ≥ 30) be 1 for age ≥ 30 and 0 otherwise would fit a step term at age 30.

» As a spline for underlying raw predictors which are numeric or ordinal (e.g. age, benefit quarter, duration on benefit): The dependency of a linear predictor on duration could be modelled (if appropriate) by a combination of several line segments. For instance, if the linear predictor varied in a linear fashion with duration with one slope from duration 1 to 4, a different slope from 4 to 12 and a third slope from 12 onwards, then using three line pieces(1-4, 4-12 and 12+) would capture this dependency. The points 4 and 12 where the resulting fitted spline bends are referred to as knot points.

» As interaction terms: All of the above may be used as interaction terms. For example a duration effect may be well fitted by one spline for those aged under 30 and another for those aged 30 and above. This could be accommodated by interacting the spline with the I(age ≥ 30) term.

F.1.3 Model fitting approach

Our typical approach to fitting a model includes the following:

» First fit a saturated model including most, if not all, raw predictors as well as any known interactions. For continuous predictors like age, or categorical ordered predictors like duration, we would usually fit the predictor as a grouped version (e.g. for age which is in quarter years, we might fit it as integer years).

» Simplify the model by:
- Removing insignificant parameters
- Grouping together related parameters with similar estimated values
- Using splines where this is warranted

» Using diagnostics check to see if there is evidence of poor fitting which may suggest the need for some interactions. Add additional terms as required until a satisfactory fit is obtained.

F.1.4 References

The following books give a complete introduction to GLMs:

» McCullagh P. and Nelder J. (1989). Generalized linear models, second edition. Chapman and Hall, London UK.
» Dobson A. J. (2002). An introduction to generalized linear models, second edition. Chapman & Hall/CRC, Florida USA.

For a discussion on the application of GLMs in contexts similar to the modelling of the MSD benefit liabilities (e.g. claim size and claim numbers modelling in insurance), the following papers provide some starting points.

» England, P. D. and Verrall, R. J. (2002). Stochastic claims reserving in general insurance. British Actuarial Journal, 8 443-544.
» Haberman, S. and Renshaw, A. E. (1996). Generalized linear models and actuarial science. The Statistician, 45 407-436.

» Mulquiney, P. and Taylor, G. (2007). Modelling Mortgage Insurance as a multi-state process. Variance 1, 81-102.
» Taylor, G. and McGuire, G (2004). Loss reserving with GLMs: a case study. Casualty Actuarial Society Discussion Paper Program 2004. Available at http://www.casact.org/pubs/dpp/dpp04/04dpp327.pdf

F.2 Transition models

The modelling involves producing probability estimates for:

» transitioning from any given housing state to any other each quarter
» transitioning from any given benefit state to any other each quarter
» making a register application or moving off the register

In this context, 'housing state' refers to if a client is in a social house (SH), receiving Accommodation Supplement (AS) or neither (Nil). Transition probabilities will depend on a client's state as well as other modelling variables, listed in Section F.5. The transition models are fitted using generalised linear models; further detail on their exact parameterisations is given in Appendix G – Model coefficients.

The transition model approach focuses on understanding how people move through the system over time. It is worth mentioning here that alternatives to such an approach exist (see for instance, the snapshot based approaches used in Section 15 of the 2012 welfare valuation report for the segmentation analysis). However, we have chosen the transition approach for a number of reasons:

» **Responsiveness:** Changes in movement behaviour observed in recent years can be correctly reflected in the models.
» **Long range accuracy:** We are able to leverage the behaviour of clients at various stages of the housing system to make appropriate long range assumptions. For instance, the behaviour of older clients can be used to model the behaviour of the younger clients in the distant future.
» **Intuitive appeal:** A focus on measures such as probability of entering/exiting housing is natural, and will allow easier drill down analysis.
» **Consistency:** This approach is used and works well for the welfare valuations, a consistent approach is required to combine the two valuations. The significant overlap between these systems means that considerable insight will be gained by a combined approach.

The three housing states and nine benefit states are illustrated diagrammatically in Figure F.1. While there are 9 (3x3) housing transition types and 81 (9x9) different welfare transition types, it is worth noting that the most important transitions are:

» A household staying unchanged in a social house
» A primary householder leaving a social house and receiving AS the next quarter
» A client moving from receiving AS into a social house the next quarter
» A client remaining in their current benefit state
» A client moving from benefits to no benefits (moving into the NOB state)
» A client moving from no benefits back to benefits (moving out of the NOB state)

We also note that the valuation population is not equally distributed across the various states. The largest seven states are SH & NOB, AS & JS-WR, AS & JS-HCD, AS & SPS, AS & SLP-HCD, AS & SUP and Nil & NOB. Overall liability results will tend to be dominated by changes to these clients, by sheer weight of numbers.

Figure F.1 Housing states (left) and welfare states (right) in the valuation quarterly transition model

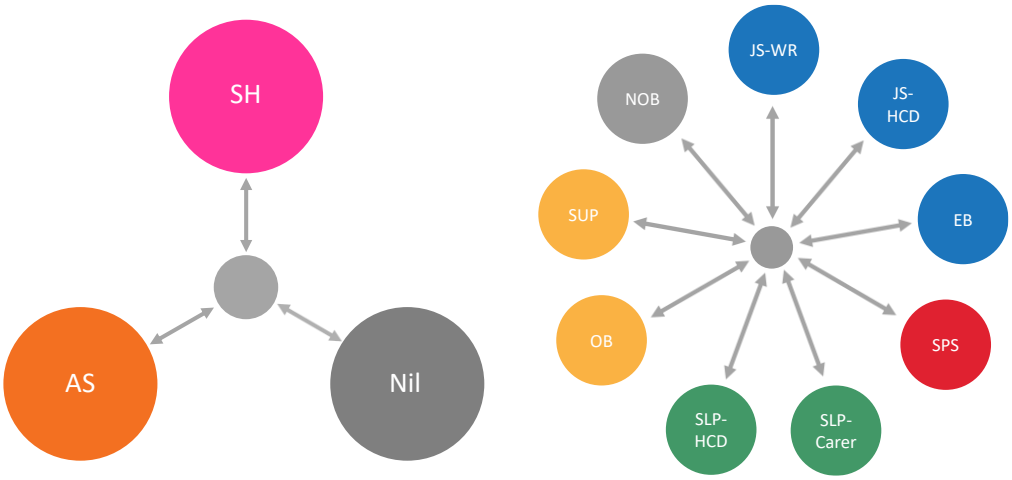


Table F.1 and Table F.2 show the models that have been fit to describe the transition behaviour in the social housing system and welfare system respectively. Detailed parameter values for these models are given in Appendix G, with a brief guide to these provided in Section F.8. All models were GLMs with the standard logistic link, with the exception of eight multinomial models. These multinomial models used the multinomial extension to logistic regression.

Table F.1 List of housing transition models used in valuation

Housing state	Type	Model ID	Description
SH	Logistic	hou_tra	Probability that a client in a social house and aged <65 remains in a social house the following quarter
SH	Logisic	hou_trap	Probability that a client in a social house and aged 64.75 remains in a social house the following quarter
SH	Logistic	hou_acc	Probability that a primary householder aged <65 and in a social house exits the social house and receives AS the following quarter
SH	Logistic	hou_accp	Probability that a primary householder aged >64.75 and in a social house exits the social house and receives AS the following quarter
SH	Logistic	hou_sec	Probability that a non-primary householder remains in a social house given the primary householder exits
SH	Logistic	hou_sec2	Probability that a non-primary householder remains in a social house given the primary householder remains
AS	Logistic	acc_nil	Probability that an AS client aged <65 does not receive AS in the next quarter, given the client does not move into a social house
AS	Logistic	acc_nilp	Probability that an AS client aged >64.75 does not receive AS in the next quarter, given the client does not move into a social house
Nil	Logistic	nil_acc	Probability a client aged <65 who is not 'Not on benefit' (NOB) receives AS in the next quarter, given they do not move into a social house

Housing state	Type	Model ID	Description
Nil	Logistic	nil_accp	Probability a client aged >64.75 who is not 'Not on benefit' (NOB) receives AS in the next quarter, given they do not move into a social house
AS or Nil	Logistic	reg_hou	Probability a client moves from the register to a social house
AS or Nil	Logistic	reg_oth	Probability a client exits the register not to a social house
SH	Logistic	tran1	Probability a client in a social house makes a register application in the quarter
AS or Nil	Logistic	reg1	Probability a client not in a social house makes a register application in the quarter
SH, AS or Nil	Logistic	a_dea	Probability a client aged >64.75 dies

Table F-2 List of welfare transition models used in valuation

Benefit state	Type	Model ID	Description
JS-WR	Logistic	jwr_tra	Probability that a client remains in JS-WR in the next quarter
JS-WR	Logistic	jwr_nob	Probability that a client moves from JS-WR to NOB, given that they leave JS-WR
JS-WR	Multinomial	jwr_mul	Multinomial Probability of moving to JS-HCD, SLP-HCD, SPS and OTH, conditional on leaving JS-WR and not entering NOB
JS-HCD	Logistic	jhd_tra	Probability that a client remains in JS-HCD in the next quarter
JS-HCD	Logistic	jhd _nob	Probability that a client moves from JS-HCD to NOB, given that they leave JS-HCD
JS-HCD	Multinomial	jhd _mul	Multinomial Probability of moving to JS-WR, SLP-HCD, SPS and OTH, conditional on leaving JS-HCD and not entering NOB
SPS	Logistic	sps_tra	Probability that a client remains in SPS in the next quarter
SPS	Logistic	sps_nob	Probability that a client moves from SPS to NOB, given that they leave SPS
SPS	Multinomial	sps_mul	Multinomial Probability of moving to JS-WR, SLP-HCD, JS-HCD and OTH, conditional on leaving SPS and not entering NOB
SLP-HCD	Logistic	slh_tra	Probability that a client remains in SLP-HCD in the next quarter
SLP-HCD	Logistic	slh_nob	Probability that a client moves from SLP-HCD to NOB, given that they leave SLP-HCD
SLP-HCD	Multinomial	slh_mul	Multinomial Probability of moving to JS-WR, JS-HCD, SPS and OTH, conditional on leaving SLP-HCD and not entering NOB
NOB	Logistic	nob_tra	Probability that a client remains in NOB in the next quarter

Benefit state	Type	Model ID	Description
NOB	Multinomial	nob_mul	Multinomial Probability of moving to JS-WR, JS-HCD, SPS, SLP-HCD and OTH, conditional on leaving NOB
Other –inwards	Logistic	oi_sup	Probability that someone entering OTH is entering SUP
Other - inwards	Multinomial	oi_mulm	Multinomial probability that someone entering OTH but not SUP enters EB, SLP-Carer or OB
Other	Logistic	o_tra	Probability that someone in OTH leaves their current state
Other	Logistic	o_nob	Probability that someone in OTH moves to NOB, given that they leave their current state
Other	Logistic	o_key	Probability that someone in OTH moves to one of JS-WR, JS-HCD, SPS or SLP-HCD, given that they leave their current state and do not move to NOB
Other	Multinomial	o_mulk	Multinomial probability of moving from OTH to each of JS-WR, JS-HCD, SPS and SLP-HCD, given that they move to one of these states
Other	Multinomial	o_mul2	Multinomial probability of moving within OTH to each of SUP, EB, SLP-Carer and OB, given that they move to one of these states

Notes:
(a) Other (OTH) in the table refers to benefits other than the main Tier 1 benefits, i.e. SUP, EB, SLP-Carer and OB

The structure is designed to place greater emphasis on the most important transitions; remaining in housing, remaining on the current benefit, moving out of housing, and moving out of the welfare system. Transitions where the client remains in the same state are handled by the models with “tra” suffixes. Transitions out of housing and welfare are handled by models with “nil” and “nob” suffixes respectively.

F.3 Combining the transition models

The transition models are combined to permit calculation of the probability of moving into any state. This is done on an individual level, but with consideration as to the transitions of others in the household. For example the probability of a non-signatory exiting housing the next quarter is much higher in cases where the primary householder exits, but is still less than one – the individual transition models allow for this. The diagrams below show the steps involved in calculating these probabilities for:

- A primary householder starting in a social house (SH) and a key benefit state (JS-WR/JS-HCD/SPS/SLP-HCD, here JS-WR)
- A non-primary (signatory) householder starting in a social house (SH) and off benefits (NOB)

Figure F-2 Transition diagram for a primary householder aged < 65 starting in a key benefit - here JS-WR

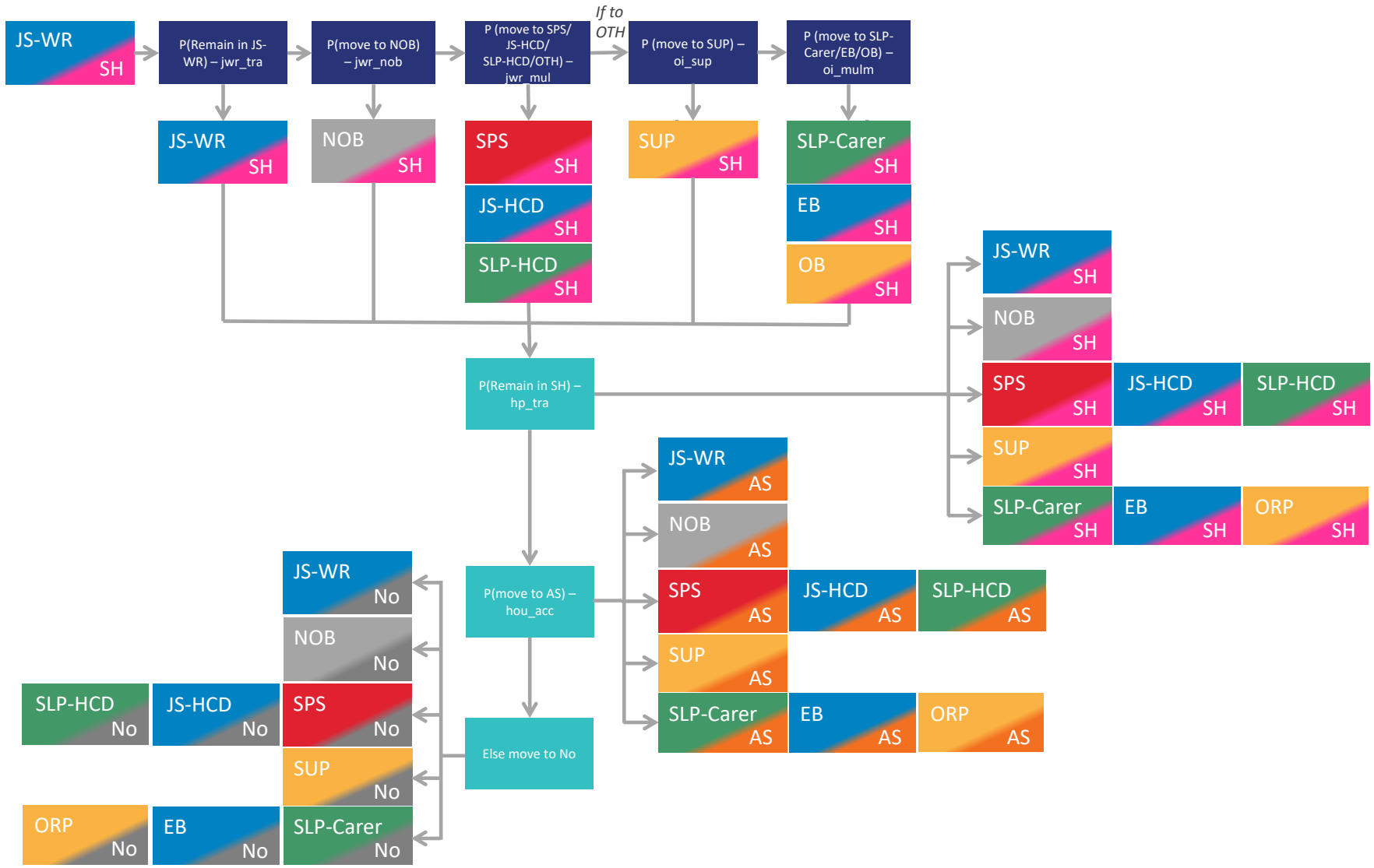
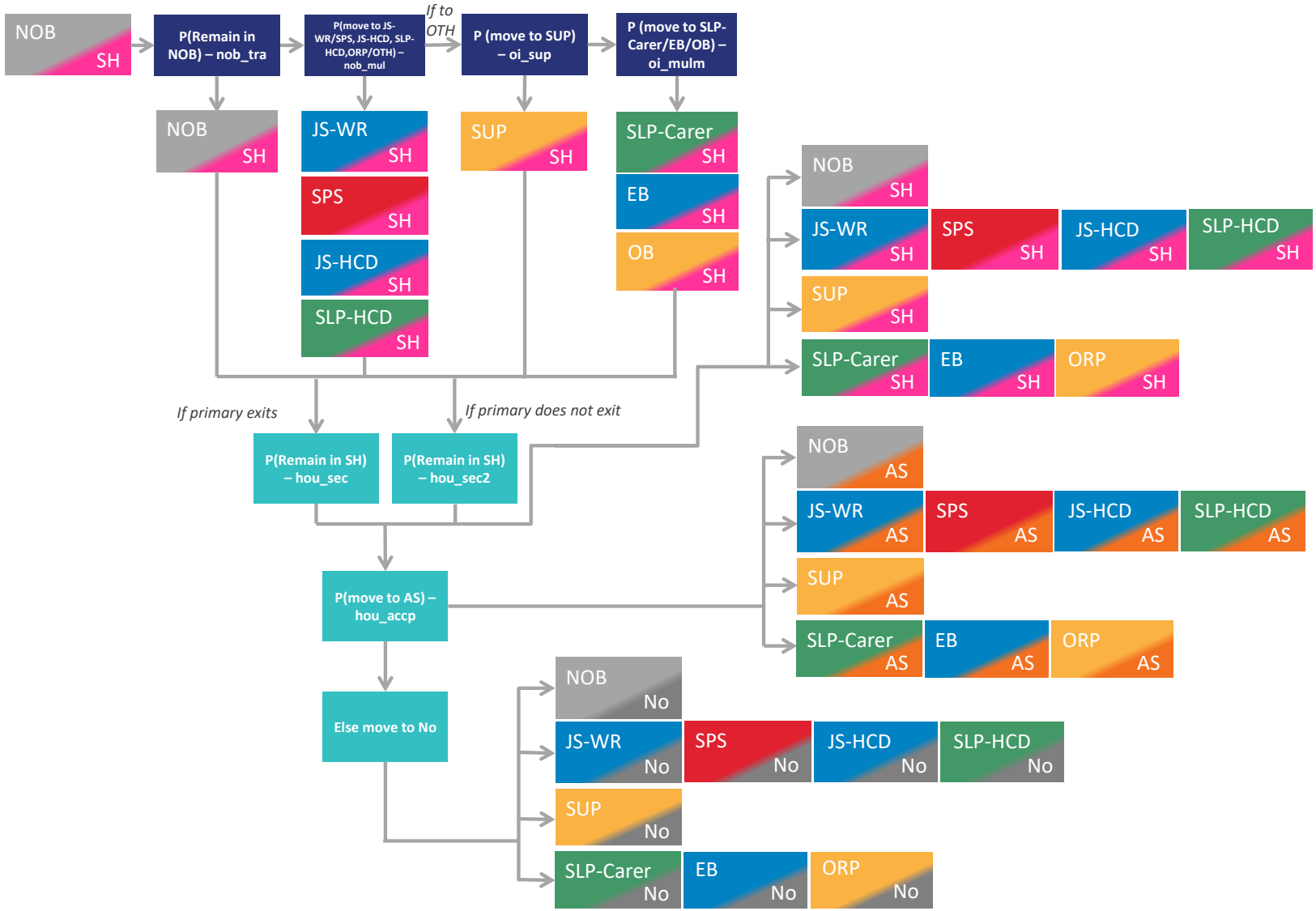


Figure F-3 Transition diagram for a non-primary (signatory) householder aged 65+ starting in a social house (SH) and off benefits (NOB)



F.4 Payment models

Clients in each state can receive a number of different payment types simultaneously:

- Income related rent subsidy (IRRS)
- Accommodation supplement (AS)
- Their main Tier 1 payment
- Orphans (or child living alone) Benefit (OB)
- Disability allowance (DA)
- Child disability allowance (CDA)
- Childcare subsidy (CCS)
- Hardship assistance (HS)
- Employment intervention payments (EI)
- Recoverable assistance (LOA in this section)

If we want to be able to distinguish between these various benefits, then separate models are required to estimate each. The models also need to be sensitive to the current state of a client, as well as all their other characteristics listed in Section F.5.

These models are summarised in Table F.2, which shows the payment models required for each of the states. Note that although it is impossible to receive AS while in a social house, it is possible to receive both in a quarter – hence the need to have both an IRRS and AS model for the Social housing states.

Table F.2 Payment models attributable to each state

Housing state	Benefit state	Payment Type										
		IRRS	AS	TAS	Main T1 (excl OB)	OB	DA	CDA	CCS	HS	EI	LOA
SH	SPS	●	●	●	●	●	●	●	●	●	●	●
SH	SLP-HCD	●	●	●	●	●	●	●	●	●	●	●
SH	JS-HCD	●	●	●	●	●	●	●	●	●	●	●
SH	JS-WR	●	●	●	●	●	●	●	●	●	●	●
SH	SLP-Carer	●	●	●	●	●	●	●	●	●	●	●
SH	EB	●	●	●	●	●	●	●	●	●	●	●
SH	OB	●	●	●		●	●	●	●	●	●	●
SH	SUP	●	●	●			●	●	●	●	●	●
SH	NOB	●		●					●	●	●	●
AS	SPS		●	●	●	●	●	●	●	●	●	●
AS	SLP-HCD		●	●	●	●	●	●	●	●	●	●
AS	JS-HCD		●	●	●	●	●	●	●	●	●	●
AS	JS-WR		●	●	●	●	●	●	●	●	●	●
AS	SLP-Carer		●	●	●	●	●	●	●	●	●	●
AS	EB		●	●	●	●	●	●	●	●	●	●
AS	OB		●	●		●	●	●	●	●	●	●
AS	SUP		●	●			●	●	●	●	●	●
AS	NOB			●					●	●	●	●
No	SPS			●	●	●	●	●	●	●	●	●
No	SLP-HCD			●	●	●	●	●	●	●	●	●
No	JS-HCD			●	●	●	●	●	●	●	●	●
No	JS-WR			●	●	●	●	●	●	●	●	●
No	SLP-Carer			●	●	●	●	●	●	●	●	●
No	EB			●	●	●	●	●	●	●	●	●
No	OB			●		●	●	●	●	●	●	●
No	SUP			●			●	●	●	●	●	●
No	NOB			●					●	●	●	●

While there are a large number of payment models, we note that the relative significance of each differs greatly. IRRS payments make up over 90% of the payments in the social housing current liability and main

benefits plus accommodation support make up 90% of benefit payments in the welfare current client liability payments, so these payment types are modelled in greater detail.

It is therefore possible to rationalise the number of models by combining payments of a particular type across recipients in different benefit states. The models fitted are shown in Table F.3. The IRRS payment model and each of the main benefit models are fitted separately as are the larger components of Tier 2 payments (e.g. AS for JS-WR recipients, DA for JS-HCD and SLP-HCD recipients).

Table F.3 Payment models attributable to each state

Housing state	Benefit state	Payment Type										
		IRRS	AS	TAS	Main T1 (excl OB)	OB	DA	CDA	CCS	HS	EI	LOA
SH	SPS	hou_irrs2	hou_as	hou_tas	jwr_abp	jwr_orp	a_da	a_cda	a_ccs	jwr_hs	x_ei	jwr_loa
SH	SLP-HCD	hou_irrs2	hou_as	hou_tas	jhd_abp	jhd_orp	jhd_da	a_cda	a_ccs	jhd_hs	a_ei	jhd_loa
SH	JS-HCD	hou_irrs2	hou_as	hou_tas	sps_abp	sps_orp	sps_da	sps_cda	sps_ccs	sps_hs	x_ei	sps_loa
SH	JS-WR	hou_irrs2	hou_as	hou_tas	slh_abp	slh_orp	slh_da	a_cda	a_ccs	slp_hs	a_ei	slh_loa
SH	SLP-Carer	hou_irrs2	hou_as	hou_tas	emb_abp	a_orp	a_da	a_cda	a_ccs	a_hs	x_ei	a_loa
SH	EB	hou_irrs2	hou_as	hou_tas	slc_abp	a_orp	a_da	z_cda	z_ccs	a_hs	a_ei	a_loa
SH	OB	hou_irrs2	hou_as	hou_tas	orp_abp		a_da	z_cda	z_ccs	a_hs	a_ei	a_loa
SH	SUP	hou_irrs2	hou_as	hou_tas			z_da	z_cda	z_ccs	z_hs	a_ei	z_loa
SH	NOB	hou_irrs2	hou_as	hou_tas					nob_ccs	nob_hs	nob_ei	nob_loa
AS	SPS		acc_pmt	acc_tas	jwr_abp	jwr_orp	a_da	a_cda	a_ccs	jwr_hs	x_ei	jwr_loa
AS	SLP-HCD		acc_pmt	acc_tas	jhd_abp	jhd_orp	jhd_da	a_cda	a_ccs	jhd_hs	a_ei	jhd_loa
AS	JS-HCD		acc_pmt	acc_tas	sps_abp	sps_orp	sps_da	sps_cda	sps_ccs	sps_hs	x_ei	sps_loa
AS	JS-WR		acc_pmt	acc_tas	slh_abp	slh_orp	slh_da	a_cda	a_ccs	slp_hs	a_ei	slh_loa
AS	SLP-Carer		acc_pmt	acc_tas	emb_abp	a_orp	a_da	a_cda	a_ccs	a_hs	x_ei	a_loa
AS	EB		acc_pmt	acc_tas	slc_abp	a_orp	a_da	z_cda	z_ccs	a_hs	a_ei	a_loa
AS	OB		acc_pmt	acc_tas	orp_abp		a_da	z_cda	z_ccs	a_hs	a_ei	a_loa
AS	SUP		acc_pmt	acc_tas			z_da	z_cda	z_ccs	z_hs	a_ei	z_loa
AS	NOB		acc_pmt	acc_tas					nob_ccs	nob_hs	nob_ei	nob_loa
No	SPS			niltas	jwr_abp	jwr_orp	a_da	a_cda	a_ccs	jwr_hs	x_ei	jwr_loa
No	SLP-HCD			niltas	jhd_abp	jhd_orp	jhd_da	a_cda	a_ccs	jhd_hs	a_ei	jhd_loa
No	JS-HCD			niltas	sps_abp	sps_orp	sps_da	sps_cda	sps_ccs	sps_hs	x_ei	sps_loa
No	JS-WR			niltas	slh_abp	slh_orp	slh_da	a_cda	a_ccs	slp_hs	a_ei	slh_loa
No	SLP-Carer			niltas	emb_abp	a_orp	a_da	a_cda	a_ccs	a_hs	x_ei	a_loa
No	EB			niltas	slc_abp	a_orp	a_da	z_cda	z_ccs	a_hs	a_ei	a_loa
No	OB			niltas	orp_abp		a_da	z_cda	z_ccs	a_hs	a_ei	a_loa
No	SUP			niltas			z_da	z_cda	z_ccs	z_hs	a_ei	z_loa
No	NOB			niltas					nob_ccs	nob_hs	nob_ei	nob_loa

Some detailed comments on the payment models follow:

» Payments are allocated by client quarter, or proportionally in the event that payment spells span multiple quarters. Further, all payments are scaled to June 2015 benefit levels, using the CPI index applied to benefit payments over the past 22 years. We have used past increases in DPB/SPS payment levels to infer these CPI increases. Non-CPI increases (such as those seen for AS) come through as additional time series effects in the models. IRRS payments are modelled as a proportion of market rent, rather than as a dollar amount.

» All models were Poisson with a log link, expect the IRRS payment model, which uses a logit link. The choice of distribution was found to have a very minor effect on predictions in the payment models.

» Table F.3 is a simplification in two ways:

- It shows the housing payment models for clients up to age 65. For clients aged 65 and above a second model is used with the suffix 'p'. For example for AS payments a clients aged 65 and above the model acc_pmtp is used.
- It shows one IRRS payment model for clients in social housing ('hou_irrs2'), there is in fact a second model used on the quarter of entry to social housing ('hou_irrs1').

- As implied above, some payment models are 'shared' across states– for example, the accommodation supplement payments for all clients in the AS housing state use the 'acc_pmt' payment model. Similarly the main payment model for clients on Jobseeker support is 'jwr_abp', this is used regardless of housing state. This sharing is done when the individual models are believed to share similarities to improve the efficiency of modelling. In these cases the current state is also used as a predictor to ensure that any differences between states are still modelled.
- It is possible to receive more than one Tier 1 benefit in a quarter. We have dealt with this by reallocating all Tier 1 payments to the current state; for example if someone is allocated to JS-WR in a quarter but they receive both JS-WR and JS-HCD, all payments are summed and treated as JS-WR. The overall impact of this allocation is very small, since:
    - The amounts involved are generally small compared to a full quarter's benefit
    - The allocations largely offset each other (e.g. for every client with a JS-HCD payment allocated to JS-WR there is another with a JS-WR payment allocated to JS-HCD)
    - The average number of quarters before transitions is high enough that such a reallocation occurs in a relatively small proportion of quarters.
- NOB requires payment models for Childcare subsidy (CCS), Hardship benefit (HS) and Employment intervention (EI) because clients only in receipt of these benefits are assigned to the NOB state.
- There is an important point to note regarding the non-main payment models (that is, every column of models except the first, second and fourth in Table F.3). These payments represent an **average** value across people in a given benefit state; thus to take an example, the TAS model for those in the JS-WR state estimates the average TAS paid to clients receiving JS-WR, conditional on all their attributes like age, gender etc. However in reality some JS-WR clients receive TAS and some do not, so at an individual level these payment models are misleading since the actual AS payments will usually be much higher (if the client receives TAS) or much lower (if they do not). Thus these payment levels are appropriate for the aggregate and segment level valuation, but must be interpreted carefully when inspected at an individual level. Distinguishing between the cases of receipt of supplementary payments at an individual level is beyond the scope of this valuation.

F.5 Model predictors

A list of independent variables or predictors used in the various GLM models includes:

- Quarter
- Client age
- Gender
- Number of quarters:
    - In current housing state
    - On current benefit
    - Since last in housing
    - Since last on the register for housing
    - Since first benefit
    - Spent in social housing
    - Spent in each of the various benefit states
- Ethnicity
- Region (Territorial Local Authority and Board in Auckland)
- Regional unemployment rates
- Education level
- For those in social housing and/or the register:
    - Income level
    - IRRS level
    - Household size

    - Number of quarters the household has been together
    - Designation of primary and signatory
    - SAS priority of application
    - Market rent for the location
- Youngest child age and number of registered children (for SPS clients)
- Partner flag (SLP-HCD, JS-HCD, JS-WR and EB clients)
- Incapacity type (SLP-HCD and JS-HCD clients)
- Whether the incapacity belongs to the client's partner (SLP-HCD and JS-HCD clients)
- Benefit last spell (if any)
- Housing last spell (if any)
- Family benefit history ('intergenerational') variables including match type with a parent beneficiary and intensity of the parent's benefit receipt while the client was aged 13-18 (note that this data is available only for those aged 25 or under)
- Child, Youth and Family history variables which measure a client's exposure to CYF services as a child
- Criminal conviction history variables which measure a client's convictions and related recent and longer-term exposure to correctional services
- Relevant client characteristics which depend upon the benefit being received (e.g. Health condition or disability for JS-HCD or SLP-HCD, number and ages of children for SPS, partner information for a number of benefits etc).

In theory there are a very large number of variables that would impact on a client's lifetime social housing cost that do not feature in the list above (including health system information, employment history, family status etc.). The omission of a variable does not imply that it is unimportant. Rather, it indicates that our results should be considered as an average over that variable.

The variables may be separated into two categories:

- **Static variables:** those that remain fixed at all points in time (for example gender).

- **Dynamic variables:** those that change over time. These may be further subdivided into:
    - Those that vary in a known (deterministic manner). Examples include quarter, age, the various duration measures, and market rents (given our assumptions of a single set of forecasts for rental growth by future benefit quarter and region).
    - Those that vary in an unknown (stochastic manner). A client's region, the number of children and age of youngest child for SPS recipients and the incapacity type for HCD clients (JS and SLP) are examples of these predictors.

We generally refer to the last category as "semi-dynamic", recognising that while they change over time, changes are generally slow; the value does not change for most clients every quarter. For example, most clients remain in the same region in the subsequent quarter, but a small proportion move between regions.

A full list of the semi-dynamic variables is given here together with an overview of their updating method. Some detailed examples are then given.

Numerous modelling variables are used including:

- **Variables while in social housing:** Relationship to primary householder, number of signatories, household size, weekly IRRS level, weekly market rent, number of bedrooms, territorial authority.
- **Variables while on register:** Relationship to primary applicant, SAS priority and need scores, household size, preferred locations.
- **Variables for everyone, regardless of housing state:** Territorial authority, private market rents, social housing and AS history variables.
- **Time-related variables:** Quarter and the corresponding unemployment rate (at a national and regional level).
- **Client-related variables:** Age, gender, ethnicity, education level and region.

- **Client history:** Whether the client's parents were beneficiaries while the client was aged 13-18 and the intensity of benefit receipt.
- **Benefit history:** Number of quarters: on current benefit, previous benefit, since first benefit and spent in each state.
- **Family-related variables:** Youngest child age and number of registered children (for SPS clients), and Partner flag (for JS and SLP clients).
- **Health and disability-related variables:** Incapacity type for JS-HCD and SLP-HCD clients, and whether the incapacity belongs to the primary client or to their partner.
- **Criminal convictions history:** Four variables that related to time serving criminal sentences resulting from an offence. The most important two are the percentage of time spent in prison in the past year and the percentage of time over the past ten years serving any type of criminal sentence.
- **Child protection and youth justice variables:** For clients up to age 25 we include whether the client as a child was involved in a child protection or youth justice event, the number of events that occurred, the age of the client when the first event occurred and the number of days in placement.

The omission of certain variables does not mean they are unimportant. Rather, it indicates that our results can be viewed as an average over that variable.

F.5.1 Macroeconomic variables

We use private sector level of rents (25th percentile, based on data from MBIE) in some housing models. Historically this has a moderate influence on the rate of register applications.

We use the unemployment rate extensively in benefit system models but not in housing models. This means that the unemployment rate is an important but indirect variable in our housing projection. In our projection higher unemployment rates increase entries into the benefit system which in turn increases register applications.

F.5.2 Mortality adjustments

As well as a using a mortality model for those aged over 65, we attempt to adjust for improving mortality over time. Statistics New Zealand projects substantial mortality improvements over time[2]; life expectancy should grow by 12 years for females over the next 90 years and by 14 years for males. This means older clients will tend to leave homes slower in the future, as about half of social housing exits for those over 70 is due to death or poor health.

We have allowed for mortality by 'shifting the age curve to the right' for older clients. So a 73-year-old male in 2023 is assumed to have the same dynamics as a 72-year-old male in 2016, and a 73-year-old male in 2030 is assumed to behave like a 71-year-old male in 2016. We apply this shift for all clients aged over 70, and do so at a rate of 1 year per 26 quarters for males and 1 year per 30 quarters for females.

F.5.3 List of semi-dynamic predictors

Register status

Information on any register applications active during the quarter is stored for all clients.

[2] http://www.stats.govt.nz/methods/research-papers/working-papers-original/forecasting-mortality-14-01.aspx

IRRS as a ratio of market rent

The IRRS payment level and the market rent of the house for the area is stored for all clients in social housing.

Region and TLA

The client's region is stored for every client on benefit. For clients in a social house this is at the Territorial Local Authority (and Board in Auckland) level. Information on the region when last on benefit is retained for those not on benefit.

Household

Household size, primary and signatory status can all evolve with time. For this valuation we have not modelled this evolution (see section 10.3 of the main body of the report).

Children variables

The number of children (1, 2 or 3+) is stored for SPS recipients, as is the age of the youngest child.

Partner flag

This is stored for clients in EB, SLP-HCD, JS-HCD and JS-WR. It is not stored for all other benefit types.

Incapacity variables

The variables relating to incapacity group, the number of incapacities and a flag for whether the incapacity relates to a partner (for cases where the client has a partner) are stored for SLP-HCD and JS-HCD only.

Child, Youth and Family variables

Variables specifying whether the client as a child was involved in child protection or youth justice services (or both), the number of CYF events, days in child protection and age at first entry into the CYF system are stored for clients up to age 25. These can potentially change for clients up to age 18, but are fixed thereafter.

Criminal conviction history variables

We used for variables related to criminal conviction and related sentences, available for all clients. These were the percentage of time in prison over the last year, serving any sentence over the last year excluding those for driving offences, serving any sentence over the last ten years excluding driving offences, and in serving a sentence specifically related to theft over the last ten years.

F.5.4 Updating semi-dynamic predictors

This section discusses the updating methods for each of the semi-dynamic variables. Note that GLMs and probability tables referred to here are presented in the electronic appendices G and J.

Register status

The register status of clients is updated as follows:

Clients in social housing:

- **On the transfer register:** A model is run to determine the probability the client moves into a different social house. All clients on the register are semi randomly sorted according to assessed need and the probability of moving into a house depends on an appropriately sized house being available in the desired TLA (or neighboring TLAs). The sorting is done in a way such that a client twice as likely to enter housing (according to the reg_hou model) is twice as likely to be higher in the list. If the client does not move into social housing a second model is run to determine the probability they exit the register not to social housing.
- **Not on the register:** A model is run to determine the probability that the client makes a new transfer application in the quarter. If so a second model is run to determine the priority of this application and the requested TLA is sampled from a table of probabilities.

Clients not in housing but on benefits:

- **On the register:** A model is run to determine the probability the client moves into a social house. All clients on the register are semi randomly sorted according to assessed need and the probability of moving to a house depends on an appropriately sized house being available in the desired TLA (or neighboring TLAs). If the client does not move into social housing a second model is run to determine the probability they exit the register not to social housing.
- **Not on the register:** A model is run to determine the probability that the client makes a new application in the quarter. If so a second model is run to determine the priority of this application and the requested TLA is sampled from a table of probabilities.

IRRS as a ratio of market rent

For clients entering social housing we simulate the market rent of the house (based on a distribution around first quartile rent levels) and then simulate the expected fraction of market rent that will be paid by IRRS.

For clients remaining in social housing IRRS level is first given a 'default' update:

$$Default\ IRRS\ update = (Old\ rent \times rental\ growth\ \ inflation - old\ rent) + old\ IRRS$$

The default update is slightly modified when the individuals are on NZ Super. These benefits are indexed to AWE, which we assume grows faster than CPI.

We have a series of models for IRRS updating each quarter:

- Probability that IRRS level moves from zero to nonzero, or vice versa
- If it toggles to nonzero, we have a probability table for expected IRRS level (as a fraction of market rent)
- If IRRS remains nonzero, we have a probability model for whether the new IRRS equals the default update. If not, we apply a probability table for the new IRRS level.

Region – all benefits

Region is updated as follows:

Switching between benefits: A model is run to determine whether the region changes. If it changes, then the region is sampled from a table of probabilities. The new TLA is then sampled from a second table of probabilities. If the region does not change a second model is run to determine if the TLA changes. If it changes, then the new TLA is sampled from another table of probabilities.

Returning to benefit after being off benefit for at least one quarter: a binomial GLM gives the probability that a client's region (last updated when they were last on benefits) has changed while they were off benefit. In each simulation, if we sample that the region has changed and if so the new region is sampled from a table of probabilities. The new TLA is then sampled from a second table of probabilities.

If the region has not changed a second model is run to determine if the TLA has changed. If it has, then the new TLA is sampled from another table of probabilities.

Leaving benefits: the region is not changed but the current value is stored.

Children variables - number of children and age of youngest child – SPS only

These variables are updated as follows:

Entering SPS: Values for the number of children are sampled from a table of probabilities based on the client's age. Values for the age of the youngest child are sampled from a zero inflated beta model (**aye**).

Remaining in SPS: At each quarter

- A GLM is run to calculate the probability of a new youngest child.
- If no new youngest child, then the age of the youngest child increments by 0.25 years.
- If there is a new youngest child, then the age of this child is sampled from a zero inflated beta model. If the model returns 0 as the value, the age of the child is actually spread over 0, 0.25 and 0.5 years by the probabilities 0.2, 0.7 and 0.1 respectively.
- For all SPS clients, the change in the total number of children is sampled from a multinomial GLM. Note probabilities are different depending on whether there is a new youngest child or not.

Leaving SPS: child variable information is forgotten.

Partner flag – EB, SLP-HCD, JS-HCD and JS-WR only

The partner flag variable is updated as follows:

Moving into any of EB/SLP-HCD/JS-HCD/JS-WR from one of the other benefits: a binomial GLM gives the probability that the client has a partner.

Remaining in any of EB/SLP-HCD/JS-HCD/JS-WR: a binomial GLM gives the probability that the partner flag switches (i.e. if the client has a partner they switch to having no partner and vice versa).

Leaving EB/SLP-HCD/JS-HCD/JS-WR and moving into one of the other benefits: partner information is dropped.

Incapacity variables – incapacity group, number of incapacities, incapacity relating to partner – JS-HCD and SLP-HCD only

The incapacity variables are updated as follows:

Entry into JS-HCD or SLP-HCD from other benefits: The incapacity group is sampled from a probability table. After that a second probability table is used to simulate the number of incapacities and (if the client has a partner) a third probability table is used to determine whether the incapacity relates to the partner or not.

There are different probability tables for each of the situations: entry into JS-HCD from all benefits apart from SLP-HCD, entry into SLP-HCD from all benefits apart from JS-HCD, switching from JS-HCD to SLP-HCD and switching from SLP-HCD to JS-HCD.

Leaving JS-HCD / SLP-HCD: incapacity variables are forgotten.

Child, Youth and Family variables

The Child, Youth and Family (CYF) variables are updated (for clients under age 18) as follows:

- A binomial GLM is run for the probability of at least one CYF event occurring in the quarter. If yes:

- A lookup table is used to update the type of interaction (i.e. child protection or youth justice).
- Another lookup table is used to simulate the number of new events in the quarter (one or more).
- If it is the first event for a person, the age of entry into CYF is recorded.

» In both cases of the initial GLM, a binomial GLM is used to simulate the probability that the number of days in a CYF child protection placement changes in the quarter. This is always no if the CYF history does not include child protection.
  - If yes, then two lookup tables are used to simulate how many additional days in placement are applicable.

Criminal conviction history variables

The proportion of time in prison, non-prison theft sentences and other sentences are stored for the previous 40 quarters, making 120 variables in total. This is sufficient for calculating the four variables used in the transition and payment models. For each successive quarter, we delete the oldest of the 40 quarters and simulate the newest one:

» If there **was no** sentence served in the previous quarter, a binomial GLM is used to simulate the probability that a new sentence is served in the quarter. The GLM uses a number of demographic characteristics of the individual.
  - If no, then the sentence served variables for the new quarter are set to zero.
  - If yes, then a table is used to allocate which type of sentence is served (prison, theft or other). A second lookup table is then used to allocate the proportion of the quarter served for each non-zero variable.

» If there **was** a sentence served in the previous quarter, a binomial GLM is used to simulate the probability that a new sentence continues in the new quarter.
  - If no, then the sentence served variables for the new quarter are set to zero.
  - If yes, then an additional binomial GLM is used model the probability that the type of sentence being served changes. Lookup tables for the type and proportion are then used to simulate the new non-zero variables for that quarter.

This allows the 120 variables encoding sentence history to be updated for the new quarter. The four variables used in the models are then re-calculated before transition and payment models are applied.

F.6 Overlay models

Due to the housing and welfare state definitions of being in a housing state (SH say) or benefit (SPS say) in a quarter, additional information is needed for segment allocation to know if:

» The client is in the same state at the end of the quarter and
» The client has been on benefits continuously throughout the quarter.

We project this using models referred to as 'overlay models,' as they do not affect the main projection results, so they can be regarded as by-products of the simulation.

The overlay models include a full multinomial allocation of benefit type received by a client at the end of a benefit quarter. The process is:

» Firstly for welfare:
  - The benefit state for the current ("ben_now") and next quarter ("ben_next") are determined using the core transition models
  - If ben_now or ben_next are NOB (not on benefit), then end of quarter benefit status ("ben_end") is set to NOB
  - If not, then if ben_now is NZ Super, then ben_end is set to NZ Super

- If not, then a binomial GLM is used for the probability that ben_end is the same as either ben_now or ben_next. If yes, then a lookup table is used to allocate
- If not, and either ben_now or ben_next are SUP, then ben_end is set to NOB
- If not, then a binomial GLM is used for the probability that the end of quarter benefit is NOB. If yes, then ben_end is set to NOB
- If not and either ben_now or ben_next are ORP, then ben_end is set to ORP
- If not, then a binomial GLM is used for the probability that the end of quarter benefit is SUP. If yes, then ben_end is set to SUP
- If not, then a lookup table is used to simulate the remaining possibilities for ben_end

» Then for housing:
- The housing state for the current ("hou_now") and next quarter ("hou_next") are determined using the core transition models
- If hou_now and hou_next are both SH then the housing end of quarter status ("hou_end") is set to SH
- If hou_now is SH but hou_next is AS then hou_end is set to AS
- Similarly if hou_now is AS but hou_next is SH then hou_end is set to AS
- If hou_now and hou_next are both AS then a binomial GLM is used to predict if hou_end is AS or No
- A person is on the register at the end of the quarter if they were on the register and failed to exit under the reg_hou or reg_exit binomial models (exit to social house and other exit respectively)

Once this chain of logic has been completed, we then update continuous duration. If ben_end is NOB, then the continuous duration is set to zero. Otherwise a binomial GLM is used to decide whether continuous duration is incremented by 1 (i.e. the client has had no 14 day breaks off benefits in the quarter) or reset to zero (i.e. they did have a 14 day break).

F.7 Number of new clients model

We allow for new individuals to be added to the projection, at the point at which they are part of a register application. This helps measure the lifetime housing cost of future applicants, but also models housing availability by plausibly estimating Numbers of individuals entering are thus a function of

» The number of register applications each quarter
» The number of individuals per application
» The proportion of future applicants who are not part of the starting projection population, nor a register applicant in an earlier period.

We have each of these components. For entries beyond 10 years into the future, the last bullet requires extrapolation due to data limitations.

For each new client on the register we randomly sample client characteristics from the equivalent population of people entering the system in 2014/15. After entry, their pathway through housing and welfare is the same as other individuals in the projection.

F.8 Guide to electronic Appendix G

The file Appendix G.xlsx contains tables of the parameters for:

» Each of the models listed in Table F.1 and Table F.3
» The models for dynamic predictors described in Section F.5.4
» The overlay models used for simulating continuous duration (Section F.6)
» The number of future new clients (Section F.7).

Many of the parameters correspond to functions of the predictors rather than the raw predictors (see Section F.1.3); thus each table is accompanied by the formulae giving the derivation of the predictor.

A number of models use offsets in their fitting, particularly for the welfare transition models. These help lock-in effects (for example, fixing the unemployment rate sensitivity to the same level as previously), as well as encoding some of the projection assumptions described in Section 9.4 of the report. A description of these offsets is also included in Appendix G - Model Coefficients.

APPENDIX G MODEL COEFFICIENTS

Please see the separate spreadsheet for model parameterisations.

APPENDIX H ACTUAL VERSUS EXPECTED COMPARISONS FOR 2015/16

H.1 Household level results

H.1.1 Actual versus expected results by starting segment

H.1.1.1 Number of households in social housing during the quarter

Segment					Q1			Q2			Q3			Q4			Average across quarters		
				H_seg	Actual	Expected	Ratio	Actual	Expected	Ratio	Actual	Expected	Ratio	Actual	Expected	Ratio	Actual	Expected	Ratio
On register	Priority A			110	489	252	194%	674	483	139%	767	640	120%	811	775	105%	685	537	128%
	Priority B and other			120	182	67	271%	309	132	234%	393	169	233%	438	229	191%	330	149	221%
IRRS recipients, primary aged <65	Less close / IRRS>$150	Child in the household	Work obligated	211	8,225	8,345	99%	8,166	8,182	100%	8,013	8,030	100%	7,854	7,874	100%	8,064	8,108	99%
			Not work obligated	212	8,402	8,517	99%	8,336	8,365	100%	8,171	8,227	99%	8,004	8,092	99%	8,228	8,300	99%
			NOMB	213	7,044	7,230	97%	6,983	7,072	99%	6,862	6,954	99%	6,720	6,853	98%	6,902	7,027	98%
		No child in the household	Work obligated	214	1,644	1,659	99%	1,629	1,619	101%	1,592	1,583	101%	1,564	1,553	101%	1,607	1,603	100%
			Not work obligated	215	8,996	9,041	100%	8,920	8,906	100%	8,790	8,773	100%	8,675	8,666	100%	8,845	8,847	100%
			NOMB	216	3,085	3,167	97%	3,056	3,097	99%	3,007	3,043	99%	2,955	2,985	99%	3,026	3,073	98%
	Closer / IRRS≤$150	Child in the household	Work obligated	221	1,493	1,528	98%	1,458	1,473	99%	1,412	1,427	99%	1,372	1,373	100%	1,433	1,450	99%
			Not work obligated	222	1,367	1,390	98%	1,346	1,336	101%	1,296	1,294	100%	1,259	1,252	100%	1,317	1,318	100%
			NOMB	223	3,707	3,794	98%	3,641	3,677	99%	3,499	3,582	98%	3,389	3,493	97%	3,559	3,637	98%
		No child in the household	Work obligated	224	442	453	98%	432	434	99%	421	415	101%	411	399	103%	426	425	100%
			Not work obligated	225	2,620	2,651	99%	2,588	2,584	100%	2,523	2,519	100%	2,466	2,460	100%	2,549	2,553	100%
			NOMB	226	2,623	2,685	98%	2,554	2,611	98%	2,437	2,542	96%	2,336	2,474	94%	2,488	2,578	96%
IRRS recipients, primary aged 65+	Less close / IRRS>$150	Child in the household		311	1,389	1,384	100%	1,387	1,355	102%	1,376	1,328	104%	1,354	1,312	103%	1,376	1,345	102%
		No child in the household		312	8,435	8,403	100%	8,334	8,172	102%	8,167	7,973	102%	8,036	7,785	103%	8,243	8,083	102%
	Closer / IRRS≤$150	Child in the household		321	231	231	100%	229	225	102%	226	219	103%	223	215	104%	227	222	102%
		No child in the household		322	2,994	2,986	100%	2,943	2,893	102%	2,871	2,803	102%	2,788	2,716	103%	2,899	2,849	102%
Recent exit from housing	Receiving AS			410	33	7	451%	74	28	267%	118	59	199%	171	89	191%	99	46	215%
	Not receiving AS	Aged <60		420	61	8	808%	92	30	307%	121	55	217%	156	85	183%	107	45	241%
		Aged 60+		430	8	1	1309%	11	0	-	12	1	1215%	14	2	651%	11	1	1203%
Recent exit from register	Receiving AS			510	37	9	416%	81	26	304%	147	58	251%	211	100	210%	119	49	245%
	Not receiving AS			520	161	3	6429%	210	10	2183%	220	16	1387%	234	32	741%	206	15	1385%
Total					63,665	63,808	100%	63,449	62,707	101%	62,435	61,711	101%	61,437	60,816	101%	62,746	62,260	101%

H.1.1.2 Average IRRS per household ($)

Segment					Q1			Q2			Q3			Q4			Average across quarters		
				H_seg	Actual	Expected	Ratio	Actual	Expected	Ratio	Actual	Expected	Ratio	Actual	Expected	Ratio	Actual	Expected	Ratio
On register	Priority A			110	1,985	3,035	65%	2,692	2,990	90%	2,869	2,950	97%	2,992	2,987	100%	2,635	2,990	88%
	Priority B and other			120	1,507	2,883	52%	2,333	2,785	84%	2,628	2,717	97%	2,809	2,875	98%	2,319	2,815	82%
IRRS recipients, primary aged < 65	Less close / IRRS > $150	Child in the household	Work obligated	211	3,587	3,559	101%	3,612	3,588	101%	3,622	3,568	102%	3,646	3,591	102%	3,617	3,577	101%
			Not work obligated	212	3,680	3,650	101%	3,719	3,684	101%	3,740	3,664	102%	3,791	3,692	103%	3,732	3,673	102%
			NOMB	213	3,385	3,314	102%	3,356	3,367	100%	3,379	3,349	101%	3,422	3,384	101%	3,386	3,354	101%
		No child in the household	Work obligated	214	3,485	3,392	103%	3,448	3,397	102%	3,455	3,358	103%	3,452	3,369	102%	3,460	3,379	102%
			Not work obligated	215	3,506	3,447	102%	3,529	3,466	102%	3,528	3,439	103%	3,556	3,463	103%	3,530	3,454	102%
			NOMB	216	3,316	3,238	102%	3,266	3,278	100%	3,272	3,238	101%	3,288	3,275	100%	3,286	3,257	101%
	Closer / IRRS ≤ $150	Child in the household	Work obligated	221	1,516	1,457	104%	1,509	1,473	102%	1,547	1,464	106%	1,566	1,486	105%	1,535	1,470	104%
			Not work obligated	222	1,462	1,402	104%	1,472	1,433	103%	1,515	1,438	105%	1,574	1,457	108%	1,506	1,432	105%
			NOMB	223	963	932	103%	1,031	1,004	103%	1,127	1,057	107%	1,231	1,120	110%	1,088	1,028	106%
		No child in the household	Work obligated	224	1,520	1,453	105%	1,509	1,453	104%	1,526	1,442	106%	1,553	1,451	107%	1,527	1,450	105%
			Not work obligated	225	1,509	1,476	102%	1,515	1,485	102%	1,534	1,476	104%	1,568	1,493	105%	1,531	1,482	103%
			NOMB	226	846	826	102%	892	880	101%	988	910	109%	1,089	956	114%	954	893	107%
IRRS recipients, primary aged 65+	Less close / IRRS > $150	Child in the household		311	3,834	3,754	102%	3,864	3,791	102%	3,869	3,786	102%	3,927	3,797	103%	3,874	3,782	102%
		No child in the household		312	3,233	3,178	102%	3,260	3,209	102%	3,282	3,194	103%	3,319	3,217	103%	3,274	3,199	102%
	Closer / IRRS ≤ $150	Child in the household		321	1,079	1,050	103%	1,134	1,102	103%	1,270	1,158	110%	1,307	1,208	108%	1,198	1,129	106%
		No child in the household		322	1,280	1,247	103%	1,309	1,271	103%	1,348	1,275	106%	1,402	1,297	108%	1,335	1,273	105%
Recent exit from housing	Receiving AS			410	1,326	3,329	40%	1,991	2,909	68%	2,282	2,819	81%	2,181	3,023	72%	1,945	3,020	64%
	Not receiving AS	Aged <60		420	2,678	3,311	81%	2,508	3,089	81%	2,677	3,205	84%	2,507	3,285	76%	2,592	3,223	80%
		Aged 60+		430	2,895	1,196	242%	2,727	-	-	2,900	2,068	140%	2,896	2,482	117%	2,854	1,915	149%
Recent exit from register	Receiving AS			510	1,311	3,250	40%	2,252	3,132	72%	2,361	2,776	85%	2,571	2,717	95%	2,124	2,969	72%
	Not receiving AS			520	2,741	3,551	77%	2,846	2,761	103%	2,838	2,809	101%	2,839	2,587	110%	2,816	2,927	96%
Total					2,907	2,871	101%	2,934	2,909	101%	2,967	2,901	102%	3,013	2,934	103%	2,955	2,904	102%

H.1.1.3 Total IRRS ($m)

Segment					Q1			Q2			Q3			Q4			Average across quarters		
				H_seg	Actual	Expected	Ratio	Actual	Expected	Ratio	Actual	Expected	Ratio	Actual	Expected	Ratio	Actual	Expected	Ratio
On register	Priority A			110	1.0	0.8	127%	1.8	1.4	126%	2.2	1.9	117%	2.4	2.3	105%	1.9	1.6	116%
	Priority B and other			120	0.3	0.2	142%	0.7	0.4	196%	1.0	0.5	225%	1.2	0.7	186%	0.8	0.4	194%
IRRS recipients, primary aged < 65	Less close / IRRS > $150	Child in the household	Work obligated	211	29.5	29.7	99%	29.5	29.4	100%	29.0	28.7	101%	28.6	28.3	101%	29.2	29.0	101%
			Not work obligated	212	30.9	31.1	99%	31.0	30.8	101%	30.6	30.1	101%	30.3	29.9	102%	30.7	30.5	101%
			NOMB	213	23.8	24.0	100%	23.4	23.8	98%	23.2	23.3	100%	23.0	23.2	99%	23.4	23.6	99%
		No child in the household	Work obligated	214	5.7	5.6	102%	5.6	5.5	102%	5.5	5.3	103%	5.4	5.2	103%	5.6	5.4	103%
			Not work obligated	215	31.5	31.2	101%	31.5	30.9	102%	31.0	30.2	103%	30.9	30.0	103%	31.2	30.6	102%
			NOMB	216	10.2	10.3	100%	10.0	10.2	98%	9.8	9.9	100%	9.7	9.8	99%	9.9	10.0	99%
	Closer / IRRS ≤ $150	Child in the household	Work obligated	221	2.3	2.2	102%	2.2	2.2	101%	2.2	2.1	105%	2.1	2.0	105%	2.2	2.1	103%
			Not work obligated	222	2.0	1.9	102%	2.0	1.9	103%	2.0	1.9	106%	2.0	1.8	109%	2.0	1.9	105%
			NOMB	223	3.6	3.5	101%	3.8	3.7	102%	3.9	3.8	104%	4.2	3.9	107%	3.9	3.7	103%
		No child in the household	Work obligated	224	0.7	0.7	102%	0.7	0.6	103%	0.6	0.6	107%	0.6	0.6	110%	0.7	0.6	106%
			Not work obligated	225	4.0	3.9	101%	3.9	3.8	102%	3.9	3.7	104%	3.9	3.7	105%	3.9	3.8	103%
			NOMB	226	2.2	2.2	100%	2.3	2.3	99%	2.4	2.3	104%	2.5	2.4	108%	2.4	2.3	103%
IRRS recipients, primary aged 65+	Less close / IRRS > $150	Child in the household		311	5.3	5.2	103%	5.4	5.1	104%	5.3	5.0	106%	5.3	5.0	107%	5.3	5.1	105%
		No child in the household		312	27.3	26.7	102%	27.2	26.2	104%	26.8	25.5	105%	26.7	25.0	106%	27.0	25.9	104%
	Closer / IRRS ≤ $150	Child in the household		321	0.2	0.2	103%	0.3	0.2	105%	0.3	0.3	113%	0.3	0.3	112%	0.3	0.3	108%
		No child in the household		322	3.8	3.7	103%	3.9	3.7	105%	3.9	3.6	108%	3.9	3.5	111%	3.9	3.6	107%
Recent exit from housing	Receiving AS			410	0.0	0.0	180%	0.1	0.1	183%	0.3	0.2	161%	0.4	0.3	138%	0.2	0.1	153%
	Not receiving AS	Aged <60		420	0.2	0.0	653%	0.2	0.1	250%	0.3	0.2	181%	0.4	0.3	140%	0.3	0.1	192%
		Aged 60+		430	0.0	0.0	3168%	0.0	0.0	-	0.0	0.0	1704%	0.0	0.0	760%	0.0	0.0	1588%
Recent exit from register	Receiving AS			510	0.0	0.0	168%	0.2	0.1	219%	0.3	0.2	214%	0.5	0.3	198%	0.3	0.1	204%
	Not receiving AS			520	0.4	0.0	4962%	0.6	0.0	2250%	0.6	0.0	1401%	0.7	0.1	813%	0.6	0.0	1440%
Total					185	183	101%	186	182	102%	185	179	103%	185	178	104%	185	181	103%

H.1.1.4 Number of households on the register at the end of the quarter

Segment					Q1			Q2			Q3			Q4			Average across quarters		
				H_seg	Actual	Expected	Ratio	Actual	Expected	Ratio	Actual	Expected	Ratio	Actual	Expected	Ratio	Actual	Expected	Ratio
On register	Priority A			110	942	1,443	65%	662	974	68%	485	660	73%	391	431	91%	620	877	71%
	Priority B and other			120	1,250	1,596	78%	927	1,259	74%	661	1,014	65%	544	805	68%	846	1,169	72%
IRRS recipients, primary aged < 65	Less close / IRRS > $150	Child in the household	Work obligated	211	196	335	59%	209	345	61%	196	339	58%	207	295	70%	202	328	62%
			Not work obligated	212	289	490	59%	318	468	68%	301	441	68%	331	370	90%	310	442	70%
			NOMB	213	68	207	33%	90	228	39%	87	245	36%	103	224	46%	87	226	39%
		No child in the household	Work obligated	214	17	35	48%	15	40	38%	23	42	55%	23	40	58%	20	39	50%
			Not work obligated	215	212	310	68%	237	311	76%	239	301	80%	268	257	104%	239	295	81%
			NOMB	216	27	60	45%	26	64	41%	19	66	29%	27	59	46%	25	62	40%
	Closer / IRRS ≤ $150	Child in the household	Work obligated	221	25	44	56%	29	45	64%	30	41	73%	38	37	102%	31	42	73%
			Not work obligated	222	44	53	83%	42	55	76%	42	50	84%	37	42	89%	41	50	83%
			NOMB	223	18	90	20%	25	94	26%	24	100	24%	33	89	37%	25	93	27%
		No child in the household	Work obligated	224	7	9	78%	7	10	73%	11	8	131%	9	8	113%	9	9	97%
			Not work obligated	225	60	79	76%	66	77	86%	65	72	90%	74	61	122%	66	72	92%
			NOMB	226	7	28	25%	9	31	29%	14	34	41%	20	33	60%	13	32	39%
IRRS recipients, primary aged 65+	Less close / IRRS > $150	Child in the household		311	29	41	71%	36	43	85%	29	44	66%	29	42	68%	31	43	72%
		No child in the household		312	100	169	59%	99	175	56%	95	170	56%	90	164	55%	96	170	57%
	Closer / IRRS ≤ $150	Child in the household		321	1	3	33%	4	5	80%	4	5	87%	5	4	119%	4	4	83%
		No child in the household		322	19	44	43%	28	44	63%	24	46	52%	24	41	58%	24	44	54%
Recent exit from housing	Receiving AS			410	70	49	142%	74	60	124%	106	69	154%	101	66	153%	88	61	144%
	Not receiving AS	Aged <60		420	27	50	54%	37	56	67%	55	56	99%	69	51	134%	47	53	88%
		Aged 60+		430	6	0	-	3	2	151%	5	3	144%	7	4	157%	5	2	211%
Recent exit from register	Receiving AS			510	124	45	274%	159	87	183%	152	84	182%	157	67	235%	148	71	210%
	Not receiving AS			520	46	17	266%	45	25	183%	55	33	166%	63	37	171%	52	28	187%
Total					3,584	5,197	69%	3,147	4,498	70%	2,722	3,924	69%	2,650	3,227	82%	3,026	4,212	72%

H.1.1.5 Number of new register applications in the quarter

Segment				H_seg	Q1 Actual	Q1 Expected	Q1 Ratio	Q2 Actual	Q2 Expected	Q2 Ratio	Q3 Actual	Q3 Expected	Q3 Ratio	Q4 Actual	Q4 Expected	Q4 Ratio	Average across quarters Actual	Average across quarters Expected	Average across quarters Ratio
On register	Priority A			110	0	0	-	114	12	919%	85	24	354%	79	30	267%	70	17	421%
	Priority B and other			120	0	0	-	92	7	1394%	74	11	649%	83	18	451%	62	9	684%
IRRS recipients, primary aged < 65	Less close / IRRS > $150	Child in the household	Work obligated	211	83	190	44%	129	186	70%	95	176	54%	118	159	74%	106	178	60%
			Not work obligated	212	133	217	61%	165	207	80%	132	196	67%	203	163	124%	158	196	81%
			NOMB	213	60	153	39%	84	137	61%	57	142	40%	87	132	66%	72	141	51%
		No child in the household	Work obligated	214	12	26	46%	16	29	54%	17	29	59%	14	22	65%	15	26	56%
			Not work obligated	215	95	134	71%	98	148	66%	91	135	68%	111	114	97%	99	133	74%
			NOMB	216	15	31	49%	17	33	52%	15	37	41%	21	34	62%	17	34	51%
	Closer / IRRS ≤ $150	Child in the household	Work obligated	221	16	34	47%	17	29	59%	23	25	92%	25	26	96%	20	28	71%
			Not work obligated	222	38	32	119%	28	31	90%	37	29	127%	23	32	71%	32	31	101%
			NOMB	223	16	59	27%	27	66	41%	24	67	36%	36	53	68%	26	61	42%
		No child in the household	Work obligated	224	2	6	32%	10	7	152%	6	4	136%	4	7	61%	6	6	92%
			Not work obligated	225	29	42	69%	34	40	85%	25	34	74%	31	31	101%	30	37	81%
			NOMB	226	3	26	12%	7	22	32%	14	23	60%	10	27	38%	9	24	35%
IRRS recipients, primary aged 65+	Less close / IRRS > $150	Child in the household		311	27	31	88%	32	25	126%	17	27	64%	17	25	67%	23	27	86%
		No child in the household		312	39	79	49%	25	83	30%	39	68	58%	39	74	53%	36	76	47%
	Closer / IRRS ≤ $150	Child in the household		321	0	4	0%	6	4	143%	1	4	28%	3	5	58%	3	4	57%
		No child in the household		322	7	28	25%	19	27	70%	3	27	11%	5	16	31%	9	25	34%
Recent exit from housing	Receiving AS			410	99	90	110%	82	65	126%	103	73	140%	83	62	133%	92	73	126%
	Not receiving AS	Aged <60		420	55	76	72%	59	58	102%	68	51	133%	71	47	152%	63	58	109%
		Aged 60+		430	8	2	393%	4	2	217%	5	3	157%	6	3	179%	6	3	221%
Recent exit from register	Receiving AS			510	178	78	230%	148	89	167%	110	66	166%	119	64	187%	139	74	187%
	Not receiving AS			520	85	27	310%	55	25	221%	54	29	188%	54	24	221%	62	26	235%
Total					1,000	1,364	73%	1,268	1,332	95%	1,095	1,280	86%	1,242	1,168	106%	1,151	1,286	90%

H.1.2 Actual versus expected results by region

H.1.2.1 Number of households in social housing during the quarter

Region	Q1 Actual	Q1 Expected	Q1 Ratio	Q2 Actual	Q2 Expected	Q2 Ratio	Q3 Actual	Q3 Expected	Q3 Ratio	Q4 Actual	Q4 Expected	Q4 Ratio	Average across quarters Actual	Average across quarters Expected	Average across quarters Ratio
Auck	29,680	29,748	100%	29,652	29,349	101%	29,254	29,024	101%	28,896	28,721	101%	29,370	29,210	101%
Cant	5,676	5,604	101%	5,718	5,535	103%	5,682	5,471	104%	5,622	5,468	103%	5,674	5,519	103%
Central	1,949	1,959	99%	1,926	1,904	101%	1,873	1,851	101%	1,816	1,801	101%	1,891	1,878	101%
East	3,903	3,947	99%	3,874	3,842	101%	3,786	3,743	101%	3,704	3,642	102%	3,817	3,794	101%
Nelson	1,428	1,431	100%	1,409	1,400	101%	1,365	1,369	100%	1,325	1,338	99%	1,382	1,384	100%
Northld	2,064	2,084	99%	2,043	2,032	101%	2,004	1,985	101%	1,975	1,937	102%	2,021	2,009	101%
Plenty	2,844	2,851	100%	2,827	2,799	101%	2,786	2,742	102%	2,728	2,682	102%	2,796	2,769	101%
South	2,380	2,386	100%	2,353	2,333	101%	2,292	2,275	101%	2,237	2,215	101%	2,315	2,302	101%
Taran	1,893	1,904	99%	1,869	1,851	101%	1,820	1,804	101%	1,770	1,756	101%	1,838	1,829	101%
Waik	3,901	3,877	101%	3,888	3,809	102%	3,831	3,740	102%	3,771	3,684	102%	3,847	3,777	102%
Wlgtn	7,949	8,018	99%	7,891	7,852	100%	7,745	7,708	100%	7,595	7,573	100%	7,795	7,788	100%
Total	63,665	63,808	100%	63,449	62,707	101%	62,435	61,711	101%	61,437	60,816	101%	62,746	62,260	101%

H.1.2.2 Average IRRS per household ($)

Region	Q1			Q2			Q3			Q4			Average across quarters		
	Actual	Expected	Ratio	Actual	Expected	Ratio	Actual	Expected	Ratio	Actual	Expected	Ratio	Actual	Expected	Ratio
Auck	3,629	3,572	102%	3,695	3,627	102%	3,743	3,620	103%	3,805	3,665	104%	3,718	3,621	103%
Cant	3,083	3,119	99%	3,009	3,147	96%	3,002	3,137	96%	2,984	3,158	95%	3,019	3,140	96%
Central	1,554	1,553	100%	1,527	1,562	98%	1,526	1,553	98%	1,582	1,563	101%	1,547	1,558	99%
East	1,770	1,751	101%	1,745	1,752	100%	1,768	1,729	102%	1,807	1,735	104%	1,772	1,742	102%
Nelson	2,188	2,203	99%	2,257	2,194	103%	2,300	2,154	107%	2,309	2,162	107%	2,263	2,178	104%
Northld	1,950	1,947	100%	1,958	1,977	99%	1,988	1,971	101%	2,000	2,002	100%	1,974	1,974	100%
Plenty	2,188	2,158	101%	2,217	2,185	101%	2,272	2,176	104%	2,341	2,205	106%	2,255	2,181	103%
South	1,836	1,828	100%	1,841	1,856	99%	1,818	1,847	98%	1,815	1,876	97%	1,828	1,852	99%
Taran	1,572	1,570	100%	1,553	1,574	99%	1,573	1,559	101%	1,617	1,572	103%	1,579	1,569	101%
Waik	2,425	2,371	102%	2,440	2,384	102%	2,469	2,368	104%	2,515	2,378	106%	2,462	2,375	104%
Wlgtn	2,486	2,447	102%	2,472	2,459	101%	2,480	2,431	102%	2,509	2,435	103%	2,487	2,443	102%
Total	2,907	2,871	101%	2,934	2,909	101%	2,967	2,901	102%	3,013	2,934	103%	2,955	2,904	102%

H.1.2.3 Total IRRS ($m)

Region	Q1			Q2			Q3			Q4			Average across quarters		
	Actual	Expected	Ratio	Actual	Expected	Ratio	Actual	Expected	Ratio	Actual	Expected	Ratio	Actual	Expected	Ratio
Auck	107.7	106.2	101%	109.6	106.5	103%	109.5	105.1	104%	109.9	105.3	104%	109.2	105.8	103%
Cant	17.5	17.5	100%	17.2	17.4	99%	17.1	17.2	99%	16.8	17.3	97%	17.1	17.3	99%
Central	3.0	3.0	100%	2.9	3.0	99%	2.9	2.9	99%	2.9	2.8	102%	2.9	2.9	100%
East	6.9	6.9	100%	6.8	6.7	100%	6.7	6.5	103%	6.7	6.3	106%	6.8	6.6	102%
Nelson	3.1	3.2	99%	3.2	3.1	104%	3.1	2.9	106%	3.1	2.9	106%	3.1	3.0	104%
Northld	4.0	4.1	99%	4.0	4.0	100%	4.0	3.9	102%	3.9	3.9	102%	4.0	4.0	101%
Plenty	6.2	6.2	101%	6.3	6.1	102%	6.3	6.0	106%	6.4	5.9	108%	6.3	6.0	104%
South	4.4	4.4	100%	4.3	4.3	100%	4.2	4.2	99%	4.1	4.2	98%	4.2	4.3	99%
Taran	3.0	3.0	100%	2.9	2.9	100%	2.9	2.8	102%	2.9	2.8	104%	2.9	2.9	101%
Waik	9.5	9.2	103%	9.5	9.1	104%	9.5	8.9	107%	9.5	8.8	108%	9.5	9.0	106%
Wlgtn	19.8	19.6	101%	19.5	19.3	101%	19.2	18.7	102%	19.1	18.4	103%	19.4	19.0	102%
Total	185	183	101%	186	182	102%	185	179	103%	185	178	104%	185	181	103%

H.1.2.4 Number of households on the register at the end of the quarter

Region	Q1			Q2			Q3			Q4			Average across quarters		
	Actual	Expected	Ratio	Actual	Expected	Ratio	Actual	Expected	Ratio	Actual	Expected	Ratio	Actual	Expected	Ratio
Auck	1,884	2,672	70%	1,676	2,349	71%	1,404	2,105	67%	1,312	1,796	73%	1,569	2,231	70%
Cant	448	721	62%	315	586	54%	235	493	48%	256	336	76%	314	534	59%
Central	44	64	69%	46	54	86%	45	48	93%	60	41	145%	49	52	94%
East	180	253	71%	159	229	69%	172	194	89%	163	166	98%	169	211	80%
Nelson	55	100	55%	46	88	53%	50	78	64%	53	65	82%	51	83	62%
Northld	129	178	72%	142	145	98%	126	120	105%	104	96	108%	125	135	93%
Plenty	182	249	73%	187	206	91%	176	173	102%	170	144	118%	179	193	93%
South	75	126	60%	58	103	56%	54	88	62%	65	72	91%	63	97	65%
Taran	55	74	75%	51	59	87%	35	45	77%	40	33	120%	45	53	86%
Waik	260	351	74%	221	309	72%	177	267	66%	163	215	76%	205	285	72%
Wlgtn	272	409	67%	246	370	66%	248	314	79%	264	263	100%	258	339	76%
Total	3,584	5,197	69%	3,147	4,498	70%	2,722	3,924	69%	2,650	3,227	82%	3,026	4,212	72%

H.1.2.5 Number of new register applications in the quarter

Region	Q1			Q2			Q3			Q4			Average across quarters		
	Actual	Expected	Ratio	Actual	Expected	Ratio	Actual	Expected	Ratio	Actual	Expected	Ratio	Actual	Expected	Ratio
Auck	451	646	70%	543	606	90%	437	589	74%	531	549	97%	491	598	82%
Cant	111	92	120%	126	92	137%	123	94	131%	163	86	189%	131	91	143%
Central	18	28	64%	37	24	155%	44	27	161%	59	26	225%	40	26	150%
East	76	93	82%	95	103	93%	108	90	119%	83	93	89%	91	95	95%
Nelson	19	31	62%	23	28	83%	28	30	92%	22	24	91%	23	28	81%
Northld	47	60	79%	92	52	176%	62	51	121%	48	44	110%	62	52	120%
Plenty	54	57	95%	80	54	148%	48	55	87%	56	46	122%	60	53	112%
South	25	33	76%	32	37	86%	31	35	90%	40	34	118%	32	35	92%
Taran	28	30	93%	30	32	94%	19	24	78%	29	22	132%	27	27	98%
Waik	57	81	70%	62	87	71%	58	78	74%	52	65	80%	57	78	73%
Wlgtn	114	212	54%	147	218	67%	137	205	67%	159	178	89%	139	203	68%
Total	1,000	1,364	73%	1,267	1,332	95%	1,095	1,280	86%	1,242	1,168	106%	1,151	1,286	89%

H.1.3 Actual versus expected results by welfare benefit receipt at valuation date

H.1.3.1 Number of households in social housing during the quarter

Benefit receipt	Q1			Q2			Q3			Q4			Average across quarters		
	Actual	Expected	Ratio	Actual	Expected	Ratio	Actual	Expected	Ratio	Actual	Expected	Ratio	Actual	Expected	Ratio
JWR	4,895	4,902	100%	4,919	4,834	102%	4,870	4,766	102%	4,821	4,706	102%	4,876	4,802	102%
JHD	5,837	5,778	101%	5,858	5,738	102%	5,807	5,693	102%	5,755	5,659	102%	5,814	5,717	102%
SPS	10,524	10,472	100%	10,576	10,305	103%	10,438	10,136	103%	10,260	9,955	103%	10,449	10,217	102%
SLH	10,806	10,749	101%	10,788	10,638	101%	10,658	10,515	101%	10,542	10,425	101%	10,698	10,582	101%
SLC	1,344	1,333	101%	1,356	1,324	102%	1,354	1,317	103%	1,359	1,306	104%	1,353	1,320	103%
SUP	1,199	1,216	99%	1,200	1,194	100%	1,209	1,175	103%	1,208	1,163	104%	1,204	1,187	101%
ORP	258	261	99%	258	257	100%	256	254	101%	254	251	101%	256	256	100%
PEN	12,852	12,783	101%	12,723	12,433	102%	12,459	12,110	103%	12,215	11,810	103%	12,562	12,284	102%
EMB	151	146	103%	154	145	106%	153	145	105%	153	144	107%	153	145	105%
NOB	15,799	16,168	98%	15,619	15,839	99%	15,233	15,600	98%	14,871	15,398	97%	15,380	15,751	98%
Total	63,665	63,808	100%	63,449	62,707	101%	62,435	61,711	101%	61,437	60,816	101%	62,746	62,260	101%

H.1.3.2 Average IRRS per household ($)

Benefit receipt	Q1			Q2			Q3			Q4			Average across quarters		
	Actual	Expected	Ratio	Actual	Expected	Ratio	Actual	Expected	Ratio	Actual	Expected	Ratio	Actual	Expected	Ratio
JWR	3,149	3,100	102%	3,154	3,110	101%	3,163	3,084	103%	3,185	3,099	103%	3,162	3,098	102%
JHD	3,534	3,482	102%	3,577	3,502	102%	3,586	3,475	103%	3,625	3,501	104%	3,581	3,490	103%
SPS	3,189	3,200	100%	3,227	3,239	100%	3,245	3,230	100%	3,278	3,259	101%	3,235	3,232	100%
SLH	2,957	2,948	100%	2,980	2,970	100%	2,997	2,951	102%	3,030	2,978	102%	2,991	2,962	101%
SLC	3,622	3,631	100%	3,691	3,660	101%	3,735	3,636	103%	3,758	3,672	102%	3,701	3,650	101%
SUP	2,789	2,668	105%	2,803	2,725	103%	2,820	2,728	103%	2,882	2,786	103%	2,824	2,727	104%
ORP	2,687	2,593	104%	2,709	2,683	101%	2,718	2,696	101%	2,874	2,737	105%	2,747	2,677	103%
PEN	2,814	2,766	102%	2,846	2,798	102%	2,876	2,793	103%	2,926	2,817	104%	2,866	2,794	103%
EMB	3,109	3,135	99%	3,104	3,137	99%	3,188	3,111	102%	3,189	3,103	103%	3,147	3,122	101%
NOB	2,404	2,357	102%	2,412	2,417	100%	2,476	2,424	102%	2,542	2,476	103%	2,459	2,419	102%
Total	2,907	2,871	101%	2,934	2,909	101%	2,967	2,901	102%	3,013	2,934	103%	2,955	2,904	102%

H.1.3.3 Total IRRS ($m)

Benefit receipt	Q1			Q2			Q3			Q4			Average across quarters		
	Actual	Expected	Ratio	Actual	Expected	Ratio	Actual	Expected	Ratio	Actual	Expected	Ratio	Actual	Expected	Ratio
JWR	15.4	15.2	101%	15.5	15.0	103%	15.4	14.7	105%	15.4	14.6	105%	15.4	14.9	104%
JHD	20.6	20.1	103%	21.0	20.1	104%	20.8	19.8	105%	20.9	19.8	105%	20.8	20.0	104%
SPS	33.6	33.5	100%	34.1	33.4	102%	33.9	32.7	103%	33.6	32.4	104%	33.8	33.0	102%
SLH	31.9	31.7	101%	32.1	31.6	102%	31.9	31.0	103%	31.9	31.1	103%	32.0	31.3	102%
SLC	4.9	4.8	101%	5.0	4.8	103%	5.1	4.8	106%	5.1	4.8	106%	5.0	4.8	104%
SUP	3.3	3.2	103%	3.4	3.3	103%	3.4	3.2	106%	3.5	3.2	107%	3.4	3.2	105%
ORP	0.7	0.7	103%	0.7	0.7	101%	0.7	0.7	102%	0.7	0.7	106%	0.7	0.7	103%
PEN	36.2	35.4	102%	36.2	34.8	104%	35.8	33.8	106%	35.7	33.3	107%	36.0	34.3	105%
EMB	0.5	0.5	103%	0.5	0.5	105%	0.5	0.5	108%	0.5	0.4	110%	0.5	0.5	106%
NOB	38.0	38.1	100%	37.7	38.3	98%	37.7	37.8	100%	37.8	38.1	99%	37.8	38.1	99%
Total	185	183	101%	186	182	102%	185	179	103%	185	178	104%	185	181	103%

H.1.3.4 Number of households on the register at the end of the quarter

Benefit receipt	Q1			Q2			Q3			Q4			Average across quarters		
	Actual	Expected	Ratio	Actual	Expected	Ratio	Actual	Expected	Ratio	Actual	Expected	Ratio	Actual	Expected	Ratio
JWR	307	480	64%	243	415	58%	229	361	63%	207	304	68%	247	390	63%
JHD	523	695	75%	432	585	74%	382	489	78%	350	385	91%	422	538	78%
SPS	926	1,272	73%	810	1,072	76%	688	900	76%	676	714	95%	775	990	78%
SLH	865	1,098	79%	807	914	88%	693	782	89%	686	628	109%	763	856	89%
SLC	105	140	75%	102	117	87%	93	95	98%	91	75	122%	98	107	92%
SUP	149	201	74%	130	170	76%	100	145	69%	91	111	82%	118	157	75%
ORP	10	11	94%	5	9	54%	2	8	24%	1	6	16%	5	9	52%
PEN	376	505	75%	320	436	73%	270	390	69%	238	342	70%	301	418	72%
EMB	13	22	59%	12	18	67%	13	14	90%	12	13	94%	13	17	74%
NOB	310	772	40%	286	760	38%	252	739	34%	298	650	46%	287	730	39%
Total	3,584	5,197	69%	3,147	4,498	70%	2,722	3,924	69%	2,650	3,227	82%	3,026	4,212	72%

H.1.3.5 Number of new register applications in the quarter

Benefit receipt	Q1			Q2			Q3			Q4			Average across quarters		
	Actual	Expected	Ratio	Actual	Expected	Ratio	Actual	Expected	Ratio	Actual	Expected	Ratio	Actual	Expected	Ratio
JWR	113	149	76%	164	153	107%	139	138	101%	150	130	116%	142	142	99%
JHD	124	124	100%	136	127	107%	138	120	115%	120	99	121%	130	117	110%
SPS	251	270	93%	329	277	119%	282	248	114%	330	236	140%	298	258	116%
SLH	190	198	96%	224	203	110%	194	203	96%	220	178	124%	207	195	106%
SLC	31	34	91%	35	31	112%	26	25	102%	33	26	129%	31	29	107%
SUP	37	35	105%	69	33	210%	46	34	135%	46	26	177%	50	32	154%
ORP	6	3	214%	1	3	38%	0	3	0%	1	4	26%	2	3	63%
PEN	72	116	62%	72	107	68%	65	99	66%	63	92	69%	68	103	66%
EMB	2	4	45%	8	4	182%	7	4	167%	2	4	50%	5	4	112%
NOB	174	431	40%	230	396	58%	198	406	49%	277	374	74%	220	402	55%
Total	1,000	1,364	73%	1,268	1,332	95%	1,095	1,280	86%	1,242	1,168	106%	1,151	1,286	90%

H.1.4 Actual versus expected results by client age

H.1.4.1 Number of households in social housing during the quarter

Age	Q1			Q2			Q3			Q4			Average across quarters		
	Actual	Expected	Ratio	Actual	Expected	Ratio	Actual	Expected	Ratio	Actual	Expected	Ratio	Actual	Expected	Ratio
16-19	179	180	99%	201	216	93%	200	269	74%	210	343	61%	197	252	78%
20-24	2,048	2,027	101%	2,093	1,971	106%	2,062	1,936	107%	2,045	1,923	106%	2,062	1,964	105%
25-29	3,865	3,874	100%	3,872	3,779	102%	3,795	3,706	102%	3,705	3,638	102%	3,809	3,749	102%
30-34	4,745	4,773	99%	4,736	4,659	102%	4,642	4,557	102%	4,547	4,450	102%	4,668	4,610	101%
35-39	5,325	5,350	100%	5,317	5,258	101%	5,254	5,165	102%	5,164	5,071	102%	5,265	5,211	101%
40-44	6,690	6,735	99%	6,652	6,629	100%	6,544	6,535	100%	6,430	6,451	100%	6,579	6,588	100%
45-49	7,938	7,983	99%	7,902	7,881	100%	7,794	7,777	100%	7,675	7,686	100%	7,827	7,832	100%
50-54	7,768	7,811	99%	7,753	7,724	100%	7,654	7,631	100%	7,561	7,542	100%	7,684	7,677	100%
55-59	6,513	6,539	100%	6,491	6,468	100%	6,400	6,407	100%	6,321	6,342	100%	6,431	6,439	100%
60-64	5,713	5,724	100%	5,687	5,659	100%	5,611	5,591	100%	5,546	5,532	100%	5,639	5,627	100%
65-74	7,937	7,901	100%	7,888	7,726	102%	7,774	7,570	103%	7,643	7,419	103%	7,810	7,654	102%
75-84	3,954	3,930	101%	3,898	3,811	102%	3,804	3,693	103%	3,734	3,587	104%	3,848	3,755	102%
85+	988	980	101%	960	924	104%	901	875	103%	856	832	103%	926	903	103%
Total	63,664	63,808	100%	63,449	62,707	101%	62,435	61,711	101%	61,436	60,816	101%	62,746	62,260	101%

H.1.4.2 Average IRRS per household ($)

Age	Q1			Q2			Q3			Q4			Average across quarters		
	Actual	Expected	Ratio	Actual	Expected	Ratio	Actual	Expected	Ratio	Actual	Expected	Ratio	Actual	Expected	Ratio
16-19	2,460	2,459	100%	2,409	2,474	97%	2,480	2,461	101%	2,411	2,535	95%	2,440	2,482	98%
20-24	2,709	2,683	101%	2,719	2,732	100%	2,760	2,728	101%	2,778	2,774	100%	2,742	2,729	100%
25-29	2,827	2,808	101%	2,847	2,851	100%	2,862	2,855	100%	2,910	2,880	101%	2,862	2,848	100%
30-34	2,921	2,887	101%	2,947	2,929	101%	2,976	2,927	102%	3,021	2,953	102%	2,966	2,924	101%
35-39	2,951	2,921	101%	2,974	2,962	100%	3,012	2,959	102%	3,047	2,989	102%	2,996	2,958	101%
40-44	2,956	2,922	101%	2,978	2,964	100%	3,008	2,964	101%	3,055	2,996	102%	2,999	2,962	101%
45-49	2,980	2,953	101%	3,016	2,996	101%	3,050	2,992	102%	3,098	3,031	102%	3,036	2,993	101%
50-54	2,921	2,889	101%	2,946	2,930	101%	2,986	2,916	102%	3,032	2,958	103%	2,971	2,923	102%
55-59	2,956	2,921	101%	2,989	2,957	101%	3,039	2,938	103%	3,099	2,983	104%	3,021	2,950	102%
60-64	2,970	2,917	102%	2,996	2,940	102%	3,013	2,911	104%	3,061	2,942	104%	3,010	2,927	103%
65-74	2,760	2,718	102%	2,796	2,751	102%	2,825	2,747	103%	2,879	2,772	104%	2,815	2,747	102%
75-84	2,881	2,829	102%	2,919	2,858	102%	2,955	2,852	104%	2,994	2,878	104%	2,937	2,854	103%
85+	2,964	2,886	103%	2,942	2,932	100%	2,983	2,930	102%	3,042	2,951	103%	2,983	2,925	102%
Total	2,907	2,871	101%	2,934	2,909	101%	2,967	2,901	102%	3,014	2,934	103%	2,955	2,904	102%

H.1.4.3 Total IRRS ($m)

Age	Q1			Q2			Q3			Q4			Average across quarters		
	Actual	Expected	Ratio	Actual	Expected	Ratio	Actual	Expected	Ratio	Actual	Expected	Ratio	Actual	Expected	Ratio
16-19	0.4	0.4	99%	0.5	0.5	90%	0.5	0.7	75%	0.5	0.9	58%	0.5	0.6	77%
20-24	5.5	5.4	102%	5.7	5.4	106%	5.7	5.3	108%	5.7	5.3	106%	5.7	5.4	105%
25-29	10.9	10.9	100%	11.0	10.8	102%	10.9	10.6	103%	10.8	10.5	103%	10.9	10.7	102%
30-34	13.9	13.8	101%	14.0	13.6	102%	13.8	13.3	104%	13.7	13.1	105%	13.8	13.5	103%
35-39	15.7	15.6	101%	15.8	15.6	102%	15.8	15.3	104%	15.7	15.2	104%	15.8	15.4	102%
40-44	19.8	19.7	101%	19.8	19.7	101%	19.7	19.4	102%	19.6	19.3	102%	19.7	19.5	101%
45-49	23.7	23.6	100%	23.8	23.6	101%	23.8	23.3	102%	23.8	23.3	102%	23.8	23.4	101%
50-54	22.7	22.6	101%	22.8	22.6	101%	22.9	22.3	103%	22.9	22.3	103%	22.8	22.4	102%
55-59	19.3	19.1	101%	19.4	19.1	101%	19.4	18.8	103%	19.6	18.9	104%	19.4	19.0	102%
60-64	17.0	16.7	102%	17.0	16.6	102%	16.9	16.3	104%	17.0	16.3	104%	17.0	16.5	103%
65-74	21.9	21.5	102%	22.1	21.3	104%	22.0	20.8	106%	22.0	20.6	107%	22.0	21.0	105%
75-84	11.4	11.1	102%	11.4	10.9	104%	11.2	10.5	107%	11.2	10.3	108%	11.3	10.7	105%
85+	2.9	2.8	103%	2.8	2.7	104%	2.7	2.6	105%	2.6	2.5	106%	2.8	2.6	105%
Total	185	183	101%	186	182	102%	185	179	103%	185	178	104%	185	181	103%

H.1.4.4 Number of households on the register at the end of the quarter

Age	Q1			Q2			Q3			Q4			Average across quarters		
	Actual	Expected	Ratio	Actual	Expected	Ratio	Actual	Expected	Ratio	Actual	Expected	Ratio	Actual	Expected	Ratio
16-19	69	171	40%	49	211	23%	46	214	21%	43	194	22%	52	197	26%
20-24	305	452	67%	256	407	63%	216	366	59%	236	305	77%	253	383	66%
25-29	395	605	65%	378	521	73%	310	433	72%	312	352	89%	349	478	73%
30-34	405	580	70%	362	483	75%	318	412	77%	295	321	92%	345	449	77%
35-39	416	574	72%	374	482	78%	316	417	76%	295	335	88%	350	452	78%
40-44	369	562	66%	330	487	68%	290	423	69%	276	340	81%	316	453	70%
45-49	402	572	70%	336	478	70%	308	413	75%	297	332	89%	336	449	75%
50-54	358	491	73%	313	415	75%	282	355	79%	290	297	98%	311	390	80%
55-59	287	391	73%	246	328	75%	194	281	69%	196	225	87%	231	306	75%
60-64	202	293	69%	183	249	74%	172	219	79%	172	185	93%	182	236	77%
65-74	261	343	76%	218	299	73%	181	266	68%	161	233	69%	205	285	72%
75-84	104	143	73%	94	120	78%	85	109	78%	74	96	77%	89	117	76%
85+	11	21	53%	8	19	43%	4	18	23%	3	14	22%	7	18	37%
Total	3,584	5,197	69%	3,147	4,498	70%	2,722	3,924	69%	2,650	3,227	82%	3,026	4,212	72%

H.1.4.5 Number of new register applications in the quarter

Age	Q1			Q2			Q3			Q4			Average across quarters		
	Actual	Expected	Ratio	Actual	Expected	Ratio	Actual	Expected	Ratio	Actual	Expected	Ratio	Actual	Expected	Ratio
16-19	60	198	30%	48	175	27%	58	166	35%	80	153	52%	62	173	36%
20-24	170	173	98%	170	168	101%	150	169	89%	207	151	137%	174	166	105%
25-29	125	161	78%	211	152	138%	173	147	118%	198	147	135%	177	152	117%
30-34	112	137	82%	153	141	109%	150	129	116%	158	119	133%	143	131	109%
35-39	117	119	98%	174	130	134%	113	117	96%	131	102	128%	134	117	114%
40-44	92	118	78%	126	124	102%	96	118	81%	100	100	100%	104	115	90%
45-49	76	108	70%	110	105	105%	102	109	94%	89	95	94%	94	104	90%
50-54	76	102	75%	89	101	88%	87	92	94%	92	88	104%	86	96	90%
55-59	51	76	67%	70	67	104%	52	73	71%	75	65	115%	62	70	88%
60-64	49	54	90%	44	61	72%	49	61	80%	49	55	89%	48	58	82%
65-74	58	70	83%	52	74	70%	44	63	70%	52	62	84%	52	67	77%
75-84	11	38	29%	21	28	76%	20	29	69%	7	28	25%	15	31	48%
85+	3	9	35%	0	7	0%	1	7	14%	4	3	143%	2	6	31%
Total	1,000	1,364	73%	1,268	1,332	95%	1,095	1,280	86%	1,242	1,168	106%	1,151	1,286	90%

H.1.5 Actual versus expected results by client ethnicity

H.1.5.1 Number of households in social housing during the quarter

Ethnicity	Q1			Q2			Q3			Q4			Average across quarters		
	Actual	Expected	Ratio	Actual	Expected	Ratio	Actual	Expected	Ratio	Actual	Expected	Ratio	Actual	Expected	Ratio
Asian	3,241	3,221	101%	3,244	3,181	102%	3,218	3,141	102%	3,205	3,108	103%	3,227	3,163	102%
Maori	22,634	22,726	100%	22,524	22,283	101%	22,111	21,886	101%	21,701	21,508	101%	22,243	22,101	101%
NZEU	16,604	16,580	100%	16,508	16,278	101%	16,194	15,980	101%	15,890	15,725	101%	16,299	16,141	101%
PIsland	15,866	15,958	99%	15,859	15,727	101%	15,680	15,544	101%	15,485	15,381	101%	15,722	15,652	100%
Other	5,319	5,323	100%	5,315	5,238	101%	5,233	5,160	101%	5,155	5,094	101%	5,255	5,204	101%
Total	63,665	63,808	100%	63,449	62,707	101%	62,435	61,711	101%	61,437	60,816	101%	62,746	62,260	101%

H.1.5.2 Average IRRS per household ($)

Segment	Q1			Q2			Q3			Q4			Average across quarters		
	Actual	Expected	Ratio	Actual	Expected	Ratio	Actual	Expected	Ratio	Actual	Expected	Ratio	Actual	Expected	Ratio
Asian	3,210	3,141	102%	3,248	3,176	102%	3,288	3,177	103%	3,327	3,208	104%	3,268	3,176	103%
Maori	2,708	2,670	101%	2,733	2,705	101%	2,770	2,696	103%	2,810	2,727	103%	2,755	2,700	102%
NZEU	2,651	2,634	101%	2,650	2,659	100%	2,665	2,645	101%	2,698	2,672	101%	2,666	2,652	101%
PIsland	3,287	3,240	101%	3,342	3,298	101%	3,387	3,292	103%	3,455	3,336	104%	3,367	3,291	102%
Other	3,239	3,198	101%	3,258	3,227	101%	3,278	3,214	102%	3,323	3,243	102%	3,275	3,221	102%
Total	2,907	2,871	101%	2,934	2,909	101%	2,967	2,901	102%	3,013	2,934	103%	2,955	2,904	102%

H.1.5.3 Total IRRS ($m)

Segment	Q1			Q2			Q3			Q4			Average across quarters		
	Actual	Expected	Ratio	Actual	Expected	Ratio	Actual	Expected	Ratio	Actual	Expected	Ratio	Actual	Expected	Ratio
Asian	10.4	10.1	103%	10.5	10.1	104%	10.6	10.0	106%	10.7	10.0	107%	10.5	10.0	105%
Maori	61.3	60.7	101%	61.6	60.3	102%	61.2	59.0	104%	61.0	58.6	104%	61.3	59.7	103%
NZEU	44.0	43.7	101%	43.7	43.3	101%	43.2	42.3	102%	42.9	42.0	102%	43.5	42.8	101%
PIsland	52.1	51.7	101%	53.0	51.9	102%	53.1	51.2	104%	53.5	51.3	104%	52.9	51.5	103%
Other	17.2	17.0	101%	17.3	16.9	102%	17.2	16.6	103%	17.1	16.5	104%	17.2	16.8	103%
Total	185	183	101%	186	182	102%	185	179	103%	185	178	104%	185	181	103%

H.1.5.4 Number of households on the register at the end of the quarter

Segment	Q1			Q2			Q3			Q4			Average across quarters		
	Actual	Expected	Ratio	Actual	Expected	Ratio	Actual	Expected	Ratio	Actual	Expected	Ratio	Actual	Expected	Ratio
Asian	241	323	75%	202	278	73%	182	236	77%	174	192	91%	200	257	78%
Maori	1,405	2,064	68%	1,246	1,773	70%	1,108	1,540	72%	1,096	1,270	86%	1,214	1,662	73%
NZEU	882	1,213	73%	757	1,019	74%	629	873	72%	611	692	88%	720	949	76%
PIsland	655	1,070	61%	588	978	60%	487	894	54%	470	758	62%	550	925	59%
Other	401	528	76%	354	450	79%	316	381	83%	299	316	95%	343	419	82%
Total	3,584	5,197	69%	3,147	4,498	70%	2,722	3,924	69%	2,650	3,227	82%	3,026	4,212	72%

H.1.5.5 Number of new register applications in the quarter

Segment	Q1			Q2			Q3			Q4			Average across quarters		
	Actual	Expected	Ratio	Actual	Expected	Ratio	Actual	Expected	Ratio	Actual	Expected	Ratio	Actual	Expected	Ratio
Asian	52	68	76%	77	64	120%	61	55	111%	56	54	103%	62	61	102%
Maori	479	600	80%	587	585	100%	519	567	92%	558	516	108%	536	567	94%
NZEU	182	231	79%	211	241	88%	204	234	87%	234	208	113%	208	228	91%
PIsland	202	355	57%	257	341	75%	210	333	63%	278	299	93%	237	332	71%
Other	85	109	78%	136	102	133%	101	91	111%	116	91	128%	110	98	111%
Total	1,000	1,364	73%	1,268	1,332	95%	1,095	1,280	86%	1,242	1,168	106%	1,151	1,286	90%

H.2 Individual client level results

H.2.1 Actual versus expected results by starting segment

H.1.1.1 Number of clients not in social housing but receiving AS during the quarter

Segment					Q1			Q2			Q3			Q4			Average across quarters		
				H_seg	Actual	Expected	Ratio	Actual	Expected	Ratio	Actual	Expected	Ratio	Actual	Expected	Ratio	Actual	Expected	Ratio
On register	Priority A			110	1,274	1,400	91%	1,137	1,180	96%	1,043	1,049	99%	990	908	109%	1,111	1,134	98%
	Priority B and other			120	1,562	1,644	95%	1,427	1,542	93%	1,342	1,471	91%	1,286	1,380	93%	1,404	1,509	93%
IRRS recipients, primary aged < 65	Less close / IRRS > $150	Child in the household	Work obligated	211	85	0	-	229	165	138%	385	323	119%	502	476	105%	300	241	124%
			Not work obligated	212	112	0	-	276	186	148%	449	360	125%	613	523	117%	363	267	136%
			NOMB	213	42	0	-	165	97	169%	250	186	134%	349	269	130%	202	138	146%
		No child in the household	Work obligated	214	16	0	-	47	39	119%	77	75	103%	110	92	120%	63	52	121%
			Not work obligated	215	68	0	-	180	134	134%	296	259	114%	402	359	112%	237	188	126%
			NOMB	216	19	0	-	74	34	215%	127	71	179%	154	96	160%	94	50	185%
	Closer / IRRS ≤ $150	Child in the household	Work obligated	221	31	0	-	66	49	134%	99	94	106%	150	133	112%	87	69	125%
			Not work obligated	222	22	0	-	45	53	84%	96	97	99%	137	139	99%	75	72	104%
			NOMB	223	26	0	-	86	51	168%	145	108	134%	186	161	115%	111	80	138%
		No child in the household	Work obligated	224	10	0	-	15	15	100%	26	28	92%	39	39	101%	23	21	110%
			Not work obligated	225	22	0	-	53	52	102%	91	101	90%	125	142	88%	73	74	99%
			NOMB	226	15	0	-	37	29	128%	71	60	118%	95	84	113%	55	43	126%
IRRS recipients, primary aged 65+	Less close / IRRS > $150	Child in the household		311	6	0	-	26	24	107%	41	49	84%	62	63	99%	34	34	99%
		No child in the household		312	15	0	-	66	60	109%	87	117	74%	122	167	73%	73	86	84%
	Closer / IRRS ≤ $150	Child in the household		321	2	0	-	5	4	132%	7	7	97%	12	11	107%	7	6	117%
		No child in the household		322	7	0	-	25	20	123%	33	40	82%	52	56	93%	29	29	100%
Recent exit from housing	Receiving AS			410	3,119	3,273	95%	2,831	2,961	96%	2,662	2,745	97%	2,457	2,548	96%	2,767	2,882	96%
	Not receiving AS	Aged <60		420	710	523	136%	1,020	832	123%	1,143	1,001	114%	1,204	1,056	114%	1,019	853	119%
		Aged 60+		430	16	71	22%	36	97	37%	45	112	40%	56	134	42%	38	103	37%
Recent exit from register	Receiving AS			510	3,945	4,112	96%	3,703	3,818	97%	3,510	3,696	95%	3,296	3,469	95%	3,614	3,774	96%
	Not receiving AS			520	391	271	144%	524	410	128%	589	474	124%	649	471	138%	538	407	132%
Total					11,515	11,294	102%	12,073	11,856	102%	12,614	12,522	101%	13,048	12,779	102%	12,313	12,113	102%

H.1.1.2 Average AS payment per client ($)

Segment					Q1			Q2			Q3			Q4			Average across quarters		
				H_seg	Actual	Expected	Ratio	Actual	Expected	Ratio	Actual	Expected	Ratio	Actual	Expected	Ratio	Actual	Expected	Ratio
On register	Priority A			110	839	916	92%	884	921	96%	915	910	101%	898	934	96%	884	920	96%
	Priority B and other			120	990	1,000	99%	1,040	1,012	103%	1,049	998	105%	1,053	1,021	103%	1,033	1,008	102%
IRRS recipients, primary aged < 65	Less close / IRRS > $150	Child in the household	Work obligated	211	562	-	-	738	868	85%	787	853	92%	771	876	88%	714	866	83%
			Not work obligated	212	585	-	-	692	819	85%	739	800	92%	801	832	96%	704	817	86%
			NOMB	213	615	-	-	689	681	101%	731	677	108%	729	712	102%	691	690	100%
		No child in the household	Work obligated	214	433	-	-	517	635	81%	512	620	83%	510	640	80%	493	632	78%
			Not work obligated	215	514	-	-	586	661	89%	623	659	95%	667	692	96%	597	671	89%
			NOMB	216	494	-	-	615	571	108%	593	581	102%	602	634	95%	576	595	97%
	Closer / IRRS ≤ $150	Child in the household	Work obligated	221	487	-	-	585	616	95%	596	646	92%	574	674	85%	561	645	87%
			Not work obligated	222	354	-	-	547	637	86%	519	620	84%	607	660	92%	507	639	79%
			NOMB	223	408	-	-	486	572	85%	613	569	108%	573	605	95%	520	582	89%
		No child in the household	Work obligated	224	344	-	-	543	422	129%	437	446	98%	435	482	90%	440	450	98%
			Not work obligated	225	288	-	-	468	482	97%	467	490	95%	492	515	96%	429	496	87%
			NOMB	226	421	-	-	501	477	105%	504	502	100%	555	541	103%	495	507	98%
IRRS recipients, primary aged 65+	Less close / IRRS > $150	Child in the household		311	846	-	-	833	746	112%	870	763	114%	798	813	98%	837	774	108%
		No child in the household		312	385	-	-	538	600	90%	603	669	90%	589	700	84%	529	656	81%
	Closer / IRRS ≤ $150	Child in the household		321	270	-	-	741	567	131%	591	631	94%	443	647	69%	511	615	83%
		No child in the household		322	487	-	-	495	375	132%	574	454	126%	551	496	111%	527	442	119%
Recent exit from housing	Receiving AS			410	747	752	99%	771	793	97%	777	795	98%	790	826	96%	771	791	97%
	Not receiving AS	Aged <60		420	323	462	70%	455	485	94%	510	519	98%	534	557	96%	455	506	90%
		Aged 60+		430	287	503	57%	326	635	51%	539	660	82%	533	686	78%	421	621	68%
Recent exit from register	Receiving AS			510	1,010	910	111%	1,021	931	110%	1,023	917	111%	1,019	951	107%	1,018	927	110%
	Not receiving AS			520	417	546	76%	546	575	95%	600	617	97%	630	662	95%	548	600	91%
Total					832	846	98%	836	839	100%	832	818	102%	823	836	98%	831	834	100%

H.1.1.3 Total AS payments ($m)

Segment					Q1			Q2			Q3			Q4			Average across quarters		
				H_seg	Actual	Expected	Ratio	Actual	Expected	Ratio	Actual	Expected	Ratio	Actual	Expected	Ratio	Actual	Expected	Ratio
On register	Priority A			110	1.07	1.28	83%	1.01	1.09	93%	1.0	1.0	100%	0.89	0.85	105%	0.98	1.04	94%
	Priority B and other			120	1.55	1.64	94%	1.48	1.56	95%	1.4	1.5	96%	1.35	1.41	96%	1.45	1.52	95%
IRRS recipients, primary aged < 65	Less close / IRRS > $150	Child in the household	Work obligated	211	0.05	0.00	-	0.17	0.14	118%	0.3	0.3	110%	0.39	0.42	93%	0.23	0.21	108%
			Not work obligated	212	0.07	0.00	-	0.19	0.15	125%	0.3	0.3	115%	0.49	0.44	113%	0.27	0.22	123%
			NOMB	213	0.03	0.00	-	0.11	0.07	171%	0.2	0.1	145%	0.25	0.19	133%	0.14	0.10	150%
		No child in the household	Work obligated	214	0.01	0.00	-	0.02	0.03	97%	0.0	0.0	85%	0.06	0.06	95%	0.03	0.03	97%
			Not work obligated	215	0.03	0.00	-	0.11	0.09	119%	0.2	0.2	108%	0.27	0.25	108%	0.15	0.13	117%
			NOMB	216	0.01	0.00	-	0.05	0.02	231%	0.1	0.0	183%	0.09	0.06	152%	0.06	0.03	183%
	Closer / IRRS ≤ $150	Child in the household	Work obligated	221	0.02	0.00	-	0.04	0.03	127%	0.1	0.1	98%	0.09	0.09	96%	0.05	0.05	110%
			Not work obligated	222	0.01	0.00	-	0.02	0.03	72%	0.0	0.1	83%	0.08	0.09	91%	0.04	0.05	89%
			NOMB	223	0.01	0.00	-	0.04	0.03	143%	0.1	0.1	144%	0.11	0.10	109%	0.06	0.05	132%
		No child in the household	Work obligated	224	0.00	0.00	-	0.01	0.01	129%	0.0	0.0	90%	0.02	0.02	91%	0.01	0.01	106%
			Not work obligated	225	0.01	0.00	-	0.02	0.02	99%	0.0	0.0	86%	0.06	0.07	84%	0.03	0.04	92%
			NOMB	226	0.01	0.00	-	0.02	0.01	134%	0.0	0.0	119%	0.05	0.05	115%	0.03	0.02	127%
IRRS recipients, primary aged 65+	Less close / IRRS > $150	Child in the household		311	0.01	0.00	-	0.02	0.02	119%	0.0	0.0	96%	0.05	0.05	97%	0.03	0.03	105%
		No child in the household		312	0.01	0.00	-	0.04	0.04	98%	0.1	0.1	67%	0.07	0.12	61%	0.04	0.06	72%
	Closer / IRRS ≤ $150	Child in the household		321	0.00	0.00	-	0.00	0.00	172%	0.0	0.0	91%	0.01	0.01	73%	0.00	0.00	98%
		No child in the household		322	0.00	0.00	-	0.01	0.01	162%	0.0	0.0	104%	0.03	0.03	103%	0.02	0.01	118%
Recent exit from housing	Receiving AS			410	2.33	2.46	95%	2.18	2.35	93%	2.1	2.2	95%	1.94	2.11	92%	2.13	2.27	94%
	Not receiving AS	Aged <60		420	0.23	0.24	95%	0.46	0.40	115%	0.6	0.5	112%	0.64	0.59	109%	0.48	0.44	109%
		Aged 60+		430	0.00	0.04	13%	0.01	0.06	19%	0.0	0.1	33%	0.03	0.09	33%	0.02	0.07	27%
Recent exit from register	Receiving AS			510	3.99	3.74	107%	3.78	3.55	106%	3.6	3.4	106%	3.36	3.30	102%	3.68	3.50	105%
	Not receiving AS			520	0.16	0.15	110%	0.29	0.24	121%	0.4	0.3	121%	0.41	0.31	131%	0.30	0.25	123%
Total					10	10	100%	10	10	101%	10	10	102%	11	11	100%	10	10	101%

H.2.2 Actual versus expected results by region

H.1.2.1 Number of clients not in social housing but receiving AS during the quarter

Region	Q1			Q2			Q3			Q4			Average across quarters		
	Actual	Expected	Ratio	Actual	Expected	Ratio	Actual	Expected	Ratio	Actual	Expected	Ratio	Actual	Expected	Ratio
Auck	4,808	4,785	100%	5,068	4,982	102%	5,227	5,212	100%	5,378	5,272	102%	5,120	5,063	101%
Cant	1,166	1,160	101%	1,180	1,153	102%	1,219	1,180	103%	1,258	1,139	110%	1,206	1,158	104%
Central	326	328	99%	339	361	94%	361	395	91%	392	414	95%	355	374	95%
East	814	774	105%	853	846	101%	887	915	97%	915	951	96%	867	872	100%
Nelson	319	304	105%	333	314	106%	356	332	107%	382	336	114%	348	322	108%
Northld	625	591	106%	663	628	106%	686	673	102%	714	692	103%	672	646	104%
Plenty	755	735	103%	814	774	105%	845	822	103%	844	847	100%	815	795	103%
South	451	453	99%	473	479	99%	478	492	97%	507	511	99%	477	484	99%
Taran	360	337	107%	389	374	104%	421	404	104%	460	431	107%	408	386	105%
Waik	913	885	103%	959	905	106%	1,004	953	105%	1,028	977	105%	976	930	105%
Wlgtn	978	941	104%	1,002	1,039	96%	1,130	1,142	99%	1,170	1,209	97%	1,070	1,083	99%
Total	11,515	11,294	102%	12,073	11,854	102%	12,614	12,521	101%	13,048	12,778	102%	12,313	12,112	102%

H.1.2.2 Average AS payment per client ($)

Region	Q1			Q2			Q3			Q4			Average across quarters		
	Actual	Expected	Ratio	Actual	Expected	Ratio	Actual	Expected	Ratio	Actual	Expected	Ratio	Actual	Expected	Ratio
Auck	1,067	1,078	99%	1,058	1,063	100%	1,056	1,030	103%	1,044	1,048	100%	1,056	1,055	100%
Cant	698	674	104%	713	682	104%	720	671	107%	711	692	103%	710	680	104%
Central	557	584	95%	575	591	97%	590	592	100%	606	622	97%	582	597	97%
East	627	632	99%	630	631	100%	633	621	102%	625	648	96%	629	633	99%
Nelson	721	707	102%	742	715	104%	756	702	108%	740	723	102%	740	712	104%
Northld	638	643	99%	651	654	100%	658	656	100%	640	685	93%	647	659	98%
Plenty	718	774	93%	711	766	93%	699	745	94%	692	764	91%	705	762	92%
South	595	571	104%	610	585	104%	624	590	106%	610	610	100%	610	589	104%
Taran	536	549	98%	562	554	101%	569	553	103%	580	572	101%	562	557	101%
Waik	685	718	95%	687	719	96%	686	705	97%	677	725	93%	684	717	95%
Wlgtn	705	732	96%	731	722	101%	695	703	99%	704	720	98%	709	719	99%
Total	832	846	98%	836	839	100%	832	818	102%	823	836	98%	831	834	100%

H.1.2.3 Total AS payments ($m)

Region	Q1			Q2			Q3			Q4			Average across quarters		
	Actual	Expected	Ratio	Actual	Expected	Ratio	Actual	Expected	Ratio	Actual	Expected	Ratio	Actual	Expected	Ratio
Auck	5.1	5.2	99%	5.4	5.3	101%	5.5	5.4	103%	5.6	5.5	102%	5.4	5.3	101%
Cant	0.8	0.8	104%	0.8	0.8	107%	0.9	0.8	111%	0.9	0.8	113%	0.9	0.8	109%
Central	0.2	0.2	95%	0.2	0.2	92%	0.2	0.2	91%	0.2	0.3	92%	0.2	0.2	92%
East	0.5	0.5	104%	0.5	0.5	101%	0.6	0.6	99%	0.6	0.6	93%	0.5	0.6	99%
Nelson	0.2	0.2	107%	0.2	0.2	110%	0.3	0.2	115%	0.3	0.2	116%	0.3	0.2	112%
Northld	0.4	0.4	105%	0.4	0.4	105%	0.5	0.4	102%	0.5	0.5	96%	0.4	0.4	102%
Plenty	0.5	0.6	95%	0.6	0.6	98%	0.6	0.6	96%	0.6	0.6	90%	0.6	0.6	95%
South	0.3	0.3	104%	0.3	0.3	103%	0.3	0.3	103%	0.3	0.3	99%	0.3	0.3	102%
Taran	0.2	0.2	104%	0.2	0.2	106%	0.2	0.2	107%	0.3	0.2	108%	0.2	0.2	107%
Waik	0.6	0.6	98%	0.7	0.7	101%	0.7	0.7	102%	0.7	0.7	98%	0.7	0.7	100%
Wlgtn	0.7	0.7	100%	0.7	0.8	98%	0.8	0.8	98%	0.8	0.9	95%	0.8	0.8	97%
Total	10	10	100%	10	10	101%	10	10	103%	11	11	100%	10	10	101%

APPENDIX I CHANGE IN LIABILITY FROM PREVIOUS VALUATION

Table I.1 Attribution of change from 2015 to 2016 valuation by segment

Segment				2015 current client liability				Roll-forward to 2016		Change due to experience			
				Previous valuation	Updated unemployment rate and market rents	Updated inflation rates	Updated discount rates	Roll-forward before discount unwind	Unwind 1 year of discounting	Difference between actual and expected cohort	Recognition of experience	Updated expense assumptions	2016 segment allocation
				(a)	(b)	(c)	(d)	(e) (f)	(g)	(h)	(i)	(j)	(k)
				$m	$m	$m	$m	$m	$m	$m	$m	$m	$m
On register	Priority A			287	287	269	330	291	300	333	329	329	461
	Priority B and other			214	213	199	246	210	217	276	274	274	191
	Sub-total			501	501	468	575	502	516	609	602	602	652
IRRS recipients, primary aged < 65	Less close / IRRS > $150	Child in the household	Work obligated	2,507	2,521	2,363	2,887	2,767	2,848	2,817	2,712	2,712	2,863
			Not work obligated	2,743	2,752	2,581	3,150	3,024	3,112	3,070	2,960	2,960	3,041
			NOMB	2,330	2,338	2,183	2,695	2,598	2,674	2,592	2,451	2,451	2,700
		No child in the household	Work obligated	381	382	362	430	407	419	418	408	408	445
			Not work obligated	2,225	2,229	2,118	2,500	2,375	2,444	2,428	2,405	2,405	2,660
			NOMB	795	790	746	894	853	878	859	810	810	901
	Closer / IRRS ≤ $150	Child in the household	Work obligated	216	222	207	256	247	254	249	234	234	208
			Not work obligated	212	218	203	252	243	250	249	236	236	210
			NOMB	723	740	685	866	850	875	832	767	767	664
		No child in the household	Work obligated	46	46	43	52	49	51	51	51	51	48
			Not work obligated	288	289	274	324	308	318	320	317	317	278
			NOMB	341	350	328	403	393	405	376	345	345	297
	Sub-total			12,807	12,875	12,095	14,709	14,115	14,528	14,261	13,696	13,696	14,316
IRRS recipients, primary aged 65+	Less close / IRRS > $150	Child in the household		320	323	307	361	340	350	352	337	337	354
		No child in the household		1,126	1,132	1,093	1,219	1,114	1,146	1,156	1,150	1,150	1,345
	Closer / IRRS ≤ $150	Child in the household		26	29	27	33	32	33	30	30	30	30
		No child in the household		169	172	166	185	170	175	180	179	179	165
	Sub-total			1,642	1,655	1,593	1,797	1,655	1,704	1,718	1,695	1,695	1,894
Recent exit from housing	Receiving AS			290	293	270	344	48	50	73	72	72	326
	Not receiving AS	Aged <60		320	323	297	379	28	29	62	62	62	517
		Aged 60+		11	11	10	13	1	1	2	2	2	13
	Sub-total			620	626	577	736	77	79	137	137	137	855
Recent exit from register	Receiving AS			350	353	325	415	44	45	96	98	98	305
	Not receiving AS			129	130	120	153	17	18	80	77	77	102
	Sub-total			478	483	445	567	61	63	176	175	175	406
Future entries								1,341	1,380	1,886	1,818	1,818	0
Total				**16,048**	**16,140**	**15,177**	**18,384**	**17,750**	**18,269**	**18,786**	**18,124**	**18,124**	**18,124**
CHP Loading				60	60	57	69	0	0	0	0	0	0
Expenses				316	318	299	362	348	359	359	359	609	609
Grand total				16,425	16,518	15,533	18,815	18,098	18,628	19,145	18,482	18,733	18,733
Change					**94**	**-985**	**3,282**	**-717**	**530**	**517**	**-663**	**251**	**0**

Notes:
(a) Estimated future lifetime housing cost of adults in the social housing system in 2014/15 as presented in the 2015 social housing report
(b) Actual market rent and unemployment rate conditions had minimal impact on the overall estimate
(c) Lower CPI forecast reducing the liability by $1b
(c) Lower discount rates (based on New Zealand government bond yields) increasing the liability by $3.3b
(e) The expected change due to the evolution of the system over the year
(f) The CHP loading is no longer required going forward as CHP tenancies are now accounted for in the main valuation
(g) The removal of one year of discounting due to the expected timing of payments being one year closer
(h) Increase in liability by $0.5b driven by social housing allocations being higher than expected
(i) Decrease in liability by $0.7b driven by higher exit rates
(j) Increase in the expense allowance by $0.3b due to higher budget appropriations as part of the government policy initiatives
(k) Re-allocation of clients and their associated liability into segments based on their experience in 2015/16

APPENDIX J SENSITIVITY ANALYSIS

J.1 Base results

J.1.1 Current client liability excluding loans and expenses

Segment	IRRS payments ($b)	AS + TAS payments ($b)	Total liability ($b)
In housing	14.70	1.51	16.21
Register	0.47	0.18	0.65
Recent exits	0.74	0.52	1.26
Total	15.91	2.21	18.12

J.2 Sensitivity to inflation and discount rate assumptions

J.2.1 Current client liability excluding loans and expenses, discount rates 1% lower

Segment	IRRS payments ($b)	AS + TAS payments ($b)	Total liability ($b)	Change on base
In housing	17.52	1.91	19.43	19.8%
Register	0.59	0.21	0.80	22.0%
Recent exits	1.00	0.64	1.64	30.1%
Total	19.11	2.76	21.86	20.6%

Notes:
(a) Assumes all forward rates are 1% lower than those given in Appendix C

J.2.2 Current client liability excluding loans and expenses, discount rates 1% higher

Segment	IRRS payments ($b)	AS + TAS payments ($b)	Total liability ($b)	Change on base
In housing	12.61	1.23	13.83	-14.7%
Register	0.39	0.15	0.55	-16.0%
Recent exits	0.56	0.44	1.00	-20.3%
Total	13.56	1.82	15.38	-15.1%

Notes:
(a) Assumes all forward rates are 1% higher than those given in Appendix C

J.2.3 Current client liability excluding loans and expenses, CPI and AWE rates 1% lower

Segment	IRRS payments ($b)	AS + TAS payments ($b)	Total liability ($b)	Change on base
In housing	15.49	1.27	16.75	3.4%
Register	0.48	0.16	0.64	-1.2%
Recent exits	0.75	0.46	1.22	-3.5%
Total	16.73	1.89	18.62	2.7%

Notes:
(a) Assumes all April inflation increases are 1% lower than those given in Appendix C

J.2.4 Current client liability excluding loans and expenses, CPI and AWE rates 1% higher

Segment	IRRS payments ($b)	AS + TAS payments ($b)	Total liability ($b)	Change on base
In housing	13.47	1.79	15.26	-5.8%
Register	0.45	0.19	0.64	-1.7%
Recent exits	0.68	0.60	1.28	1.2%
Total	14.60	2.58	17.18	-5.2%

Notes:
(a) Assumes all April inflation increases are 1% higher than those given in Appendix C

J.3 Rental growth rate sensitivity

J.3.1 Table of national (quarterly) rental growth used in scenarios

Quarter	National rental growth rate above CPI		
	Adopted	1% increase	1% decrease
Sep-16	0.4%	0.6%	0.1%
Dec-16	0.4%	0.6%	0.1%
Mar-17	0.4%	0.6%	0.1%
Jun-17	0.4%	0.6%	0.1%
Sep-17	0.2%	0.5%	0.0%
Dec-17	0.2%	0.5%	0.0%
Mar-18	0.2%	0.5%	0.0%
Jun-18	0.2%	0.5%	0.0%
Sep-18	0.3%	0.5%	0.1%
Dec-18	0.3%	0.5%	0.0%
Mar-19	0.3%	0.5%	0.0%
Jun-19	0.3%	0.5%	0.0%
Sep-19	0.4%	0.6%	0.2%
Dec-19	0.4%	0.6%	0.1%
Mar-20	0.4%	0.6%	0.1%
Jun-20	0.4%	0.6%	0.1%
Sep-20	0.4%	0.6%	0.1%
Dec-20	0.4%	0.6%	0.1%
Mar-21	0.4%	0.6%	0.1%
Jun-21	0.4%	0.6%	0.1%
Sep-21	0.5%	0.7%	0.2%
Dec-21	0.5%	0.7%	0.2%
Mar-22	0.5%	0.7%	0.2%
Jun-22	0.5%	0.7%	0.2%
Sep-22	0.5%	0.7%	0.2%
Dec-22	0.5%	0.7%	0.2%
Mar-23	0.5%	0.7%	0.2%
Jun-23	0.4%	0.7%	0.2%
Sep-23	0.4%	0.7%	0.2%
Dec-23	0.4%	0.7%	0.2%
Mar-24	0.4%	0.7%	0.2%
Jun-24	0.4%	0.7%	0.2%
Sep-24	0.4%	0.7%	0.2%
Dec-24	0.4%	0.7%	0.2%
Mar-25	0.4%	0.7%	0.2%
Jun-25	0.4%	0.6%	0.2%
Sep-25	0.4%	0.6%	0.1%
Dec-25	0.4%	0.6%	0.1%
Mar-26	0.4%	0.6%	0.1%
Jun-26	0.4%	0.6%	0.1%
Later	0.4%	0.6%	0.1%

J.3.2 Current client liability excluding loans and expenses, market rents 1% lower

Segment	IRRS payments ($b)	AS + TAS payments ($b)	Total liability ($b)	Change on base
In housing	11.71	1.44	13.15	-18.9%
Register	0.38	0.17	0.54	-16.5%
Recent exits	0.53	0.50	1.03	-18.4%
Total	12.62	2.10	14.72	-18.8%

Notes:
(a) Assumes all quarterly rental increases are 1% lower than those given in Appendix C

J.3.3 Current client liability excluding loans and expenses, market rents 1% higher

Segment	IRRS payments ($b)	AS + TAS payments ($b)	Total liability ($b)	Change on base
In housing	18.37	1.55	19.92	22.9%
Register	0.60	0.18	0.78	19.8%
Recent exits	1.02	0.55	1.57	24.3%
Total	19.99	2.28	22.27	22.9%

Notes:
(a) Assumes all quarterly rental increases are 1% higher than those given in Appendix C

J.4 Unemployment rate sensitivity

J.4.1 Current client liability excluding loans and expenses, constant unemployment rate forecast at current rate of 5.1%

Segment	IRRS payments ($b)	AS + TAS payments ($b)	Total liability ($b)	Change on base
In housing	14.94	1.58	16.52	1.9%
Register	0.48	0.18	0.66	1.6%
Recent exits	0.74	0.56	1.30	2.8%
Total	16.16	2.32	18.48	2.0%

Notes:
(a) The national unemployment rates for this scenario a constant 5.1%, with the regional rates adjusted accordingly

J.5 Sensitivity to transition model assumptions

J.5.1 Current client liability excluding loans and expenses, housing exit rates 5% higher

Segment	IRRS payments ($b)	AS + TAS payments ($b)	Total liability ($b)	Change on base
In housing	14.36	1.52	15.88	-2.0%
Register	0.47	0.18	0.64	-1.5%
Recent exits	0.73	0.52	1.25	-0.7%
Total	15.56	2.22	17.77	-1.9%

Notes:
(a) For example, if 2% of clients transition out of housing, a 5% increase would change this to 2.0%x(1+0.05) = 2.1%

J.5.2 Current client liability excluding loans and expenses, housing exit rates 5% lower

Segment	IRRS payments ($b)	AS + TAS payments ($b)	Total liability ($b)	Change on base
In housing	14.91	1.49	16.41	1.2%
Register	0.47	0.18	0.65	-0.5%
Recent exits	0.74	0.52	1.26	-0.3%
Total	16.12	2.19	18.31	1.0%

Notes:
(a) For example, if 2% of clients transition out of housing, a 5% decrease would change this to 1.9%

J.5.3 Current client liability excluding loans and expenses, register application rates 5% higher

Segment	IRRS payments ($b)	AS + TAS payments ($b)	Total liability ($b)	Change on base
In housing	14.56	1.51	16.07	-0.9%
Register	0.47	0.18	0.65	-1.0%
Recent exits	0.73	0.53	1.25	-0.6%
Total	15.76	2.21	17.97	-0.9%

Notes:
(a) For example, if 3% of clients make a register application, a 5% increase would change this to 3.15%

J.5.4 Current client liability excluding loans and expenses, register application rates 5% lower

Segment	IRRS payments ($b)	AS + TAS payments ($b)	Total liability ($b)	Change on base
In housing	14.78	1.51	16.29	0.5%
Register	0.48	0.18	0.66	1.1%
Recent exits	0.74	0.53	1.27	0.6%
Total	16.01	2.21	18.22	0.5%

Notes:
(a) For example, if 3% of clients make a register application, a 5% decrease would change this to 2.85%

APPENDIX K OTHER ONE-WAY TABLES

K.1 Current client liability by age at valuation date

Group	Number of households	Number of adults	IRRS payments ($m)	AS payments ($m)	TAS payments ($m)	Total liability ($m)	Average individual liability ($k)
16-19	245	23,774	621	241	32.4	895	38
20-24	2,308	19,110	1,017	328	47.9	1,393	73
25-29	4,596	13,921	1,311	285	45.0	1,642	118
30-34	5,174	10,722	1,412	219	37.4	1,669	156
35-39	5,685	10,154	1,614	184	34.0	1,832	180
40-44	6,726	11,073	1,843	173	34.0	2,050	185
45-49	8,175	12,502	2,133	161	32.2	2,326	186
50-54	8,222	12,219	1,926	127	24.6	2,078	170
55-59	6,972	10,119	1,465	79	14.1	1,558	154
60-64	5,899	8,484	1,018	49	7.3	1,073	127
65-75	8,494	11,716	1,117	38	5.2	1,160	99
75-85	4,259	5,819	380	8	1.2	390	67
85+	1,079	1,544	56	1	0.1	57	37
All	**67,834**	**151,157**	**15,914**	**1,894**	**315**	**18,124**	**120**

Notes:
(a) Number of households shows the number of households by group of the primary householder
(b) Number of households excludes recent housing or register exits

K.2 Current client liability by current duration in housing state at valuation date

Group	Number of households	Number of adults	IRRS payments ($m)	AS payments ($m)	TAS payments ($m)	Total liability ($m)	Average individual liability ($k)
<1yr	6,317	32,320	1,856	541	88.1	2,485	77
1-2 yr	4,942	10,642	1,098	191	32.8	1,322	124
2-3 yr	4,877	9,884	1,098	164	27.9	1,290	130
3-4 yr	3,739	8,459	923	128	21.5	1,073	127
4-5 yr	3,198	7,117	778	101	17.0	897	126
5-6 yr	3,019	6,506	724	84	14.0	823	126
6-7 yr	3,219	6,338	764	76	12.9	853	135
7-8 yr	3,037	5,805	717	70	11.8	798	137
8-9 yr	2,777	5,234	675	59	10.0	743	142
9-10 yr	2,665	5,107	660	53	8.9	722	141
10-15 yr	11,019	21,067	2,704	199	33.4	2,936	139
15-20 yr	18,332	28,069	3,706	175	29.3	3,910	139
20-25 yr	334	2,634	108	34	4.9	147	56
25+ yr	359	1,975	104	19	2.6	126	64
All	**67,834**	**151,157**	**15,914**	**1,894**	**315**	**18,124**	**120**

Notes:
(a) Number of households shows the number of households by group of the primary householder
(b) Number of households excludes recent housing or register exits

K.3 Current client liability by cumulative time in social housing

Group	Number of households	Number of adults	IRRS payments ($m)	AS payments ($m)	TAS payments ($m)	Total liability ($m)	Average individual liability ($k)
<1yr	4,554	14,681	855	299	49.2	1,204	82
1-2 yr	3,072	9,274	757	151	24.9	933	101
2-3 yr	3,318	7,441	741	122	20.9	884	119
3-4 yr	3,292	7,313	781	111	19.1	911	125
4-5 yr	2,871	6,625	695	98	16.7	810	122
5-6 yr	3,033	6,802	741	95	16.2	852	125
6-7 yr	3,200	6,803	767	90	15.5	873	128
7-8 yr	3,320	7,026	811	91	15.5	917	131
8-9 yr	3,257	6,679	803	86	14.8	904	135
9-10 yr	3,140	6,675	799	81	13.8	894	134
10-15 yr	14,442	31,694	3,724	349	58.1	4,131	130
15-20 yr	19,403	33,188	4,083	237	38.7	4,358	131
20-25 yr	435	3,933	191	51	7.2	249	63
25+ yr	497	3,023	165	34	4.8	204	68
All	**67,834**	**151,157**	**15,914**	**1,894**	**315**	**18,124**	**120**

Notes:
(a) Number of households shows the number of households by group of the primary householder
(b) Number of households excludes recent housing or register exits

K.4 Current client liability by region

Group	Number of households	Number of adults	IRRS payments ($m)	AS payments ($m)	TAS payments ($m)	Total liability ($m)	Average individual liability ($k)
Northland	2,225	4,724	336	80	15.2	431	91
Waikato	4,067	8,463	759	119	22.6	901	106
East Coast	3,190	6,771	533	107	16.3	656	97
Bay of Plenty	4,140	8,223	533	114	19.9	666	81
Taranaki	1,904	3,536	208	49	8.9	266	75
Central	2,090	3,987	233	57	9.2	298	75
Wellington	8,365	16,841	1,518	196	32.8	1,747	104
Nelson	1,509	2,877	225	43	8.2	276	96
Canterbury	6,525	12,737	1,416	144	29.6	1,589	125
Southern	2,443	4,248	318	56	11.0	385	91
Auckland	31,376	78,743	9,835	931	141.7	10,908	139
Australia		7	0	0	0.0	0	40
All	**67,834**	**151,157**	**15,914**	**1,894**	**315**	**18,124**	**120**

Notes:
(a) The small number of adults in Australia are all recent housing exits
(b) Number of households excludes recent housing or register exits.

K.5 Current client liability by local board (Auckland only)

Group	Number of households	Number of adults	IRRS payments ($m)	AS payments ($m)	TAS payments ($m)	Total liability ($m)	Average individual liability ($k)
Albert-Eden	1,745	3,661	532	41	6	580	158
Devonport-Takapuna	280	513	79	6	1	86	167
Franklin	334	833	97	14	2	113	136
Henderson-Massey	2,741	7,380	875	99	15	989	134
Hibiscus and Bays	125	308	34	6	1	41	133
Howick	610	1,659	213	20	3	235	142
Kaipatiki	980	2,356	305	30	5	341	145
Mangere-Otahuhu	4,375	12,890	1,462	136	20	1,618	126
Manurewa	3,180	8,487	1,059	112	17	1,188	140
Maungakiekie-Tamaki	4,859	11,695	1,543	124	18	1,685	144
Orakei	757	1,461	218	14	2	234	160
Otara-Papatoetoe	3,501	9,601	1,076	109	16	1,201	125
Papakura	1,408	3,496	453	52	9	514	147
Puketapapa	2,472	5,857	791	61	9	862	147
Rodney	68	162	16	3	1	20	123
Upper Harbour	52	123	13	3	0	16	129
Waiheke	17	19	2	0	0	2	115
Waitakere Ranges	502	1,433	168	21	3	192	134
Waitemata	1,358	2,139	353	26	4	383	179
Whau	2,012	4,670	546	55	8	609	130
All	**31,376**	**78,743**	**9,835**	**931**	**142**	**10,908**	**139**

Notes:
(a) Number of households excludes recent housing or register exits.

K.6 Current client liability by ethnicity

Group	Number of households	Number of adults	IRRS payments ($m)	AS payments ($m)	TAS payments ($m)	Total liability ($m)	Average individual liability ($k)
NZ EU	17,387	30,578	3,141	368	71	3,581	117
Māori	24,470	54,448	5,327	854	148	6,329	116
Pacific	16,636	44,066	5,136	421	59	5,616	127
Asian	3,591	8,619	974	106	11.49	1,092	127
Other	5,750	13,446	1,336	144	25.5	1,506	112
All	**67,834**	**151,157**	**15,914**	**1,894**	**315**	**18,124**	**120**

Notes:
(a) Number of households shows the number of households by group of the primary householder
(b) Number of households excludes recent housing or register exits

K.7 Current client liability by household size, current households

Group	Number of households	Number of adults	IRRS payments ($m)	AS payments ($m)	TAS payments ($m)	Total liability ($m)	Average individual liability ($k)
1	18,955	18,955	2,822	130	26.7	2,979	157
2	13,457	22,415	2,618	238	42.5	2,898	129
3	10,120	20,539	2,473	256	43.1	2,772	135
4	8,147	19,093	2,284	234	37.7	2,556	134
5	5,549	14,871	1,729	170	26.4	1,925	129
6	3,528	10,959	1,217	117	17.7	1,351	123
7+	3,776	14,206	1,558	149	22.0	1,728	122
All	**63,532**	**121,038**	**14,701**	**1,292**	**216**	**16,210**	**134**

Notes:
(a) Excludes recent exits from social housing or the register
(b) Number of households excludes recent housing or register exits

K.8 Current client liability by benefit type

Group	Number of households	Number of adults	IRRS payments ($m)	AS payments ($m)	TAS payments ($m)	Total liability ($m)	Average individual liability ($k)
SLP-Carer	1,522	2,411	502	43	7.6	552	229
SPS	11,335	14,903	2,988	396	68.8	3,453	232
JS-HCD	6,531	10,085	1,739	182	35.6	1,957	194
SLP-HCD	11,618	16,860	2,651	244	48.3	2,943	175
JS-WR	5,634	10,754	1,431	219	38.5	1,688	157
OB	307	399	63	4	0.7	68	169
SUP	1,407	3,081	331	51	7.4	390	126
EB	164	300	37	5	0.8	42	140
NZ Super	13,791	18,906	1,547	47	6.4	1,600	85
NOB	15,525	73,458	4,626	704	101.1	5,431	74
All	**67,834**	**151,157**	**15,914**	**1,894**	**315**	**18,124**	**120**

Notes:
(a) Number of households shows the number of households by group of the primary householder
(b) Number of households excludes recent housing or register exits

APPENDIX L PROJECTED NUMBER OF CLIENTS AND PAYMENTS

Projected numbers and payments are included as an electronic Appendix J.