Method Report
30 June 2015
Baseline Valuation

Department of Social Services

Final report April 2016

pwc

Executive summary

Context and purpose of this report [see *Section 1*]

The Department of Social Services (the Department) is implementing the Australian Priority Investment Approach to Welfare - developing and evaluating policy interventions in the social security system, with the aim of reducing welfare dependence and improving the lifetime wellbeing of people and families in Australia. PricewaterhouseCoopers (PwC) has been engaged to undertake the actuarial analysis supporting the Australian Priority Investment Approach. This will involve four annual actuarial valuations of the Commonwealth's lifetime costs under the social security and income support system, the first of which is known as the 'baseline valuation', and will estimate the lifetime cost as at 30 June 2015. The final baseline valuation report is due 31 January 2016.

While a conceptual method for the valuations was developed by PwC in preparation for submitting our proposal, an important element of our approach is that the method should be co-designed. This co-design process has involved detailed discussion and 'workshopping' of various elements of the method with members of the Department's Investment Approach Taskforce, along with significant data preparation and exploratory analysis to test whether the proposed method is feasible.

This report formally sets out a description of the proposed method given what we have learned and agreed. Its purpose is to confirm understanding between PwC, the Department and members of the Investment Approach Inter-Departmental Committee (IDC) to enable further discussion and refinement to take place.

The report is intended to describe the proposed method in relatively simple language, highlighting key features including the scope of the model population, segmentation of the population for modelling purposes, the main assumptions required and the key information provided in the results module. In parallel, we are developing technical documentation that will cover matters such as more detailed aspects of the model structure, statistical fitting techniques, and so on.

Development of baseline method report

This report was prepared as an initial draft at the end of October 2015 based on the initial proposed approach and the discussions between PwC and the Department from when our contract commenced in mid-September 2015 up to that point in time. Between November 2015 and January 2016, we undertook a number of activities to assist in refining the methodology, progress with the implementation of the methodology, and prepare a valuation report documenting the valuation results.

This final version of the baseline method report has been updated to reflect any refinements to the method that were developed as part of the implementation work and to ensure that it is consistent with the valuation report.

Method design principles [see *Section 1*]

The design of the method has been underpinned by a number of principles such as flexibility, transparency, robustness, and ability to evolve over time. As far as possible the design is intended to represent the real factors which drive dependence on welfare, and for this reason an important design principle is that the model should be 'person-centred', with the ability to overlay forward looking adjustments so that the model represents today's welfare system and its expected utilisation in future years, rather than the system as it was in the past.

A significant constraint for the baseline valuation is the timeline, and in designing and applying the method, pragmatic choices need to be made which maximise the utility of the method, model and results, within the available time. The method design incorporates a vision for delivering valuable insights from the baseline valuation to inform a first set of policy interventions, and evolving the model over the next three years and beyond to support further policy development and evaluation.

Overview of proposed method [see *Section 3*]

The proposed method for the baseline valuation is represented diagrammatically in section 3.1 and can be broadly described by the following steps:

1. Develop a data set which represents the Australian population at 30 June 2015. The data set will contain one record for each person, along with the circumstances and characteristics of that person (age, gender, relationship status, education status, welfare status etc.). This will be developed from Census data, the Department's welfare recipient data and other sources. [*the Population module, described in section 5*]

2. Develop assumptions to project the future circumstances and characteristics of each person in the base population in each future year – such as age, education status, children and so on. [*the Flow Assumptions module, described in section 7*]
3. Develop assumptions to estimate the probability of each person receiving welfare in each future year, based on their projected circumstances and characteristics at that time. [*the Welfare utilisation module, described in section 7*]
4. Develop assumptions to estimate the future annual payments for each person who receives welfare, based on their projected circumstances and characteristics at that time. [*the Payment assumptions module, described in section 7*]
5. Build a model which applies the above assumptions to the base population to simulate the future lifetime pathway of each person or group, including their projected circumstances and characteristics in each future year, their chance of being in receipt of welfare given those characteristics, and their likely annual payment in that case. [*the Projection module, described in section 8*]
6. Develop and apply adjustments to the assumptions and resulting simulations where appropriate to ensure aggregate projections reconcile to external benchmarks and, in time, to allow for economic impacts. [*the Adjustments module, described in section 8*]
7. Develop indexation assumptions to index the payments made in future years and discounting assumptions to calculate the lifetime cost. [*the Indexation module, described in section 8*]
8. Summarise valuation results from the projection module for different purposes. [*the Results module, described in section 9*]

The method design draws on both the traditional actuarial approach of modelling payments per active claim (see Glossary) and on dynamic micro-simulation (DMS) modelling. The foundation of both these approaches is an iterative approach which considers the evolution of the model population over each time period. The outcomes from one time period feed into the next.

Scope [see Section 4]

The **scope of the population** for the baseline valuation includes estimated residents at 30 June 2015 and current overseas welfare recipients only. Future migrants and unborn children are not included in the model, but will appear in future valuations once they migrate or are born, and at that time will contribute to an increase in the total lifetime cost. The model allows for the impact of future children on the likelihood and size of welfare payments for members of the model population, but does not estimate the future lifetime costs for the unborn children once they are eligible to receive welfare payments in their own right. The model allows for new entrants to the welfare payment system in each future year to be drawn from the model population, including existing children. People have been grouped into 12 unique classes for the purpose of modelling welfare utilisation, such as ‘studying’ or ‘parenting’ as described in section 6.

The **scope of payments** is set out in section 4 and generally includes payments for which the Department has responsibility; including income support payments to both working age people and age pensioners, family payments, and various supplementary payments and allowances. The scope does not include veterans’ payments or concession card benefits. Payments have been grouped into 17 broad categories aligned to their general purpose, as described in section 5, noting that in any year people may receive payments from more than one of these categories.

The 12 welfare class groupings and 17 payment categories have been informed by our exploratory analysis of the data, and have been discussed and agreed with the Department’s Investment Approach Taskforce.

The model uses **annual** data and projects annual payments, to avoid the complications of seasonality and to achieve practical run times for the simulations.

A number of other detailed scope and definition issues have also been discussed, agreed, and documented in the glossary to this report or in technical notes.

Evolution of the model

The model is designed to be able to run for the whole population, for sub-groups, for different numbers of simulations, for different scenarios and for different sets of assumptions. It is important to note that as the

model evolves to include assumptions which reflect more detailed risk factors, it will more accurately differentiate between groups, while the aggregate lifetime cost remains similar.

Our intention for the baseline valuation is to balance the time and complexity required to introduce more detailed risk factors, with the need for robust, timely results. We are confident based on discussions and analysis of the data, that the method, even with limited risk factors, will produce valuable insights to inform policy interventions. As the model evolves over future years, we would expect to achieve greater accuracy for increasingly more refined groups, though this will be eventually limited by available predictors in the data.

Note that describing and illustrating the **uncertainty** of the assumptions and results will be important – in particular, transparently articulating the level of accuracy or reliability of the model for different group sizes and segments.

Contents

1 Introduction

1.1 Background and purpose of report

The Department of Social Services (the Department) is implementing the Australian Priority Investment Approach to developing and evaluating policy interventions in the social security system - with the aim of reducing welfare dependence, and improving the lifetime wellbeing of people and families in Australia.

PricewaterhouseCoopers (PwC) has been engaged to undertake the actuarial analysis supporting the Australian Priority Investment Approach. This will involve four annual actuarial valuations of the Commonwealth's lifetime costs under the social security and income support system, the first of which is known as the "baseline valuation", and will estimate the lifetime cost as at 30 June 2015. The final baseline valuation report is due by 31 January 2016, and a number of streams of activity are under way to achieve this, including:

- Data preparation and exploratory analysis
- Method design
- Assumption development
- Model building
- Stakeholder consultation
- Project and risk management.

These streams are interdependent, and all involve significant collaboration between the PwC and the Department's teams. While a conceptual method was developed by PwC in preparation for submitting our proposal, an important element of our approach is that the method should be co-designed - to ensure it is "fit for purpose"; that it is tailored to the available data; that it leverages the knowledge of the Department and other stakeholder departments; to provide transparency; and to build understanding of the method and its capability from the start.

During the first six weeks of the project, this co-design process involved detailed discussion and "workshopping" of various elements of the method, along with significant data preparation and exploratory analysis to test whether the proposed method is feasible. The co-design continued throughout the project period with ongoing discussions between the PwC team, the Department and members of the project steering committee and through a process of review and feedback on many of the model components by Departmental staff.

This report formally sets out a description of the proposed method given what we have learned and agreed. Its purpose is to confirm understanding between the teams and stakeholders and to enable further discussion and refinement to take place.

Development of baseline method report

This report was prepared as an initial draft at the end of October 2015 based on the initial proposed approach and the discussions between PwC and the Department from when our contract commenced in mid-September 2015 up to that point in time. It was intended to be a 'working document' with changes being made as needed to amend or further clarify aspects of the method as the project evolved.

During the month of November 2015, we undertook a number of activities to assist in refining the methodology, including to:

- Seek and respond to feedback on the format, content and clarity of explanations contained in the October draft report
- Continue to analyse the data, develop assumptions and build the model, which are all iterative processes that may lead to refinement of aspects of the method
- Discuss, agree and document further technical aspects of the method and model with the Department's Investment Approach Taskforce

- Prepare exhibits and examples of the data analysis and model to assist further understanding of the method and model
- Meet individually with nominated stakeholders to discuss different aspects of the project to ensure we understand the data required and to develop appropriate assumptions when building the model
- Conduct a full day Design Forum with members of the Department's Internal Reference Group (IRG) and IDC, and other nominated stakeholders. The purpose of this was to further explore how the actuarial analysis will support the Australian Priority Investment Approach, and what policy questions need to be answered. This forum informed further refinement of the method and model to ensure it is 'fit for purpose'.

A further draft of this method report was prepared and provided at the end of November.

During December 2015 and January 2016 we progressed with the work to implement the methodology, including undertaking a significant amount of analysis to develop and support the model assumptions. We also prepared a valuation report documenting the valuation results.

This final version of the baseline method report has been updated to reflect any refinements to the method that were developed as part of the implementation work and to ensure that it is consistent with the valuation report. However readers of the report should note that we have not revisited the terminology used; the choices of tense of the wording throughout the body of the report; or paragraphs describing the planned activities to reflect that these elements have now been implemented rather than are work in progress or to be done in the near future.

1.2 Method design principles

The Australian Priority Investment Approach to Welfare ("the investment approach") involves the use of actuarial valuations to identify groups of people at greatest risk of long-term welfare dependency and those most able to be assisted towards independence. Using the actuarial analysis, the investment approach will develop evidence-based policy interventions tailored to improve the outcomes of those identified groups. Over time, the actuarial valuations will be used to evaluate the outcomes of policy interventions and refine the identified 'groups at risk'.

The principles we have applied in designing the valuation method are:

- The method and model must be technically robust and stand up to rigorous scrutiny
- The results must add valuable insights beyond current knowledge, and be capable of answering the most important policy questions
- The method must be transparent and produce clear and compelling results that can be understood, trusted and acted upon by policy makers
- Assumptions must be transparent and, where relevant, consistent with comparable assumptions used for other long term government projections
- The model should be person-, not payment-, centric, to understand and model the real factors driving welfare dependence
- The model must have reasonable run times, making it practical to develop and run scenario analyses
- The method and model must be flexible so that they can be easily adapted as the social security system evolves
- The model should be built in a modular way ensuring that it is practical to develop and update.

1.3 The Department's areas of policy responsibility

The initial focus of the model is to provide information on the areas for which the Department has policy responsibility. These include:

- Families and Children (although noting that responsibility for early childhood and child care will move to the Department of Education)
- Housing Support
- Seniors

- Communities and Vulnerable People
- Disability and Carers
- Women's Safety
- Mental Health
- Settlement and Multicultural Affairs
- Ageing and Aged Care
- Review of Australia's Welfare System

These responsibilities have been referenced in designing the model and as a guide to the model scope.

1.4 Vision for model development

The contract covers four iterations of the model – a baseline run at 30 June 2015 and three subsequent 30 June valuations. There will be a period of around 3 months to develop the baseline model.

Our vision is that the baseline model should be developed to address the main requirements of the Department and provide results which are comprehensive, robust and achievable in the required timeframes. We will then refine and expand the model to add functionality in each subsequent year. This would, perhaps, include the incorporation of further data, refinements to the analysis underlying the assumptions, introduction of more detailed risk factors or the addition of greater functionality. This provides additional risk based assumption differentiation which will deliver further group insights. Note the addition of these more detailed risk factors will have a greater impact on the split of the lifetime cost between different groups than on the total lifetime cost.

Our collaboration approach includes a planning session each year to identify the priorities for model improvement. This allows us to consider which elements are more pressing from a policy development perspective together with the opportunities afforded through accessing broader data and investing further effort in more detailed segmentation analyses.

1.5 Reliances

This report has been prepared by the PwC Actuarial team led by s 47F . This report has been prepared for the sole use of the Department. No third party may use or rely on our report for any purpose.

Unless required by law, no copy of or extract from this report is to be distributed to third parties without our prior written consent. We may, at our discretion, grant our consent subject to conditions. No third parties may distribute this report to anyone else under any circumstances.

1.6 Professional standards

The advice in this report is Prescribed Actuarial Advice as defined in the Code of Professional Conduct issued by the Actuaries Institute. The advice is intended to satisfy that Code.

2 Terminology

In this report, **data** refers to sets of information that are being used to inform the project – this includes a range of data sets developed by the Department relating to past and current welfare recipients, population data sourced from the Australian Bureau of Statistics (ABS), and longitudinal data sets such as Household, Income and Labour Dynamics in Australia (HILDA).

The **method** refers to the description or specification of the process for selecting modelling techniques, taking the data, analysing it, developing or incorporating assumptions about the future, and projecting forward to develop the results. It includes defining which people and payments will be included, how the data will be used, the type of modelling to be used, and other aspects of design.

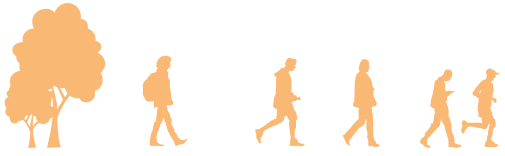
The **model** refers to the set of computer programs, spreadsheets, formulae, techniques and tools that are being built to apply the method. In a sense, the "model" is intended to represent, in a mathematical way, what happens to people as they move in, through and out of the social support system based on various assumptions. Data records that go into the model represent people, their past experiences and characteristics. Output records from the model represent the expected future experiences and characteristics of people, and their estimated cost to the social support system. Note that while simplistically the model can be thought of as one big "engine", it is actually a collection of modules and sub-components that fit together in applying the method.

Assumptions are the parameters that guide the model – these include "macro" assumptions such as economic and demographic assumptions; and "micro" assumptions such as probabilities of individuals moving into and through the welfare system based on various risk factors, and payment assumptions. It is important that assumptions are well supported, transparent, and consistent (where relevant) with comparable assumptions used for other purposes. Assumptions range from reasonably certain to highly uncertain. For example, a group of males aged 54, if they remain alive, are assumed to be males aged 55 one year later, which is a reasonably certain assumption. However, the model also needs to simulate the number of people remaining alive during the year by applying mortality assumptions, which are uncertain. Some assumptions, such as probabilities of receiving an income support payment in the next year for a person with particular characteristics and past experience, will be developed from statistical analysis of the data and our understanding of the dynamics of the system.

Actuarial valuation refers to the estimation of the lifetime cost to the Australian Government of future social security payments, which will be based on outputs from the model. Defining which people and payments will be included in the reported lifetime cost is important.

Valuation results are the summarised outputs from the model, which will be tailored to meet the needs of different users – for example, results may include average lifetime cost estimates for particular groups, projected payments for each of the next five years, projected numbers of "new entrants" to the social support system from different population segments, and so on.

Further explanation of the terminology used in this report is provided in the glossary in Appendix D.



3 Overview of model

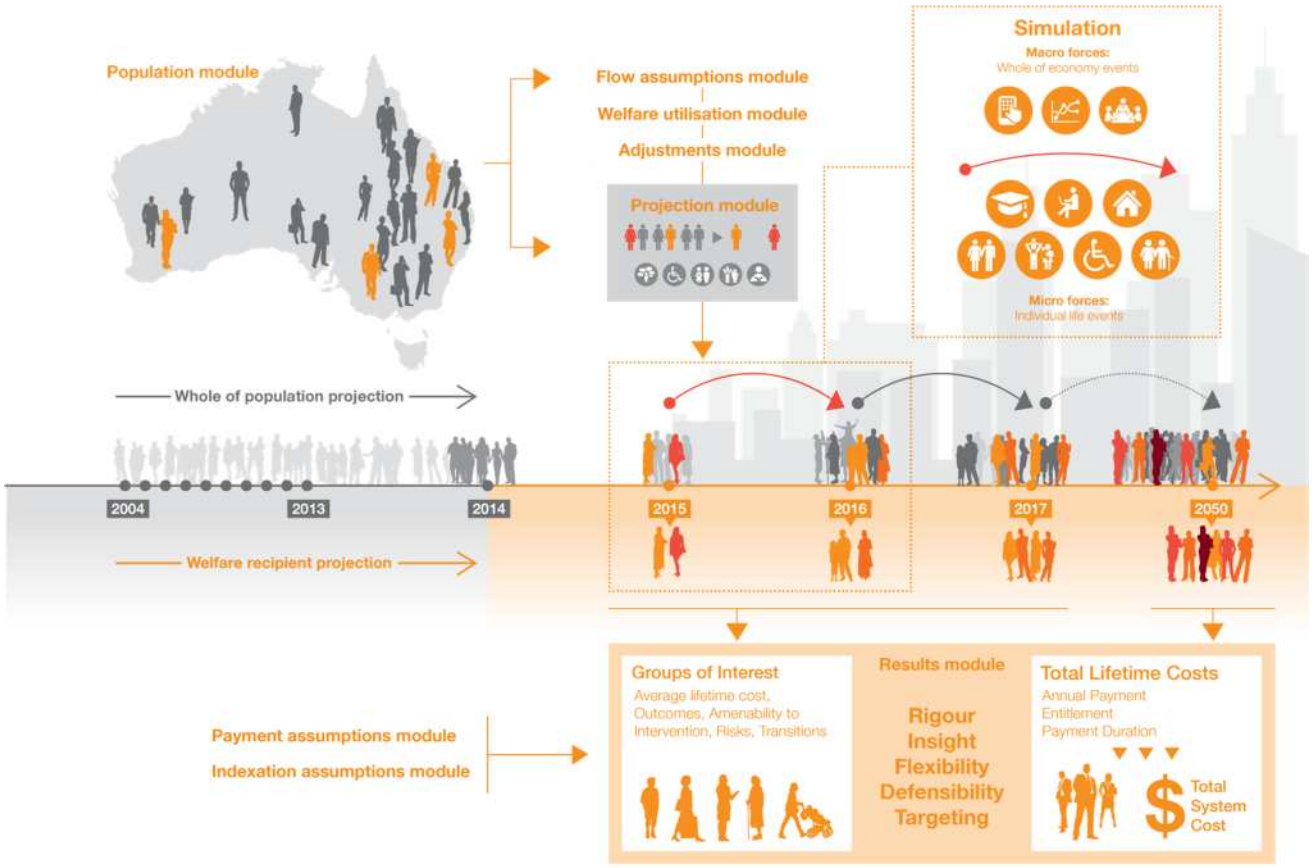
3.1 Concept of full population simulation model

Key elements of the method are:

- A dataset that reflects the full population of Australia. This includes current and previous welfare recipients as well as individuals who have not previously received welfare.
- The method is a simulation model which projects the path of each individual through their lifetime. This will involve applying assumptions to simulate the future trajectory of each person in the population, their welfare utilisation and payments in each future year. The projections include individual characteristics and outcomes such as basic demographics, education, partnering and children. The method will produce an individual average lifetime cost for each person, which will be summed to develop the headline lifetime costs and group level results.
- Individual characteristics, together with previous welfare history, form powerful predictors of the likelihood of individuals receiving welfare in future. The simulated population will be combined with assessment of these likelihoods to project the future number of welfare recipients. Payment amounts for these welfare recipients will also be projected.
- The assumptions underlying the projections will be built by combining a deep statistical analysis of historic data, knowledge of the system, modelling of the impacts of a changing economy and expert views on how welfare is expected to differ in the future. This will result in a robust forward looking view of the lifetime costs.
- The model outputs include projected welfare recipient numbers, payments and lifetime costs and projected lifecycle events. Detailed group results will provide deep insights and a strong evidence base for policy decisions. As the method is developed and more data is integrated, the richness of outputs will increase.
- The method will provide information on the people who are most mobile and those who are most at risk of future welfare reliance. This information will assist in targeting policy initiatives and understanding their likely impact. The use of economic techniques including emerging fields such as behavioural economics may assist in designing such initiatives.

Figure 1 overleaf represents the components of the method and how the modules that comprise the method interact with each other. This is a flexible method design that can evolve to include more source information, more detailed characteristics and additional payment types. For example the addition of Australian Taxation Office (ATO) or Medicare data would provide further predictive data on the need for welfare; and the addition of education, child protection or justice data could be used to provide broader and deeper insights on individual outcomes.

Figure 1: Overview of Method



3.2 Overview of modules

The method will be developed and implemented in a modular way. Our experience is that this makes it transparent and easier to understand. This approach also allows modules to be developed in parallel with each other. Parallel development will be vital for ensuring the success of this project given the timescales in which the model must be developed.

The table below provides a description of each of the modules.

Table 1: Overview of modules

	Module	Description
Model population	Population module	The population module will be used to generate an individual welfare recipient dataset with records for all existing welfare recipients as well as all potential future welfare recipients i.e. representative of the full population of Australia. This will be developed by reference to the Department's administrative data and data drawn from the 2011 Census. It will include actual data for current and recent welfare recipients and representative data for the rest of the population. A key aspect of this population model is that it will include certain household or family information since this is critical to welfare utilisation.
Projections	Projection module	The projection module is at the heart of the modelling and is used to project forward the individual characteristics and welfare features of each of person in the population. The model population and all of the model assumptions will feed into this central module.
Model assumptions	Flow assumptions module	This module is used to develop the key assumptions for projecting individuals' demographic characteristics. The way in which individual characteristics develop through the projection is a key input into the overall model. Some characteristics do not change over time (static) or change in a predictable way (semi-static) and can be modelled relatively easily. For the other (dynamic) characteristics we will simulate the evolution by considering the probabilities of the person changing characteristics.

	Module	Description
	Welfare utilisation module	This module is used to develop the assumed probability of each individual in the population receiving welfare in each future year. The probability will be estimated for existing welfare recipients and the wider population. The utilisation will be modelled separately for each payment category. The modelling will first consider how people move into, through and out of the system. It will then analyse which demographic and risk characteristics are important for the welfare utilisation of each payment category.
	Payment assumptions module	This module is used to develop assumptions on the projected size of welfare payments for a recipient each year. As with the welfare utilisation module, the payments will be considered for each of the modelled payment categories. Further supplementary analysis can also be carried out if more detailed payment splits are needed.
	Adjustments module	This module looks at adjustments which need to be made to the assumptions and resulting simulations. Economic and forward looking adjustments need to be made to flow and welfare utilisation assumptions; while benchmarking adjustments may need to be made to reconcile aggregate projections of population characteristics with external benchmark sources, such as reports released by Treasury and the ABS. The number of welfare recipients will be linked to broader factors such as the macro-economic environment, employment opportunities in the welfare recipients' region and the incentives implicit in the design of different benefits. All of these factors are dynamic and evolve over time. A key part of this module will be to understand how much, economic factors must move by in order to impact welfare utilisation and this will be included in the model in future years. The emerging field of behavioural economics may play an important role here and is part of our approach. This is used to help welfare recipients understand and address irrational behavioural tendencies, in order to move towards more optimal behavioural outcomes. We would also consider here, forward looking adjustments for any policy changes which will not have been reflected in historic data, for instance if there has been a reform. The model will be necessarily complicated and the resulting projections may drift from external benchmarks in the later projection years; as such, it will be necessary to adjust projection results of key demographic characteristics such as population growth to external government projections. The benchmarking adjustments will be important for building confidence in the overall results and ensuring that the total population projection demographics align with the 'official' projections.
	Indexation assumptions module	This module is used to develop the indexation assumptions used in the projections. These assumptions reflect how payments are expected to increase in each future year and will reflect the relevant inflation index together with information on any planned changes to the payment structure or criteria. The indexation assumptions will vary by payment. Projected payments will be indexed within this module to allow for future increases in payment amounts; and discounted or deflated to allow for the time-value of money.
Summaries	Results module	The results module will be used to summarise the outputs from the analysis and develop information for use by the Department, and included in the valuation reports. Ultimately the module will have the functionality to show overall results or those for any defined group or combination of risk characteristics.

Individual modules will provide results and insights in their own right and these will be shared with the Department. Early results will include the detailed make-up of current welfare recipients and information on which individual characteristics are most predictive of welfare usage.

The results will include the following categories:

- Lifetime cost results – e.g. overall lifetime cost results; lifetime cost forecasts; lifetime cost movements; projected welfare recipient numbers; and expenditure for future years.
- Group information and results – e.g. average lifetime cost information; demographic information; information on welfare utilisation and trajectories; and information on other outcomes.
- Sensitivity to examine the impact of changes in model assumptions; and scenario testing to consider how the results might be impacted through changes to the model inputs and system assumptions.

4 Model scope

4.1 Scope of baseline valuation

At a high level the baseline actuarial valuation is intended to cover the payments for which the Department has policy responsibility and people representing the full population of Australia.

The exact scope can be specified in terms of:

- The detailed specification for the in-scope payments
- The detailed specification for the people included within the model population
- The definition of lifetime cost.

Further details on each of these components follow.

In-scope payments

The in-scope payments include:

- Income support payments to both working age people and age pensioners. This includes payments to people studying (ABSTUDY, Austudy, Youth Allowance (students)); payments to people parenting; payments to people with caring responsibilities (Carer Payment, Carer Allowance), payments to people with disabilities; the Age Pension and a number of different payments available for working age people (including Newstart and Youth Allowance (other)).
- Family payments, including Family Tax Benefit, Child Care payments and Paid Parental Leave.
- Supplementary payments and allowances that are paid either in conjunction with the payments above or to other payment recipients.

A number of payments that are administered by the Department are out of scope, as are some others which are often discussed as being part of the social welfare system. These include veterans' payments where these are the policy responsibility of the Department of Veterans' Affairs (e.g. veterans' pensions), payments which are the policy responsibility of the Department of Agriculture (e.g. farmers' hardship payments), status resolution support services payments which are the policy responsibility of the Department of Immigration and concession card benefits (such as health and transport cards).

The precise details of in-scope payments have been determined by PwC and the Department working together and reviewing the available payment data to determine the appropriate treatment of each.

The payment information is highly detailed with the nature and purpose of individual payments being identified by a combination of the appropriation and payment type codes used within the administrative data. There are well over 1,000 combinations of these codes. A mapping was developed to identify the relevant in-scope payments and assign them to a manageable number of payment types for consideration in modelling. The mapping has been reviewed by the Department before use.

The original payment information provided has been reconciled to accounting information to validate the completeness of the underlying data. Summaries of the mapped payments have also been reviewed by departmental staff.

The reconciliation process is complicated by timing differences in our data extract (which has been developed on an accruals basis) versus the financial statement data and by some unknown details about how the underlying payments have been mapped for financial reporting purposes. At an overall level the payments reconcile to within 0.5 per cent for all but the most recent year, which tends to be most impacted by timing differences. Most major payment types also reconcile within the range 0.5-2 per cent for all but the most recent financial year, where the differences are slightly larger. The information for Family Tax Benefit and childcare payments is incomplete for the latest year but reconciles well for earlier years. The information for some of the smaller supplements reconciles less well, however given the aggregate reconciliation is satisfactory, we consider the data to be reasonable overall.

Undertaking the reconciliation process has led to productive discussions around the payment scope and delivered a strong understanding of available information for different payment types which has informed the decisions on model segmentation (see Section 6) and the modelling.

The agreed list of in-scope payments is shown in Appendix B.

Scope of population

The model population needs to include one record for each person for whom we are assessing the lifetime costs.

A range of people may receive social security payments over future years. This includes people who can be identified today: current Australian citizens (irrespective of where they reside); Australian permanent residents (including those living overseas provided they satisfy eligibility criteria); recent migrants; and some temporary residents (for a limited range of benefits). It also includes people who may arrive in Australia and become eligible in the future, such as future migrants and unborn children.

As all of these people may receive payments in future, they can contribute to the lifetime cost. However, it is challenging to include all of these groups within the model population. Based on discussions with the Department, we have agreed that the model population for the baseline valuation will consist of:

- Records for every person who has received any in-scope payment during the latest financial year (this includes some people currently resident overseas).
- Records to represent every other Australian resident.

This includes the vast majority of people who will receive payments (but omits some groups such as future migrants whose characteristics are currently unknown).

In the valuations that follow the baseline valuation we will identify new members of the population and identify the extent to which any change in lifetime cost is as a result of population changes.

Definition of lifetime cost

One of the key outputs of the actuarial valuation will be the 'headline' lifetime cost. It is important to ensure this is defined appropriately. The definition used should be clear, robust and the most useful of the different definitions that are possible given the payment and population scopes discussed above.

The model is highly flexible in this regard. It will generate lifetime costs for each person or group of people for which the model is run and these can be segmented by future time period. It has the flexibility to sum these as needed to align with the agreed definition.

There are a number of ways that the lifetime cost could be defined:

- One relatively straightforward definition is the total projected future lifetime welfare payments for all individuals in the model population (i.e. Australian residents and current overseas welfare recipients).
- Another definition would be the total projected future lifetime welfare payments for only those who are current welfare recipients. Note that under this definition the lifetime costs and other information for the rest of the population would still be assessed but would not be reported as part of the headline lifetime cost.
- Other definitions would include reporting the lifetime costs attaching to different combinations of current welfare recipients, those active in recent years and those expected to enter the payment system in future years.

The proposed definitions include payments for people's full future lifetimes. It would also be possible to limit the number of future years for which payments are considered in the definition. We are not recommending this for the headline results, but note that breakdowns by future time periods will be useful supplementary information.

The definitions of lifetime cost adopted have been discussed and agreed with the Department and members of the Investment Approach Inter-Departmental Committee (IDC). These definitions are set out in the valuation report.

The model outputs encompass information about recent recipients and will provide a useful reference for information such as annual reporting and considering the impact of interventions which are designed to reduce welfare dependency of current welfare recipients. The outputs will also include projections of total expenditures

over future years, for example looking at total payments over a budgetary period (other than those associated with people outside the scope of the model population).

Policy basis of lifetime cost assessment

The lifetime costs will be modelled on the basis that the currently legislated policies continue in perpetuity or as otherwise directed by the Department.

For instance, for the baseline valuation this means:

- The lifetime costs would include consideration of future changes in the qualifying age for Age Pension from age 65 to age 67, but would not include any further changes to qualifying age that are under discussion (e.g. further increases to age 70).
- The lifetime costs would include consideration of the changes to the pensions asset test and treatment of defined benefit superannuation income streams (as these passed into law on 30 June 2015 although they do not take effect until 1 January 2017)
- The lifetime costs would include all other payments as detailed in the legislation and summarised in "A guide to Australian Government payments" that is in force at 30 June 2015. This includes:
  - Payment design and eligibility criteria as at 30 June 2015.
  - Future indexation as indicated in legislation and advised by the Department.
  - A small number of payment types closing in future years (Schoolkids Bonus, Income Support Bonus).
- Any measures proposed in recent federal Budgets would not be included unless the relevant legislation has been passed (i.e. the legislative processes are complete and the legislation received royal assent prior to or on the valuation date)
- Similarly, any measures being discussed for the 2015-16 Budget would not be reflected in the valuation.

As discussed and agreed with the Department, the lifetime costs will exclude consideration of the expenses of administering payments. This approach aligns with the Department's needs but has been noted as it is a departure from the actuarial approach used for most insurance valuations.

This policy basis would be used for the main reported lifetime cost. It will be possible to use the model to consider other policy settings through scenario analysis.

4.2 Planned future refinements

The model is highly flexible and there is the potential to refine and extend it in future years. In general, extensions could include:

- Extending the scope of payments covered by the model, such as to include information on payments administered by other departments or state governments.
- Extending the risk characteristic information included within the model. This might involve including more variables or linking data from different sources to provide more informative variables.

  Including more detailed payment and risk characteristic information will provide a more comprehensive picture of overall government supports and will provide richer information which can help identify people who may respond positively to different policy initiatives.
- Refining the model to broaden the population to include more information on non-residents who may become Australian social security recipients in future years.

The refinements made for each valuation would be agreed with the Department and would be expected to reflect its priorities at the time. The following sections provide more information on the scope of the baseline valuation and the possible refinements in subsequent valuations.

The baseline valuation

The baseline actuarial valuation and reporting is being undertaken over the period 14 September 2015 (when PwC was appointed) to 31 January 2016. This is a relatively short period of time for delivering the inaugural valuation and as such the focus will be on delivering a model that meets the Department's key needs and has the flexibility to be refined to provide greater insights over future iterations.

The model specification will comprise the following level of detail:

- *Population module*: scope as discussed above. This will capture a number of static and dynamic variables for each person. The static variables will include gender and indigenous status.
- *Flow assumptions module*: modelling of dynamic variables which provide key demographic information: age, partner status, numbers of children, age of each child and highest level of education attained.
- *Welfare utilisation module:* assumptions will based on age, gender, and selected risk characteristics drawn from the static variables, dynamic variables (detailed above) and welfare history variables.
- *Assumptions for payment utilisation and annual payments*: set at a grouped payment type level (with categories for each main income support payment and with supplements and allowances grouped by purpose) and considering selected risk factors.

For all the assumptions, the extent to which different risk characteristics impact the assumption can be considered and included at different levels of granularity. For instance, we could model the likelihood of continuing on one particular payment type (say Parenting Payment) based just on a person's age; or on their age and gender; or age, gender, family situation, past payment experience and so forth. Including more factors increases the complexity of the modelling and the time needed to fit the assumptions but allows us to better differentiate between people in the population.

For the baseline valuation we will balance the time and complexity required to introduce more detailed risk factors, with the need for robust, timely results. This will result in selection of the few most predictive risk factors for each payment type, and a greater focus on modelling the working age population.

For the baseline valuation we have also excluded development of the economic adjustments module, owing to time constraints and the interdependencies with other modules which mean that parallel development would not be practical. We discuss this further in the valuation report.

The June 2016 valuation

The June 2016 valuation will provide an opportunity to undertake more detailed modelling where this has been constrained during the baseline model build. Proposed refinements for the Department to consider for the 2016 valuation include:

- Addition of the economic adjustments module.
- Addition of more detailed data into the full population dataset to facilitate more detailed examination of groups not currently accessing welfare.
- Targeted refinement of model to include assumptions which reflect more detailed risk characteristics.
- Addition of more detailed data into the existing social security recipient dataset agreed for the baseline valuation. This may include, for example, more information on individual family situation such as partner age, details of any people to whom care is being provided, person or partner health and disability information.
- Refinement of modelling of age pensioners to include consideration of more information about pensioner income and assets. This would be subject to the availability of the required data.

Subsequent valuations (June 2017 and 2018)

The Australian Bureau of Statistics will undertake the next Census on 9 August 2016. Provided that this data becomes available to us in sufficient time, a significant refinement for either 2017 or 2018 will be to update the population module and other model components which have been informed by Census data for this new information.

There is significant potential for other enhancements to the model in these subsequent valuations. Examples include:

- Migration modelling to explicitly model movements of individuals domestically and internationally. This would allow us to model the reduced utilisation of working age benefits from people moving overseas and the numbers of future arrivals to Australia and the extent of their welfare use.

- Links to broader sources of data.
  - For example, health data includes measures of co-morbidities (e.g. obesity), social isolation and mental health, all of which are risk factors for welfare payments.
  - Linking to state-based data. A significant proportion of social services are provided by state governments. These include social housing, justice, education, health, child protection and community services. The ability to link state based data will provide a more comprehensive view on the government support provided to individuals; provide greater and earlier ability to identify at risk individuals; and provide insights into possible interventions which may occur at a state or territory level, rather than just by the Australian Government.
- Ongoing development of increasingly sophisticated model assumptions.
  - e.g. mortality assumptions that reflect the health profile of different groups; and fertility assumptions reflecting demographic characteristics
- Including a detailed family or household micro-simulation model in addition to the core individual micro-simulation model. This will assist as eligibility and quantum of many welfare benefits in Australia are directly related to family composition. Increased model sophistication will improve the insights in the role of family in welfare consumption, provide the potential to extend the scope from welfare payments to looking at both taxes and transfers, and provide further insight into intergenerational welfare dependency.
- Working with the ABS to make significant improvements to the population module to include more detailed information, potentially as part of the 2016 Census update.
- Consideration of a greater range of geographic information as model inputs which could include information on the economic performance in different regions and measures of cost of living differentials.
- More detailed modelling of income, assets and wealth accumulation across the population, especially if longitudinal data becomes available (e.g. from the ATO). This will be useful as most welfare payments are subject to income and asset tests and so it may enable more direct modelling of the eligibility and entitlements of groups. In particular, financial information would be highly useful for modelling different policy choices for the Age Pension group since the household wealth of future pensioners will be substantially different to that of older generations.
- Extending the model to include consideration of how payment levels influence the movement of people on and off benefits and hence longer term payment utilisation.

5 Population module

The population module develops the population dataset which includes records for each person in the model population.

The scope of this population was discussed in Section 3.1 and covers current social security recipients, recent exits and other people who are current Australian residents.

Ideally a full dataset would be available which includes the required information for the chosen population, however to our knowledge no such dataset exists. Instead we propose to build a 'synthetic dataset' which will be representative of this population. The remainder of this section describes the methodology for creating this.

5.1 Summary of design of population dataset

The synthetic population dataset is created by mapping social security recipient administrative data onto a full population dataset. Thus the combined dataset will include actual data for current and recent welfare recipients and representative data for the rest of the population.

The population dataset underlying this method is based on the 2011 Census. We have used a Confidentialised Unit Record File (CURF) which contains a 1 per cent sample of dwellings and associated individuals from the 2011 Census. We make the following adjustments to this dataset:

- Expansion of dataset – the dataset is multiplied out so that there is a simulated record for every individual, rather than for 1 per cent of individuals.
- Estimated Resident Population (ERP) adjustment – the population is adjusted to be reflective of the ERP, rather than the population recorded in the Census. The Census covers everyone who was in Australia on Tuesday 9 August 2011 whereas the ERP allows for all residents. The ERP for Australia is calculated by the ABS by making the following adjustments to the Census population:
  - Adjustments to allow for the fact that not everyone is appropriately captured in the Census (this is known as the net undercount)
  - Removal of overseas visitors who were in Australia on Census night (and so included in the Census)
  - Addition of Australian residents who were out of the Country on Census night (and so were not included in the Census).

  We make use of the ABS ERP results in order to apply this adjustment to the Census dataset.
- Timing adjustments – further adjustments are made so that the final population is more reflective of the Australian population as at 30 June 2015. This allows for the overall shift in the profile of the population by age, gender and location from 2011 to 2015.
- Data enhancements – the Census file contains limited information on certain variables. In particular, the geographic information is at a broad level and there is no Indigenous status. We have used a statistical imputation process in order to substitute in more details on these variables into the population dataset. This process makes use of other ABS statistics covering these variables.

The resulting representative population dataset is compared with the in-scope social security administrative dataset by the common data fields e.g. age, gender, geography, relationship status, cultural background, work/education status. The aim of this broad comparison is to split the population dataset into the following two components:

- In-scope social security recipient component – a set of records which are representative of the population of the group of current and recent welfare recipients.
- Rest of population component – a set of records which are representative of the group of people who have not recently received welfare.

The administrative dataset is then combined with the 'Rest of population component' of the population dataset above, in order to create the final synthetic dataset for use in the analysis.

For the Rest of population component, it may be useful to 'impute' further detailed risk characteristics onto the data using other supplementary information. For example information on family characteristics could be added if this is found to be predictive of welfare utilisation. This will be explored as required during the model build.

Table 2 below illustrates the final synthetic dataset and the components which are created from DSS administrative data and Census / other ABS data.

Table 2: Composition of final population dataset

	Population characteristics	Further risk characteristics	Welfare history
Current and recent welfare recipients	For example: • Age • Gender • Geography • Relationship status • Cultural background • Work status • Education status	For example: • Family of recipient	For example: • Class • Payment utilisation • Payment amounts
Rest of Australian population		For example • Family of recipient	None

Common information in DSS data and Census

DSS administrative data

Census and other ABS data

Supplementary population datasets

Equivalent population datasets will be needed for past years to support the analysis of past experience required to develop some of the model assumptions; for instance in analysing the proportions of people first entering the payment system in previous years.

These will be developed using the approach outlined above, based on timing adjustments applicable for the relevant year.

6 Model segmentation and groupings

6.1 Model segmentation

The method uses two key groupings within the model design:

- Class variable: this is a grouping of the people within the model population into unique segments.
- Payment category: a grouping of payment types for modelling purposes.

These are discussed in turn below.

6.2 Class variable: segmentation of population for modelling purposes

From our previous experience and research we know that past and current receipt of welfare is a very strong predictor of future receipt of welfare. For example, some groups of payment recipients have few exits and it is highly likely a current payment recipient would also receive the payment next year.

Therefore, we have created broad welfare class groupings which reflect each person's life situation and use of welfare for consideration in the modelling. There are 12 classes to which a person can belong and people are assigned to a unique class each year. These are summarised in Table 3 below.

Table 3: Welfare classes

Active – income support (IS)	Active – non income support (Non-IS)	Inactive classes
1 Studying	7 Non IS Family	10 Previous welfare recipient
2 Working Age	8 Non IS Carer	11 Dead
3 Parenting	9 Non IS Other	12 Rest of Aust. Population
4 Carers		
5 Disability support		
6 Pension Age		

These classes have been defined by reference to the welfare types received over the latest year; however the types have been grouped so that the classes are more a reflection of an individual's life situation than that of the detailed payment type structure per se.

People will be assigned to classes in a hierarchical way so that any person with entitlements to any income support payment will be assigned to one of the active income support classes. People with entitlements to more than one type of income support payment during a year will be assigned to the most recent and relevant class. For example, a 65 year old person who received the Disability Support Pension for the first 7 months of the year and the Age Pension for the last 5 months will be assigned to class '6 Pension Age'.

People not entitled to receive any income support payments will be assigned to non-income support classes '7 Non IS Family', '8 Non IS Carer' and '9 Non IS Other'. These are also defined hierarchically in the following order of precedence: carer, family, other. The remainder of the population will be assigned to one of the inactive classes. This hierarchy will ensure that each person is assigned to a unique class for each year.

For FTB and family payments, because payments can be received as part of an income tax assessment post 30 June relating to a previous year, some people who are eligible for 2014-15 payments would not yet have relevant data recorded as at 30 June 2015. For modelling purposes, it is important that the classes assigned for a given year are not expected to change significantly as future data becomes available. Therefore in order to provide this stability, people are assigned to class '7 Non IS Family' based on whether they are eligible for family payments in the previous year rather than the current year.

Consequently, new welfare entrants eligible for family payments for the first year will be assigned to class '9 Non IS Other', moving to class '7 Non IS Family' in the second year. People who are no longer eligible for family payments will remain in class '7 Non IS Family' for a year before they move to class '10 Previous Welfare Recipient'.

Further details on how the class variable is set for people receiving different payment types can be found in the table in Appendix A.

Since the class definition is defined for each person at each 30 June to reflect their experience over the previous year, people may change class from one year to the next as their payment experience changes. For example, a person who received working age payments during one year but no payments the following year would be in class 2 at the end of the first year and then move to class 10 at the following 30 June. People who receive some payments but then pass away during the year will be in the relevant active class at the end of that year and then move to class 11 the following year.

6.3 Payment categorisation: grouping of in-scope payments for modelling purposes

The in-scope payments were detailed in Section 4.1. At a high level, in-scope payments are intended to cover those for which social security agencies have a policy responsibility at the valuation date. Payments which are out of scope include those that the Department does not have policy responsibility for, but administers. Examples include veterans' payments and farmers' hardship payments. Administrative costs of managing payments are also out of scope.

The Department makes a broad range of payments, including income support payments, family payments, and supplementary payments and allowances. Each type of payment serves a different purpose and provides support to a different segment of the population. The factors that influence the need for and likelihood of utilising each can be different and it would theoretically be possible to model each payment type separately. However we consider that this would be unwieldy and the benefit of undertaking modelling at that level of detail is outweighed by the additional cost, time and complexity.

As a result we have grouped the payment types into a number of payment categories aligned to their general purpose, with the modelling performed at this level. This grouping by purpose should mean that there are similarities in the risk characteristics for people accessing each category. Table 4 below shows the 17 payment categories used for modelling, and the main payment types within each category.

Table 4: Payment categories

Payment Category	Key payment types	2014/15 entitlement ($b)
A - IS Studying	Youth Allowance (student), Austudy, Abstudy	2.4
B - IS Working Age	Newstart, Youth Allowance (other)	9.9
C - IS Parents	Parenting Payment	5.3
D - IS Carer	Carer Payment	4.0
E - IS Disability	Disability Support Pension	14.3
F - IS Age	Age Pension, Wife Pension, Widow B Pension	36.7
G - IS Dependant	Widow Allowance, Partner Allowance	0.4
H - Other FTB	Family Tax Benefit	14.4
I - Other Family	Child Care Benefit, Child Care Rebate, Schoolkids Bonus	3.7
J - Other New Parents	Parental Leave Pay, Dad and Partner Pay, Newborn Upfront Payment	2.0
K - Other Living	Rent Assistance, Energy Supplement	6.0
L - Other Health & Disability	Mobility Allowance, Youth Disability Supplement	0.3
M - Other Carer	Carer Allowance, Carer Supplement	2.8
N - Other Study & Skills	Student Start-up Scholarship, Pensioner Education Supplement	0.7
O - Other Remote & Regional	Assistance for Isolated Children, Remote Area Allowance	0.1
P - Other General Allowances	Pension Supplement, Income Support Bonus	5.6
Q - All Other	Bereavement Allowance, Crisis Payment	0.1
		108.8

The payment categories will be used to model the current social security system, but they are also flexible and can be updated to reflect any future changes in system design.

This categorisation is used in modelling both the utilisation of each payment category and actual payments. Note that whilst people are in a single class for each year they may receive payments from a number of different payment categories during that year.

Further details of which individual payment types are included and how all the individual payment types are grouped into categories have been provided in Appendix B.

7 Assumptions modules

7.1 Outline of assumptions

This section sets out details of the nature of the main assumption sets and explains how each is used in the model. These comprise: the flow assumptions, welfare utilisation assumptions, payment assumptions, economic and forward looking adjustments and economic assumptions. The purpose of each of these sets of assumptions is as follows:

- **Flow assumptions** are used to ascertain how each person's individual demographic and risk characteristics change as time progresses.
- **Welfare utilisation assumptions** are used to develop the assumed probability of each individual in the population receiving each category of payment in each future year. They are developed by considering:
  - **welfare class movements** (how people move into, between and out of welfare classes).
  - **payment utilisation** of people within each welfare class for each payment category.
- **Payment assumptions** are used to assess the actual amount of payments made within each payment category once we have determined that an individual is accessing that payment.
- **Economic and forward looking adjustments** are used to support the welfare utilisation assumptions and ensure the model reflects the current economic climate and can be used to understand the potential impact of changes to the external economic environment. Other forward looking adjustments will allow for changes which will not have been reflected in historic data, for instance if there has been a reform.

  Note the economic adjustments have not been developed for inclusion in the baseline valuation; however these are planned for inclusion in the model as it is developed further.
- **Economic assumptions** are used here for:
  - Indexation – consideration of how the average payments within each payment category will change in future years.
  - Discounting – developing lifetime costs as the net present value of the future payments.

We have set out further discussion on the above in the sections below.

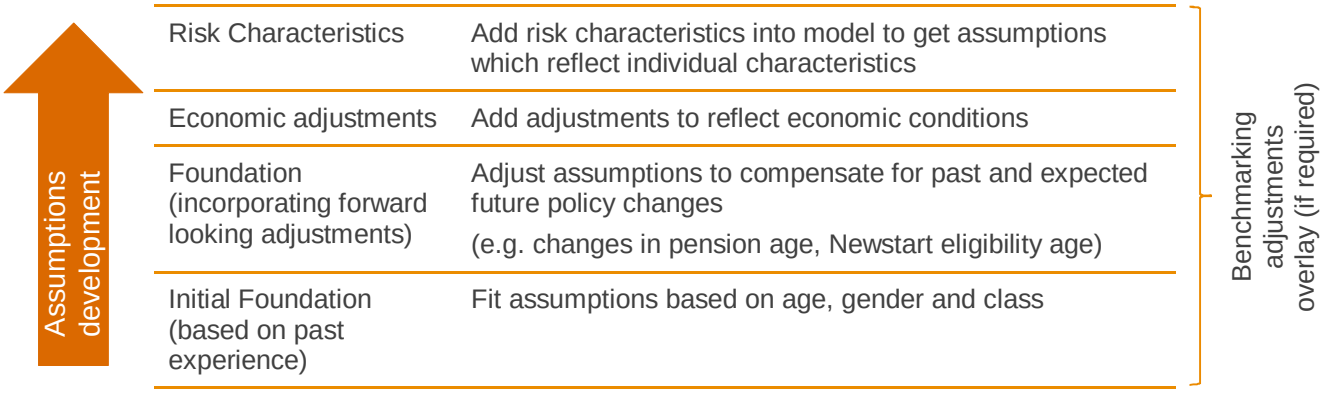
7.2 General assumption development approach

Building and refining model assumptions

The model assumptions drive the overall results and their development is a major part of the model build. We consider it important to build these in a way that is robust, transparent and forward looking. The assumptions structure should also support the development of alternative scenarios that can be used to consider the potential impact of different policy options.

The model is complex and there are a large number of assumptions. We plan to develop these assumptions in a staged way with increased complexity being introduced one step at a time. We will first build a relatively simple version of the model with the overall structure and shape of the main assumptions and then refine it through more detailed modelling as shown in Figure 2 below.

Figure 2: Representation of assumption development approach



This approach will ensure that we focus most on the more important assumptions.

This would apply to all the social security related assumptions, i.e. the welfare class, welfare utilisation and payment assumptions. For the demographic flow assumptions we will progress directly to the risk characteristic stage as the characteristics are essential inputs to determining future changes.

The *initial foundation* assumptions will not capture enough detail to produce results that reflect detailed individual characteristics but will allow us to consider the historic experience and will be simple enough to represent visually which will allow us to discuss the experience and the need for *forward looking adjustments*.

Basing a model purely on statistical analysis of past data will only tell you about what to expect if experience is repeated. Our assumptions will be reviewed and, where necessary, adjusted to better represent the expected future experience. This would include adjustments for any policy changes which have been legislated over the period up to and including the valuation date but have not been fully reflected in the past experience.

We are proposing to make the *economic adjustments* next as these are likely to operate in a systemic way and can be developed through analysing how the foundation assumptions have varied in the past. As noted above these adjustments have not been included in the baseline valuation; the rationale for this is discussed in the valuation report.

The final *risk characteristic* stage will determine the extent to which an individual's risk characteristics mean their experience is expected to differ from that of other people with the same age, gender and class. These will be developed using statistical modelling techniques.

Summary of the data used for assumption development

The main data sources used to develop the model assumptions are shown in Table 5 below.

Table 5: Social security data used for assumption development

Assumption Set	Specific individual assumptions	Information sources
1. Demographic assumptions	Mortality Having children (fertility, taking on care of children) Education status Partner status Residency	DSS data Population statistics Research on population experience HILDA Survey
2. Welfare class movement assumptions	New entrants to the payment system Movements between welfare classes Exits from the payment system	DSS data Supplemented by information on benefit design Modelled mortality
3. Payment category utilisation assumptions	For each payment category and people in each class.	DSS data Supplemented by information on benefit design
4. Payment assumptions for each payment category	For people receiving payments in each payment category.	DSS data Supplemented by information on benefit design
5. Economic and forward looking adjustment assumptions	Assumptions are planned to be used to adjust the underlying assumptions (items 1-4 above) to ensure they are forward looking and reflect current and expected future economic conditions.	Economic forecasts Past economic data and DSS data Research on past experience and any other relevant experience Information on policy changes and expected impacts

Assumption Set	Specific individual assumptions	Information sources
6. Economic assumptions	Indexation Discounting	External economic data Referencing information on benefit design

Forward looking adjustments and benchmarking adjustments are discussed further in Section 8.3.

7.3 Flow assumptions module

The flow assumptions consider changes to a range of demographic and risk characteristics. Some characteristics do not change over time (static) or change in a predictable way (known development) and can be modelled relatively easily in a rules based manner. For the other (semi-static and dynamic) characteristics we will assess the probabilities of the person changing characteristics over the year given their known or previous characteristics and apply this within the simulation. Where there is a strong dependency between two flow assumptions, we would model them in an order and make one conditional on the other to capture this relationship.

In our baseline valuation model we consider the characteristics in the order shown in Table 6 below:

Table 6: Risk characteristics

Risk characteristic	Nature of evolution	Basis of Assumptions
Ageing	Known development	n/a
Mortality	Dynamic	Population data
Partnering	Dynamic	Population data, risk overlay
Child births	Dynamic	Population data, risk overlay
Age of youngest child	Known development	Reflects known children and modelled births
Education attainment	Dynamic	Population data, risk overlay

Over time and subject to the availability of relevant data, further functionality could include more information on residency/visa types, family composition, ethnicity, health status, actual work undertaken and so forth.

The mortality assumptions will be set by firstly considering overall population experience for individuals by age and gender using AGA life tables. We will then consider the actual experience of different groups and adjust the assumptions to reflect this. For instance we know that people with certain disabilities have shorter life expectancy, as do Indigenous Australians.

For modelling the other dynamic characteristics, we will use a combination of the overall population data and the past experience of welfare recipients. A key source of overall population data is the Household, Income and Labour Dynamics in Australia (HILDA) Survey. This is a longitudinal household-based study in which detailed socioeconomic information is collected through annual interviews with all members of each household over 15 years of age. The study includes questions on basic demographics, geography, education, family and partnering, employment, wealth and expenditure.

7.4 Welfare utilisation module

This module is used to develop the assumed probability of each individual in the population receiving each category of payment in each future year. This will be modelled in two steps: first by categorising individuals in accordance with their main welfare type (referred to as **welfare class**) and assessing how this evolves over time, and then by assessing the **utilisation** of each category of payment given the individual's class and other characteristics.

Modelling of welfare class movements

From our previous experience and research we know that past and current receipt of welfare is a very strong predictor of future receipt of welfare. For example, some groups of payment recipients have few exits and it is highly likely a current payment recipient would also receive the payment next year. There also is considerable discussion on trends in the long term unemployment rate and evidence that duration out of the workforce is itself a risk factor.

From a modelling perspective, information on a person's welfare history is too valuable to discard. As a result we are developing a broad welfare class variable for use in the modelling; the definition and construction of this was discussed in Section 6.2.

The movements in this class variable reflect entries into the payment system, exits from it and movements between the different classes. They will be modelled through simulations which reference assumptions of the probabilities of people changing class in any year.

These probability assumptions will be set through examination of the past patterns of movements between classes. They will also consider the extent to which the history requires adjustment to provide a better reflection of future expected changes. This will primarily be required where there have been changes to the design of or eligibility criteria for payments, for example recent changes to the Age Pension eligibility age.

A foundation level set of assumptions will be selected to give the probability of moving between classes for people of each starting class, age and gender. These assumptions will be refined using statistical models to take into account a person's risk characteristics, such as children details.

Approach for developing payment utilisation assumptions

This module is used to develop the assumed probability of each individual in the population receiving welfare in each future year. The probability is estimated for current welfare recipients and the wider population.

Utilisation is modelled separately for the 17 different payment categories discussed in Section 6.3. By definition, people in a particular welfare class in a year will access some payments of the relevant payment types in that same year. They may also access one or more other income support payments during the year, and a number of other payments. Our model allows for welfare recipients to utilise payments from multiple payment categories.

We model utilisation of each payment type category in a conditional manner, recognising the modelled welfare class. The assumptions are developed through analysis of past experience and the foundation models will allow for characteristics including people's age, gender and current class. They will then be further refined to include risk characteristics such as payment history. For the baseline valuation we will focus on refining the most important assumptions and retain foundation assumptions for some payment categories.

7.5 Payment assumptions module

This module is used to develop assumptions on the projected size of welfare payments for a recipient each year. As with the welfare utilisation module, the payments are considered for each of the 17 modelled payment categories.

We model an annual payment amount for each payment category given that they are accessing the payment category. The annual amounts for each person are dependent on their risk characteristics. As access to the payments has already been modelled by the utilisation assumptions, the payment risk characteristics most relevant will be those that influence the weekly payment rate and the number of weeks during the year for which the person receives the benefit. This is particularly the case for Income Support payments. For the baseline valuation we will focus on refining the most important assumptions and retain foundation assumptions for some payment categories.

In modelling payment levels in the baseline valuation, a person's income and assets have not been modelled explicitly. Across all classes the model assumptions make a partial allowance for these through analysis of a number of proxy variables (such as a person's age, welfare history, duration in class and family situation). In addition for the age pension class the model makes explicit allowance for whether people are part or full pensioners by modelling payment levels at entry to age pension reflecting each person's circumstances at that point in time and by modelling payments in subsequent years in an iterative manner.

For analysing past payments, the indexation will be used to bring past payments to current values (i.e. those for the most recent payment year). The indexation module will also be used to allow for future indexation when projecting future payments.

7.6 Adjustments module and indexation

These are discussed in Section 8.

8 Projection module

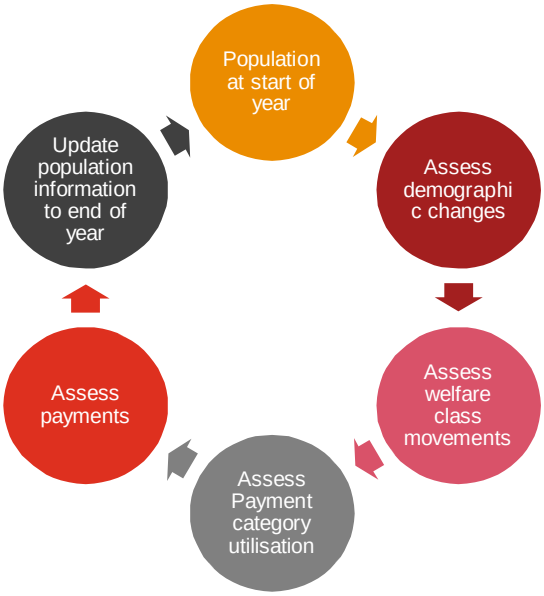
8.1 Purpose of module

The heart of the modelling is a projection of the Australian population through time. This will involve applying the model assumptions to simulate the future trajectory of each individual in the population. This design draws on both the traditional actuarial approach of modelling payments per active claim (see Glossary) and on dynamic micro-simulation (DMS) modelling. The foundation of both these approaches is an iterative approach which considers the evolution of the model population over each time period. The outcomes from one time period feed into the next.

Although the approach could be used over any time period, we are proposing an annual model as we consider that this will capture the main features of the experience in the most robust manner and will remove the need to consider seasonality in the assumption setting process.

The diagram below represents a single iteration of the simulation where we consider the evolution of a series of characteristics for each person in a sequential manner based on their characteristics at the start of the year. These characteristics will include demographic information and also information relating to the types and amounts of payments received over recent years and the payment episodes.

Figure 3: Representation of a single iteration of the simulation



The sequencing of model events is important as once one type or group of characteristics are determined they can be used in the assessment of the next, that is the transition probabilities will always be conditional upon the modelled circumstances. For instance, if someone is currently receiving Newstart (class '2 Working Age') and the model assigns them to have a child during the year there will be a greater chance of them transitioning from the class to a parenting payment (class '3 Parenting') than would be the case otherwise.

Our proposed ordering is:

- First modelling demographic changes and changes to risk characteristics.
- Next modelling how each person's overall interaction with the payments system evolves, through the welfare class variable. This variable captures information on both actual payment usage and reasons for needing support which then provides information used in modelling the payments.
- Then modelling utilisation of different payment type categories.
- Finally, modelling the amounts of the payments to the individuals utilising each category.

The output of this module is information on each person's life trajectories and payments received which is then used to develop the results.

8.2 Projection module features

The projection module is a set of computer programs supported by datasets and tables of assumptions which implements the overall model. To make this accessible, it will ultimately be able to be run from a simple control panel with the assumption sets stored in tables. The model will be able to be run for the whole population or for sub-groups of interest.

When running the model the user can select the people to be included as well as the number of simulations run for each person. The final projected outcomes will be calculated by averaging over these simulations. To allow greater control of the run time, the model will have the capacity to run the forward simulation for a selected sample of each part of the population. Sample sizes used can be varied from a small percentage of each population segment through to a full (100 per cent) sample.

In developing the model output the sample sizes will be selected and the numbers of simulations will be set to ensure the results are representative of the whole population and their range of future trajectories. In practice this will mean that ultimately we may include more people of younger ages as their longer future lifetimes mean there is a greater range of possibilities of outcomes. We would also use more simulation runs per person where the model is being used to provide insights for a narrowly defined group than when developing the aggregate lifetime cost results.

Diagnostics will be built into the model to ensure the results are developed from sufficiently representative samples and that we have run enough simulations. Person identifiers, sample weights and simulation run identifiers will be stored so that the overall results can be developed from the model output.

We plan to build the model so that it has the features outlined in Table 7 below.

Table 7: Planned features of Projection Module

Aspect	Features
Population	Ability to control the population groups for which the model is being run. Limiting the model population will allow users to produce results more quickly or to run more detailed modelling for particular groups of interest. • Ability to run the model including / excluding New Actives. • Ability to run the model only for welfare recipients currently in or first entering a specified model segment. • Ability to run the model only for welfare recipients currently in specified age range e.g. over 65s, under 30s. • Ability to run for other specific groups, as identified by any specified data field.
Projection period	Ability to control the number of years of forward projection to help achieve faster run times. • e.g. people's full natural lifetimes, or periods of 5, 10, 20, 50 or 100 years may be relevant for different purposes.
Sampling	Ability to set the model to run for different sample sizes in order to generate overall results more quickly. Ability to store sample populations to facilitate repeat runs. • Sample sizes to be set for each model segment independently, to allow sufficiently detailed modelling of smaller groups whilst developing overall results more quickly. • Smaller samples may be used during model development and when testing sensitivities or alternative assumptions, with larger samples used for developing final results or examining particular groups of interest.
Simulations	Ability to control the number of simulations run for people in each segment.
Assumptions	Ability to develop results for alternative model scenarios (as defined by different suites of input assumptions). We consider that this may be of particular value in modelling alternative policy options and in assessing the potential value of different interventions. • If required, a separate module can be built to assist with the development of the input assumptions required for alternative scenarios. • Ability to consider alternative economic scenarios (in later years). • Ability to apply different indexation to each of the main payment type categories.
Outputs	Ability to control which outputs are generated and stored and hence manage run times: • Are individual average lifetime cost results needed? • Are results needed for individual future projection years or just overall? • Results to be presented split into future duration bands (e.g. next 5 years, 5-10, 10-20, 20+) as well as overall.
Validation	Automatic production of fit statistics to assist with validation and generation of warnings where issues arise. Automatic output of control checks to ensure sufficient simulations were run in order to produce reliable results (and also to indicate whether a smaller number of simulations could be used).

The outputs from the projection module are considered further in Section 9.

8.3 Adjustments module

The past experience that can be analysed to develop the model assumptions does not necessarily reflect the expected future experience. The adjustments module recognises this and delivers three types of adjustments that may be required to better align the model and ensure it provides a good representation of the welfare system.

The adjustments are:

- Forward looking adjustments
- Economic adjustments
- Benchmarking adjustments.

Details of each are provided below, together with the approach for developing the assumptions.

Forward looking adjustments

Forward looking adjustments are required because the payments system is always changing and so the past experience captured by the historic data may not be reflective of the system as it is today and as it will be in future. Examples of this are reforms such as the July 2012 increase to the minimum qualification age for Newstart Allowance from 21 to 22 years and the future change in retirement age from 65 to 67.

The adjustments will need to reflect any changes in the system which will not have been captured in historic data. They may apply to some or all of the class movement, payment utilisation and payment amount assumptions.

The planned approach for identifying the need for adjustments is through a process of joint review of the experience over each of the last five years in conjunction with consideration of qualitative information on past and future changes to the payment system. The adjustments are then developed on a case by case basis through consideration of the nature of the underlying change and drawing on other information, points of reference and expert judgement as appropriate. We expect to work closely with departmental staff when developing these adjustments.

Adjustment to age pension payment levels

There is a significant body of analyses which suggests that the payment profile for people receiving the age pension will be different in future years as more people will have had an opportunity to self-fund some or all of their retirements through superannuation savings.

To allow for this the method includes development of a specific forward looking adjustment to reflect the expected trend. This will be parameterised to reflect a scenario developed by reference to external information sources.

Economic adjustments

Individual utilisation of welfare payments will be linked to key macro-economic factors including population, participation and productivity. Changes in these factors will impact on how individuals move on, off and between different payments as well as on utilisation and average spend for each payment category.

In time, our model aims to include these drivers of experience which will provide a more realistic view of welfare recipient numbers and payments, especially over the short to medium term. The link to these factors will also be important in understanding and explaining movements in the results of the modelling from year to year.

Our approach for developing the adjustments will be:

- To first review the need for making adjustments to each assumption set by reviewing the variations in experience over the economic cycle and with particular reference to experience changes over the GFC period.
- Adjustments will only be made where the economic influence is considered significant, with the relevant assumption sets being agreed with the Department. For instance, we would anticipate the rate of entry to working age payments may need adjusting, however the rate of transition from working age payments to Age Pension may not.

- The assumption adjustments will then be developed by considering their relationships to key economic indicators such as those shown in Table 8 below.
- The model will draw on economic forecasts to develop the view of how experience will change in future.

Table 8: List of economic factors to consider in economic adjustments

Factor	Explanation and expected impact
Unemployment rate	Reflects employment opportunities, and economic environment which affects utilisation rates.
Interest rates	Reflects cost of living pressures and sources of alternative income.
Inflation rates (CPI or AWE)	Consumer Price Index (CPI) may reflect cost of living pressures. AWE growth may be an indicator of employment opportunities and will affect utilisation rates.
Rate of GDP growth	GDP growth reflects the population, participation of that population in the workforce and the productivity of the population. It may reflect employment opportunities and availability of alternative means of support. Population is modelled directly hence the inclusion of GDP growth rates will be a proxy for changes in participation opportunities and in the interaction of productivity changes with social security payment utilisation.

The economic assumptions will be validated with reference to figures derived from Australian Government forecasts (including Budget and RBA forecasts) and by drawing on the experience of the PwC Economics team. We will work with the Department and other stakeholders to access and reference the most appropriate forecasts.

Assumptions will be subject to testing through scenario analysis to check the robustness of the model to changes in assumptions and to analyse which groups of the population are most sensitive to changing economic conditions.

Benchmarking adjustments

Our model design blends traditional actuarial and transition models with some of the features of dynamic microsimulation models. A fundamental component in establishing the credibility of the model will be the match between the simulation outcomes and 'real world' outcomes.

A well-documented issue with microsimulation models is that resulting projections can deviate from external benchmark projections both through the stochastic nature of the models and because the estimation data used in the assumption setting process is not complete. Alignment of projections to external benchmarks is common practice and a well-developed method of addressing this issue.

Where required, the benchmarking adjustments will be used to ensure:

- The population simulation results align with external benchmark information such as projections from the ABS and Treasury, across aggregate population demographics such as total population, gender and age.
- The demographic and payment profile of the simulated population is realistic over the projection period.

Our approach aims to minimise the need for benchmarking adjustments through validation of each component set of assumptions against external benchmarks and through use of statistical diagnostics during the assumption fitting process.

Nevertheless there is the potential for the assumptions to combine such that the overall model develops a degree of misalignment over time. We will assess this by validating the model outputs against external demographic projections provided by Treasury and the ABS and examining the trends in projected population profile and modelled payment utilisations.

If required, adjustments will be developed and used to realign the model. These would generally either be implemented as refinements to the original assumptions (as part of an iterative process of validation and refinement) or take the form of a small overall adjustment to one or more of the underlying assumptions.

8.4 Indexation assumptions module

Indexation assumptions

This module will consider how the average payments within each payment category will change in future years. This will bring together information on:

- Expected changes in payment levels given the legislated indexation arrangements.
- Any legislated changes in benefit levels in future years.

These would each be expressed in the form of a payments index and combined and applied to the current payment assumptions to develop the payment assumptions for each future year.

Payments are indexed differently depending on the payment type with different rates applying to pensions, allowances, family payments and supplements. Family payments and allowances are both indexed by the Consumer Price Index (CPI), once and twice a year respectively. Some supplements are also indexed by CPI; others are not indexed. The indexation of pensions is based on the larger increase of the CPI and the Pensioner and Beneficiary Living Cost Index over each six month period. After indexation, pension payment rates are then benchmarked to a fixed proportion of Male Total Average Weekly Earnings and appropriate adjustments are made to meet the benchmark. The expected rates of future changes would reflect forecasts of the relevant inflation indices.

Discounting assumptions

The lifetime cost results are developed as the net present value of the projected payments in each future year. Having already projected and indexed the payments, the key assumption in the calculation is that used for discounting: this recognises the time value of money (i.e. ‘a dollar today’ is worth more than ‘a dollar next year’ as the money could be invested to earn income).

In an insurance context, discounting approaches reference investment returns and this recognises that insurers hold actual assets and capital to support their claim liabilities and provides certainty to regulators and consumers alike that the insurer has sufficient assets. This will not be the case for the valuation of the social security lifetime costs. The lifetime costs will be considered in developing policy but will continue to be funded in a pay-as-you-go manner rather than sitting on a government balance sheet. As such we think a different discounting philosophy is appropriate. This philosophy needs to cover both the basis and reference for discounting and the link between the indexation and discounting assumptions.

Reference for discounting assumptions

The actuarial models used in assessing general insurance typically use a discount rate which reflects returns on a risk free portfolio and are based on Government bond yields matched to the future cashflows by term. This aligns with accounting standards and the need to hold actual assets in insurance balance sheets. While bond yields are available for range of future terms, these only extend for around ten years; reference rates for longer durations are not available.

The much longer term projection period and different purpose of this valuation suggests a different point of reference may be more appropriate. Other analyses which cover a number of decades often draw on GDP growth rates as ‘deflators’ and this may provide a better option.

We will be seeking guidance from Treasury and the project steering committee on this.

Link between the indexation and discounting assumptions

The long duration of social security lifetime costs means that they are highly sensitive to the combined effect of the indexation and discounting assumptions. The use of these two sets of assumptions within the model is such that the model results are more sensitive to gap between the two sets of assumptions than the assumptions themselves.

In our view, movements in lifetime cost results which are purely due to changing economic assumptions are a confounder. They could be a source of confusion which has the potential to undermine the acceptance and successful use of the model.

Our suggested approach is therefore to blend from short-term assumptions (consistent with Treasury assumptions and budget papers) for an initial period, into fixed long term assumptions over the first 5 – 10

years of the projection period. This constant long term assumption approach will provide realistic projections of expenditure over the short term and the period needed for budgeting and it will also provide lifetime cost results which are stable to changing economic assumptions from year to year. This is consistent with approaches we use for modelling other long term government liabilities.

9 Results module

9.1 Purpose of module

The results module will be used to:

- Summarise the outputs from the analysis.
- Develop the results and supporting information needed by the Department.

9.2 Information produced by the results module

The results module will have the functionality to show information for the whole population or to produce results and summaries for groups defined by combinations of characteristics. Table 9 below summarises key information we expect to develop.

Table 9: Key information produced in results module

	Output	Details	Purpose
Social Security System Lifetime Cost Results	Overall results	Total lifetime cost. Lifetime cost split: pre / post retirement age. Lifetime cost for different starting segments and for new entrants vs. current claimants.	This is the headline result which captures the overall cost of the social security system. We will be able to break this down into costs for different groups of people.
	Lifetime cost forecasts[1]	Details of the expected lifetime costs at the next valuation.	This information will be a benchmark for the cost at the next valuation and investigating the sources of change. Provides a way of understanding the cost drivers.
	Lifetime cost movements[2]	Reconciliation of changes in lifetime costs from year to year.	Allows an understanding of drivers of lifetime cost change, such as impact of experience, impact of changes in projection assumptions, impact of policy changes / interventions.
	Projected welfare recipient numbers and expenditure for future years[1].	Expected payments by payment category and year. Indicative numbers of people on each main benefit type. Information on expected growth in welfare recipient numbers and expenditure.	This will be useful for planning and budgeting purposes. The information will only be produced for the future years included in the forecast period.
Group Information and Lifetime Cost Results	Lifetime cost results and forecasts[1]	Lifetime cost information and forecasts for groups.	To determine the portion of lifetime cost that certain groups represent and how that is expected to change over time.
	Average lifetime cost information	Average lifetime costs for groups.	To understand which types of people cost more.
	Demographic information	Demographic mix for the total population, those utilising the social security system and a breakdown between groups. Demographic mixes for select payment classes and break down of lifetime cost between groups.	To understand mix of people using different types of social security and income support benefits and how that mix is changing over time. To identify risk characteristic drivers of lifetime cost for different social security and income support benefits.
	Information on social security and income support utilisation and trajectories	Likelihood of welfare recipients continuing to receive social security and income support benefits. Likelihood of people being on any income support in x years' time. Likelihood of non-welfare recipient receiving social security benefits in the next year. Likelihood of person currently on income support being on income support a number of years after a certain period of time.	Understand which types of people are likely to be dependent on social security for the longest period of time. Helps inform where interventions could be targeted. Provide insight into movements within the social security system.

	Output	Details	Purpose
	Information on other outcomes	Highest level of education. Eventual aim would be to integrate with more data which relates to other areas of wellbeing.	Understanding other outcomes for individuals.

Note:

1. This information will be for the in-scope population only
2. This information will be for the valuations following the baseline valuation only.

The presentation of results will be tailored for different purposes and audiences. For instance the information presented about the overall lifetime costs in the valuation report would be different to information used to better understand a group and the factors which identify people most at risk of long term welfare dependency.

9.3 Scenario and sensitivity results

Our model structure has the assumption sets stored in an accessible table format which can be read in by the main projection model. This will support both sensitivity and scenario testing as the structure makes it relatively easy to set up and test the impact of alternative model assumptions and we expect that these will form an important part of the model use.

- Sensitivity testing examines the impact of changes in the model assumptions on the results. Understanding sensitivities allows us to focus more modelling effort on the more important assumptions.
- Scenario testing is used to consider how the results might be impacted through changes to model inputs and system assumptions. This might include changes to the population and economic environment. Table 10 below includes some possible scenarios which may be modelled.

Table 10: Possible scenarios to model

Type	Test	Details	Purpose
Sensitivity testing	General	Testing sensitivity of result to different assumptions.	Identify where to focus model calibration effort. Understand how uncertain the model result is (i.e. how much the results vary under different plausible scenarios).
	Economic	Test impact of different economic assumptions e.g. different rates of CPI.	Provides partial information on sensitivity to economic environment (will only capture main effects).
Scenario testing	Benefit design – payments	Testing changes to payment levels and indexation.	Examine cost impact of and sensitivity to different economic scenarios. Test impact of alternative policy options.
	Benefit design – eligibility criteria	Testing impact of changes to who may receive benefits.	Can test by having step changes in social security and income support benefit utilisation assumption. Calibration of this likely to include analysis of historic and international experience as well as use of expert judgement.
	Risk characteristic impact	Testing impact of risk characteristic changes on assumptions.	To establish potential benefit of interventions that may change benefit persistency.

9.4 Model validation

Model validation is an essential part of the development process. It is necessary to ensure the model meets its objectives and to enable the model owners and users to have confidence in the results it generates.

We have proposed to mitigate the risk as best as we can through:

- Our overall approach to build the model through a series of increasingly refined models.
- Undertaking appropriate checking procedures at each stage of the model development.

Use of checking procedures

The table below outlines some of the checks we would use to satisfy both ourselves and the Department that the model assumptions are appropriate and that it delivers reasonable results.

Table 11: Summary of model validation procedures

Type	Phase(s) of work	Description
Use of existing DSS monitoring	Assumption development	As benchmark for validating.
Use of external information	Assumption development Results development	External data can be used to validate some of the assumptions and adjust simulation projections as part of our benchmarking adjustment process. E.g. • ABS population projections. • Output from other models such as the Treasury RIMGROUP retirement models. • ABS life tables and mortality projections. • Comparisons to population statistics e.g. what % of people aged 70 are in our Age Pension group.
Consultation with DSS / Experts	Assumption development	To validate factors and ensure modellers' interpretation of past experience does not overlook known influences.
Use of statistical techniques such as test / learn datasets	Assumption development	To avoid overfitting statistical models it is good practice to build the model using one part of the dataset and then test it on the other. This helps remove factors from the model that add little explanatory power.
Fit tests on model components	Assumption development	Extensive use of statistical goodness of fit tests to check individual model components. Heat maps to identify regions of poor model fit.
Simulation fit tests and diagnostics	Model development	In order to establish an appropriate number of simulations we will include diagnostics in the model output that identify when insufficient simulations have been performed.
Analysis over multi-year projection periods	Assumption development	Examining outcomes over longer 3-5 year periods of past experience will provide some indication of the extent to which models are deviating from experience.
Production of interim results	Assumption development	There will be a significant number of model outputs including projected payments by year and benefit type and projected welfare recipient numbers. Comparisons between this information and actual experience or other forecasts will assist us in determining whether the results are sensible.
Running models on past data (backtesting)	Model result validation	Recreating population data as at older reporting periods allows us to run the model and compare the modelled and actual experience. This highlights any areas of the model that are not performing well.
Sensitivity testing	Model result validation	Model runs with variations made to key assumptions to ensure sensitivity of results to inputs are well understood. We are likely to vary economic assumptions, new entrant numbers and the key persistency assumptions in these tests.
Reconciliation of change	Model update	Each valuation we would analyse the reasons for the change in results compared to the forecast from the previous valuation. This helps in both understanding the experience and identifying areas where the model assumptions need improvement.

Appendices

Appendix A Mapping of payment types to welfare classes

Table: Mapping of payment types to welfare classes

Active – income support	Active – non income support	Inactive classes
1 Studying People receiving: ABSTUDY Secondary ABSTUDY Tertiary (all ABSTUDY except working) Austudy Payment (except Austudy working) Youth Allowance (Students)	**7 Non IS Family** People receiving one or more of the following in the previous year but not currently receiving a carer payment: Family Tax Benefit Child Care Payments Dad and Partner Pay Double Orphan Pension Family Supplements Family payments Parenting Payment supplements Maternity Payments Schoolkids Bonus Single Income Family Supplement Stillborn Baby Payment Parental Leave pay	**10 Previous welfare recipient** People who were previously in one of classes 1 to 9 but are not for the latest year.
2 Working Age People receiving: Special Benefit Newstart Allowance Partner Allowance Sickness Allowance Widow Allowance Youth Allowance (Other) Austudy (working) ABSTUDY (working)	**8 Non IS Carer** People receiving any other carers payment, specifically Carer Allowance, Carer Supplement or Child Disability Assistance Payment	**11 Dead** People who have died during the previous year or in prior years.
3 Parenting People receiving: Parenting Payment (Partnered) Parenting Payment (Single)	**9 Non IS Other** People receiving payments but not in any other class.	**12 Rest of Aust. Population** Rest of modelled population.
4 Carers **P**eople receiving Carer Payment		
5 Disability support People receiving Disability Support Pension		
6 Pension Age people receiving: Age Pension Widow B Pension Wife Pension		

Appendix B Payment categories

Table: Components of payment categories A to Q

Income support payments
A - IS Studying
Abstudy - studying
Austudy
YA (Student)
B - IS Working Age
Abstudy - working
Austudy - working
Newstart
Sickness Allowance
Special Benefit
YA (other)
C - IS Parents
Parenting Payment - Partnered
Parenting Payment - Single
D - IS Carer
Carer Payment
E - IS Disability
Disability Support Pension
F - IS Age
Age Pension
Widow B Pension
Wife Pension
G - IS Dependant
Partner Allowance
Widow Allowance

Non income support payments
H - Other FTB
Family Tax Benefit A
Family Tax Benefit A Supplement
Family Tax Benefit B
Family Tax Benefit B Supplement
Large Family Supplement
Family Tax Benefit - old
I - Other Family
Child Care Payments
Double Orphan Pension
Schoolkids Bonus
Single Income Family Supplement
Child Care Benefit and Child Care Rebate
Multiple Birth Allowance
J - Other New Parents
Dad and Partner Pay
Maternity Payments
Newborn Payment
Parental Leave Pay
Stillborn Baby Payment

Non income support payments (continued)
K - Other Living
Energy Supplement
Living Allowances
Pharmaceutical Allowance
Rent Assistance
Residential Costs
Telephone Allowance
Utilities Allowance
Incidentals Allowances
L - Other Health & Disability
Mobility Allowance
Essential Medical Equipment Payment
Incentive Allowance
Youth Disability Supplement
M - Other Carer
Carer Allowance
Carer Supplement
Child Disability Assistance Payment
Carer Supplement - old
N - Other Study & Skills
CDEP Supplement
Education Supplements
Fares Allowance
Relocation Allowances
Training supplements
Education Entry Payment
Language Literacy & Numeracy Supplement
Pensioner Education Supplement
Relocation Scholarship
School Fees Allowance
School Term Allowance
Student Start-up Scholarship
Work for the dole
Work Program Supplement
O - Other Remote & Regional
Assistance for Isolated Children
Remote Area Allowance
P - Other General Allowances
General Supplement
Income Support Bonus
Low Income Supplement
Pension Supplement
Pension Bonus Scheme Payment
Pension Bonus Top-Up Payment
Pensioner Loan
Income Management
Q - All Other
Bereavement Allowance
Bereavement Lump Sum
Crisis Payment

Appendix C Data

A pre-requisite for the implementation of the method is the availability of administrative system data which is:

- At an individual person level.
- Shows the payments made to each person.
- Provides information about each person's life situation and other characteristics.

This data needs to be complete and accurate so that it can support a model which is reliable and trusted.

A Summary of the data

The Investment Approach Taskforce has developed a longitudinal database 'JASON' to support this work. The database has been developed from administrative data provided by the Department of Human Services and consists of a large series of datasets which contain the information required for the analysis.

The datasets include:

- Entitlements data for regular payments, one-time payments and family tax benefit (178 individual datasets).

  This information is captured on an episodic basis with records for each payment type provided to each person and details of the start date, end date and payment rates applying. The payment types are identifiable through a combination of appropriation and payment type codes.

- Characteristics data for a large number of different characteristics (81 individual different datasets).

  This information relates to the individual characteristics of payment recipients with data items being captured as relevant for each payment type. It is captured at the point of application for payments and updated as new information is received.

This information has not been audited by PwC. We have however undertaken a high level reconciliation of the payments and examined the information for internal consistency prior to its use.

Manipulation of the data

A number of the tables from this database have been used to construct a longitudinal dataset to support the actuarial analysis. This consists of one record for each person for each financial year during which they are in the payment system. The records reflect the information for a financial year and contain:

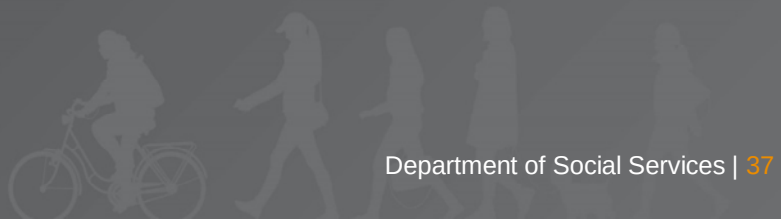
- A unique confidentialised identifier for each person
- Details of a number of static variables (e.g. date of birth)
- Details of the characteristics as at 30 June each year
- Details of the entitlements paid over the last financial year mapped to the payment types proposed for modelling purposes

A number of derived variables for use in modelling (e.g. model class, duration in class, age pension qualifying date).

Appendix D Glossary

Actuarial Valuation	Estimation of the lifetime cost to the Australian government of future social security payments using generally accepted actuarial principles.
Allowances	Allowances provide income support and access to a range of concessions for eligible Australians. The term Allowance is used by the Department to refer to income support payments that are generally at lower payment levels than Pensions.
Assumptions	Assumptions are the parameters that guide the model– these include 'macro' assumptions such as economic forecasts and demographic assumptions; and 'micro' assumptions such as probabilities of individuals moving into and through the welfare system based on various risk factors.
Group	In this report we have used the term group to refer to a group of people defined by a set of common characteristics in the model - for example , a group could be "females aged 20 to 24 who were in welfare class 'studying' in 2014/15" or could be "male carers". Generally, groups will be defined by the model structure and individual's characteristics.
Data	Data refers to sets of information that are being used to inform the project.
Datasets	A set of values of qualitative (characters) or quantitative (numbers) variables that is data coded in a form suitable for using in analysis.
Discounting	The process of determining the present value of a payment or a stream of payments that is to be received in the future. Given the time value of money, a dollar is worth more today than it would be worth tomorrow given its capacity to earn interest.
Dynamic	A term we are using to describe information or data variables that change with the progression of time (e.g. a person's marital status).
Flow assumptions	This comprises the set of assumptions used to ascertain how each person's individual demographic and risk characteristics change as time progresses.
Indexation	Indexation is a technique to adjust payments by means of an index, in order to maintain the purchasing power of the payment after inflation.
Liability	In Finance, the term liability is used to refer to general obligations to make future payments. The specific meaning varies depending on the person using the term and context of its use. Actuaries also use this term to describe the net present value of the cash flows arising from future obligations.
Lifetime cost	For the investment model, the lifetime cost will be the net present value of all future welfare payments (to the in-scope population).
Average lifetime cost (future)	The net present value of the payments that we expect to be made to an individual over their future lifetime. Note that these will be assessed for groups of similar individuals, not for specific people.
Method	The method refers to the description or specification of the process for selecting modelling techniques, taking the data, analysing it, developing or incorporating assumptions about the future, and projecting forward and summarising the expected welfare payments for each individual within the model population.
Model	The model refers to the set of computer programs, spreadsheets, formulae, techniques and tools that are being built to apply the method. In a sense, the model is intended to represent, in a mathematical way, what happens to people as they move in, through and out of the social support system based on various assumptions. The model is a collection of modules and sub-components that fit together in applying the method.
Model population	The model population is the set of individual person records used in the model. The model design allows the model to be run for either a sample of the population or the whole population. Where the model is run for the entire model population, and not a sample, we refer to this as the full population.
Net Present Value	The sum of the present values of incoming and outgoing cash flows over a period of time.
Payment	A generic term used to describe all the different types of benefits which an individual can be paid. Includes Pensions, Allowances, Entitlements etc.

Payment assumptions	The assumptions which describe the payments which individuals receive given that they use a specific Payment category.
Payment categories	The groupings of individual payment types used for modelling purposes.
Payment types	A term used to describe the labels which have been assigned to all the underlying payments so they can be considered for modelling purposes. The assignation has been through a mapping process with around 2,000 underlying payments being identified by codes and these mapped to around 100 payment types.
Payment utilisation assumptions	The assumptions which describe the probabilities with which individuals use different Payment categories.
Payments per active claim model	An actuarial valuation technique which models claim costs through analysis of the numbers of active claims, being those claims in receipt of payments during each future time period and the average payment made to each active claim.
Pensions	Pensions provide income support and access to a range of concessions for eligible Australians. The term Pension is used by the Department to refer to income support payments that are generally at higher payment levels than Allowances.
Present Value	The present value is the value of an expected income stream determined as of the date of valuation. The present value is always less than or equal to the future value because money has interest-earning potential, a characteristic referred to as the time value of money.
Probability	Probability is the measure of the likelihood that an event will occur. Probability is quantified as a number between 0 and 1 (where 0 indicates impossibility and 1 indicates certainty). The higher the probability of an event, the more certain we are that the event will occur.
Projection	The use of the model to forecast the future payment experience of the population based on current statistics and trends.
Risk characteristics	Measurable or observable factors or characteristics that are used to assign each individual to one of the risk classes of a risk classification system. Examples of risk characteristics in the context of the actuarial valuation model include age, gender, family situation and education status.
Risk classes	A set of risks grouped together under a risk classification system.
Risk classification system	The process of systematically arranging risks into groups or categories according to similar risk characteristics.
Risk factors	See risk characteristics.
Simulation	Simulation is the imitation of the operation of a real-world process or system over time. In the context of the actuarial valuation model, we will simulate how the payment system operates. Where the system is stochastic, multiple simulations may be used to show the range of possible outcomes.
Static	A term we are using to describe information or data variables that do not change over time. (e.g. a person's date of birth or country of birth).
Statistics	The study of the collection, analysis, interpretation, presentation, and organisation of data.
Stochastic	The term stochastic describes events or systems that are unpredictable due to the influence of random variables. A stochastic model will not produce the same output from a given starting condition or initial state even if run in the same way.
Valuation	see Actuarial Valuation
Valuation Date	The reference date for the actuarial valuation. The valuation will consider the lifetime cost as at the valuation date for all payments after the valuation date.
Valuation Results	The summarised outputs from the model, which will be tailored to meet the needs of different users – for example, as well as the total reported lifetime cost, results may include average lifetime cost estimates for particular groups, projected payments for each of the next five years, projected numbers of "new entrants" to the social support system from different population segments.
Welfare class	The assignation of people into unique segments used within the model. There are 12 classes: 6 for income support recipients (studying, carers, etc.) 3 for people receiving payments but no income support and 3 for the rest of the population. Each person is assigned to the single most appropriate category for each financial year.
Welfare class assumptions	The assumptions which describe the probabilities with which individuals move between welfare classes.
Welfare utilisation assumptions	A term covering both the Welfare class and Payment utilisation assumptions.



www.pwc.com.au

Confidential