

# **INSTITUTE AND FACULTY OF ACTUARIES**

## **AUDIT TRAIL**

February 2016

**CA2: Model Documentation, Analysis and Reporting**

**Paper 2**

## **Audit trail**

The following audit trail should be read alongside the provided model.

### **Objective**

The purpose of the spreadsheet is to project the profits that Sally can expect to receive from her business, Josie's Jamboree ("JJ's").

JJ's is a children's playgroup where an age dependent fee is charged for children to attend classes and costs are incurred in its running.

In order to calculate the income which is anticipated to be received from class fees it is necessary to project the expected population of children over the term (10 years), allowing for new children to join the centre and some existing children to leave.

Sally is also considering selling franchises of her JJ's playgroup business model and would like to know the income (in the form of a one off up front charge, plus an annual charge which is a percentage of the profits earned) she could receive from doing so.

The population and children and financial projections have been completed for continuing the business in its current form and for a franchise playgroup.

*NB: Input cells are shown in blue. Cells shaded in red do not copy down/across.*

### **Parameters**

*This worksheet details the data and inputs used in the projections.*

Several data items are required in order to perform the projections. Sally, the owner of JJ's, has specified the following data items:

- The current population of children, split by age group, at JJ's.
- The decrements for new starters and leavers.
- The factor to apply to the adjustment formula for new starters, under the existing business and for a franchise
- The costs associated with running the business. Some costs are fixed, some are semi-variable and some are variable.
- The fees per child per class for each age group.

- The franchise charges:
  - fixed upfront
  - annual proportion of profits charged:
    - 10% if the profits are between 0 and £10,000
    - 20% if the profits are between £10,000 and £20,000
    - Subject to a minimum charge of £250

In addition, your boss has cited that the government data indicates that inflation has been 0% for several years.

*NB: Where cell names have been defined these are shown in red beneath the relevant cells.*

### **Assumptions**

The following assumptions are applied to the benefit projections:

- The data provided by Sally is correct.
- Children are expected to join and leave on average half way through the year.
- The age of the children is only increased at the start of the financial year.
- Children are expected to attend 52 classes a year.
- The maximum age a child can attend a class is 4.
- Inflation is assumed to be 0% for the next 10 years.
- Children are assumed to start and leave in whole numbers, therefore new starters are rounded up to whole numbers and leavers are rounded down to whole numbers.
- Profits are not affected by taxation.

### **JJs\_Base**

*This worksheet performs the projection of the children starters and leavers and performs the profit projections.*

The beginning of year (BoY) population in year 1 is linked through from the 'Parameters' worksheet.

From year 2 onwards the BoY population is found as follows:

Year  $n$  population for age  $x$  =

(Year  $n - 1$  BoY population + Year  $n - 1$  starters – Year  $n - 1$  leavers) all for age  $x - 1$ .

Alongside the decrements Sally suggested a distribution to apply to the decrement table to reflect the increased number of children starting each year. The decrement provided is therefore adjusted by a percentage, which depends on the year. Part of the calculation is a factor which varies depending on the scenario.

Number of children age  $x$  starting =

$$\Phi\left(\frac{\ln(n)}{\text{fac}}\right) \times \text{number of children age } x \text{ in starters in decrement table.}$$

where  $n$  is the year of the projection and fac is the factor for the scenario (this is 2 for the existing business).

As stated in the assumptions, the projected number of children starting is rounded up to the nearest whole number.

The number of leavers in the year is a proportion of the population. As we are assuming that new starters and leavers come and go in a uniform manner over the year, we only apply half of the decrement to the new starters (as they start on average half way through the year). Therefore:

Number of leavers = (number at BoY +  $0.5 \times$  number of starters)  $\times$  proportion of population in decrement table

As stated in the assumptions, the projected number of children leaving is rounded down to the nearest whole number.

The profit projection is performed on a financial year basis with the following calculations being performed each year:

- The income is:
  - the sum of the product of the number of children in each age group in that year with the fee charged for that age group, all multiplied by 52.
- The outgoings are as follows:
  - Fixed cost, constant over the course of the projections, as per the parameters.
  - Semi variable cost – these are dependent on the number of children, with a cost being incurred for every  $y$  children (where  $y$  is specified in the parameters) who are members of the centre:
    - The multiple of this cost that is incurred is found by rounding up the following  $(\text{total children at BoY} + 0.5 \times (\text{total starters} - \text{total leavers}))/y$ .

- This number is then multiplied by the semi variable cost as included in the parameters worksheet.
- Variable costs = (total children at BoY +  $0.5 \times (\text{total starters} - \text{total leavers})$ )  $\times$  variable cost  $\times 12$ .

### **JJ's\_Start Up**

*This worksheet performs the projection of the children population and the profit projections for a single franchise*

The 'number of children' projection table is the same as that contained within JJs\_Base worksheet but with the following adjustments:

- The year 1 BoY population is linked through to the franchise starting population contained in the parameters worksheet.
- The factor for the franchise is used in the cumulative normal distribution function adjustment to the starters decrements.

The financial projections table is the same as that within JJs\_Base worksheet but with the following adjustments:

- Income: Where there were links to the 'number of children' worksheet these are now to the 'number of children\_start up' worksheet.
- Outgoings: In addition to the three types of existing outgoings, a 'start up fee' is added. In year 1 this is the fee charged for a franchise, in all other years this is zero.
- Profit: The difference between the income and total outgoings is now the profit before charges.
- Annual charge: This is calculated as a percentage of the profit before charges, with the applicable percentage looked up from a table on the parameters worksheet, with a minimum of \$250.
- Profit after charges: This is calculated as the profit before charges minus annual charges.
- Total franchise costs: This is equal to the start up fee plus the annual charge.

**END OF AUDIT TRAIL**