CumpstonSarjeant
CONSULTING ACTUARIES

Mr Michael Strong
Senior Director
Cash Economy Risk and Strategy
Tax Practitioner and Lodgement Strategy
140 Elizabeth Street
Brisbane Queensland 4000

30th September, 2013

Review of Statistical Methodology used in producing Small Business Benchmarks

Dear Mr Strong,

The following represents our report into the review of statistical methodology employed in the production of Small Business Benchmarks.

I understand that both this report, and a version of the executive summary (as supplied on September 18th, 2013) shall be published on the relevant section of the ATO website.

I appreciate the assistance provided by you and your colleagues during this process.

We remain available to answer any questions regarding our analysis and report.

Yours sincerely,

David Heath
Director, Cumpston Sarjeant Pty Ltd
Fellow of the Institute of Actuaries of Australia

Executive Summary

1. Cumpston Sarjeant Pty Ltd is an actuarial consulting firm, based at 160 Queen Street, Melbourne. As actuaries we have expertise in statistics and probability, as well as economic and financial analyses.

2. Cumpston Sarjeant were appointed to review the statistical methodology in accordance with a recommendation from the Inspector General of Taxation (IGT) within its July 2012 report, "*Review into the ATO's use of benchmarking to target the cash economy*" ("the IGT report").

3. That IGT report was prompted by concerns from stakeholders over the production and use of the Small Business Benchmarks ("SBB").

4. It is not possible to assess the statistical methodology without simultaneous consideration of the context in which the SBB are used by the ATO and other stakeholders. Accordingly our analyses and findings occur within the context in which the SBB are used.

5. Many of the aspects of the development and use of the SBB are regarded as policy decisions of the ATO, so are beyond the scope of our investigation. Nevertheless there is considerable overlap between the policy decisions of the ATO and the practical assessment of the statistical methodology.

6. The SBB have several uses in practice, including:

- To provide guidance to users on the typical ranges of certain financial ratios which can be calculated from data used in the completion of tax returns and Business Activity statements.

- Use as a tool (amongst other tools) by the ATO to select higher risk businesses for the purpose of audit activity.

- In some cases, where a taxpayer cannot provide sufficient taxation records, the ratios may be used to provide deemed assessments for taxpayers. These are known as default assessments.

7. Having gained an understanding of the derivation of the published benchmarks, we requested further clarifying information from the ATO. In order to perform some independent tests of the methodology, we selected six industries, and requested relevant data. This was supplied by the ATO, but in order to preserve confidentiality, did not contain any data that would allow identification of individual taxpayers.

8. For the sample industries, we are able to confirm that the published benchmarks for the 2010 financial year are in accordance with the methodology described by the ATO in its document, "*Small Business Benchmarks methodology and ratio calculations*". The methodology outlined in that document is consistent with that described in the IGT report.

9. The document, "*Small Business Benchmarks methodology and ratio calculations*" provides a clear description of the process of the development of published benchmarks. Our analyses and assessment follow a similar path as described in that document.

10. In our assessment, we believe there are components of the methodology which while not strictly necessary, contribute to the objective whereby the published SBB appropriately reflect the financial performance of like businesses.

11. The discrete steps employed by the ATO in the derivation of Small Business Benchmarks have been considered in our analyses. Some steps may be regarded as policy decisions, so are outside the scope of our investigation. Nevertheless, we believe that all steps described contribute to the appropriate identification of like businesses, and the derivation of ratios that reflect typical behaviour of these groups of like businesses.

12. While we have identified some steps which could be removed without significant differences to the published SBB, and without major loss of robustness, the use of all the procedures in the derivation of the SBB reflect an underlying thorough approach by the ATO in developing useful ratios for homogeneous groups. This is further indicated by the use of keywords to identify business type in order to maximise the relevant datasets.

13. Benchmark ratios are published as bands for relevant business types and within specified turnover ranges for a financial year. Clearly they are calculated using business data from the relevant business type, turnover range and financial year. In turn, the ratios are used as a basis of comparison for businesses within that same business type and turnover range.

14. I understand the use of SBB is just one method to identify taxpayers for audit activity. I support the policy that SBB is not the sole indicator of further investigation.

15. Given the relatively narrow range from which published ratios are derived, only those entities with ratios significantly outside the benchmark ratios should be targeted for audit on the basis of the benchmark ratios.

16. Overall, it is my opinion that the statistical methodology adopted in the production of Small Business Benchmarks is sound and robust. Our analyses indicate the published benchmarks are correctly calculated and published.

17. We thank the staff of the ATO for their assistance in this process, particularly members of the Cash Economy Risk and Strategy Tax Practitioner and Lodgement Strategy Division.

Introduction

18. You have requested that we review the statistical methodology employed in the derivation of Small Business Benchmarks ("SBB").

19. I understand this assignment arose following a report published by the Inspector General of Taxation, "*Review into the ATO's use of benchmarking to target the cash economy*" ("the IGT report"), in July 2012.

20. I am aware that the IGT report included several recommendations following their investigation, and that the ATO has acted on many of these recommendations.

21. In recommendation 3.1 in the report, the IGT recommends improvement in community understanding and confidence in the benchmarks, including: *(b) assurance from an independent party with statistical expertise about the robustness of the benchmarking methodology;*

22. It is important to define the scope of our investigation. The recommendation in the IGT report and our subsequent brief call for an independent assessment of the statistical methodology used in the SBB process. However, we believe that it is not possible to confine our investigations and report to the mere calculation of the SBB, and the statistical methodology employed. The derivation of the benchmarks, the decisions on their publication, and their use by the ATO and other stakeholders reflect policy decisions that are wider than mere statistical techniques. The statistical methodology must be assessed within this context of the use of the benchmarks.

23. It should be remembered that while the process of the calculation, publishing and use of the SBB include statistical methodology, that methodology is merely a tool as part of the overall process and objectives.

24. Similarly, the assessment of the validity or otherwise of the statistical methodology employed must consider the context of the ultimate use of the SBB. As statistics are merely a tool, they still contain significant levels of judgement in their use. For example, in using confidence interval testing (a commonly applied statistical technique) the user must decide on an appropriate level of confidence.

25. The Inspector General of Taxation (IGT) report was a review into the ATO's use of benchmarking to target the cash economy.

26. That report took a broad approach in considering the derivation and use of the benchmark ratios. In our review of the statistical methodology, we are unable, nor are we required to consider all aspects of the benchmarks, particularly in the usage of the final published ratios by the ATO. However, where appropriate we may make comments in areas that are not purely statistical in nature.

27. For example, the use of benchmarks in issuing default or amended assessments – this is really a policy issue so not really within our assessment of statistical methodology. However, in discussions with representatives of the ATO, we understand that in applying the benchmarks, taxpayers subject to such assessments receive some "benefit of the doubt". Default assessments may be made where a taxpaying entity is unable to produce adequate records. In applying a benchmark in such cases, the ATO chooses the higher end of the relevant benchmark range. This has the effect, of assuming the taxpayer in question has below average profitability; indeed the default assessment effectively assumes a profitability close to the lower 35% of profitability of comparable taxpayers.

28. The choice to use a particular ratio, and the resultant degree of "leeway" in applying the chosen ratio (rather than an average, or some ratio that implicitly considers the taxpayers in question in a punitive manner) is a policy choice. As part of the scope of our assignment, we can only comment on our understanding of derivation of applied ratios.

Material used in our investigation

29. We began our investigation by reading the July 2012 report, published by the Inspector General of Taxation, "*Review into the ATO's use of benchmarking to target the cash economy*" ("the IGT report").

30. We also perused the relevant sections of the ATO website, which contained the published Small Business benchmarks, as well as additional background material.

31. Having gained this initial understanding we had meetings with relevant ATO staff, and at our request were supplied with further documents, as well as answers to particular questions. We chose six industries in order to verify the methodology and practise by the ATO, and were supplied with relevant datasets that enabled our own calculations.

32. Perhaps the most useful document for our investigation was an internal document , "*Small Business Benchmarks, A summary of the small business (performance) benchmark development process*". I am aware this is an internal document, and that a version entitled "*Small Business Benchmarks methodology and ratio calculations*" shall be published on the ATO website. References below are still to the internal document.

33. The SBB document provides a clear and inherently sensible description of the process of the development of published benchmarks. I understand this is an internal document. Clearly its focus is the description of the development and derivation of the benchmarks, rather than their application. Accordingly it forms a good description of the process that we are required to assess, being the statistical validity robustness of the derivation of the benchmarks.

34. Rather than be concerned with coding our broad process has been to understand and assess the process whereby SBB are derived, and then perform some specific testing.

35. We have relied on this document to provide an outline of the framework used to determine the benchmarks. Having gained an understanding of the methodology used, we then took several steps

- asked for clarification of some areas of the process, both during meetings with ATO representatives and by email
- gained an understanding of the derivation of the population to be used in the calculation of benchmark ratios and ranges. In particular we looked at the number of businesses before and after each data cull.
- tested sample data, in particular that used to derive the ranges

36. The Small Business benchmarks document describes twelve steps. We have described our investigations in terms of these twelve steps:

Step 1 – Identification of industries to benchmark

37. There are 233 business industry codes and associated titles that have been chosen as having higher risk relevant to the cash economy. In essence, the identification of this initial set of industries is a policy decision.

38. Clearly some of the 233 industries are not suitable for benchmarking due to their small population size. Others may be excluded for policy reasons including assessment of their risk rating. It is more appropriate for us to comment on the methodological approach employed, once the 102 industries are chosen by the ATO. These 102 industries are shown in Appendix B.

Step 2 – Identify the starting population of the selected business industry codes

39. Having identified the 102 industries that are to be benchmarked, steps 2 and 3 of the process involve the attempt to define and produce appropriate populations prior to the calculation of any ratios. We sought clarification of some aspects of the process in steps 2 and 3, as well as requesting the numbers at each stage for the 2010-11 financial year.

40. Initially, starting populations are derived by culling some of the available data. The starting population includes businesses that

- Lodged their income tax return for the year to be benchmarked (as benchmarks for a particular year are derived from tax returns in that year)
- Are registered and have a current Australian Business Number (ABN)
- Are in one of the identified Business Industry Codes.

41. For the 2010-11 financial year there were 1,328,737 such entities.

42. The exclusions from the entire potential dataset must involve some judgement by the relevant staff of the ATO, but the exclusions at this point appear to be inherently sensible and reasonable.

43. The next stage of exclusions is to exclude certain businesses; those that are:

- currently insolvent (presumably these would not form a good benchmark)
- Deceased
- Are not a company, partnership, trust or individual sole trader – I understand this excludes entities such as superannuation funds
- In not for profit, government or large market segments
- A tax file number culled from the system (often for reasons of fraud)

44. Having made these exclusions the 1,328,737 entities reduce to 1,307,155, representing a reduction of 1.6%.

45. Again, these exclusions appear inherently sensible when considering the objective to reach a representative population prior to the calculation of any ratios.

46. The next set of filters (together with my comments) are:

- Limit to business income turnover between $30,000 and $15,000,000. I note this excludes a large number, reducing the 1,307,155 businesses down to 596,925 (i.e. by a further 54%)
- exclude those with mixed business activities (the IGT report includes commentary on the issue of mixed businesses – I concur with the view that it is difficult to compare mixed businesses. Their financial behaviour will be difficult to capture in a process which has the grouping of like businesses at its heart).
- exclude new businesses (so for the 2010-11 financial year, any businesses registered after July 2009 are excluded – presumably on the basis that set up costs involved in the establishment of a new business may distort the financial ratios. Further, newer businesses may have lower turnover in their initial stages)

47. These two exclusions reduce the 596,925 businesses down to 492,441 (i.e. by a further 17.5%).

48. All the exclusions are an attempt to derive a usable population for the calculation of ratios which will later be published as benchmarks. They are inherently sensible in attempting to gain relatively homogeneous groups. Other than their qualitative objective to remove records that may not be typical of the remaining groups, there is little to say regarding the statistical basis for the exclusions.

Step 3 – Industry allocation – Grouping of Businesses into Industry sub-groups

49. Having made the exclusions as described in Step 2, the next main step is to group businesses into sub-groups, being the 102 industry groups.

50. This is done on two bases (use of codes and keywords):

    First, the ATO bases sub-groups on Business Industry Codes; these are a modified version of the ANZSIC codes (Australian and New Zealand Standard Industry Classification). The ANZSIC codes represent a hierarchical four digit coding. The ATO achieves further stratification of business type with the addition of a fifth digit. The IGT report provides a description of the ANZSIC and Business Industry Codes (at Appendix 4).

51. Beginning with the five digit Business Industry Codes, some industries are further divided into sub-groups. Examples are given in the Small Business Benchmarks document, including the division of Business Industry Code 32430 into 3 industry sub-groups (Carpet laying services, Tiling services and Timber Floor Sanding).

52. The division is on the basis that the sub-group divisions are a further attempt to arrive at similar or like groups for the purpose of calculating benchmark ratios. For the three sub-groups, this heterogeneity is demonstrated by the different published ratios for each sub-group. The division of the Business Industry Code is useful as it produces three distinct sub-groups rather than an amalgam of three separate business types which share a Business Industry Code.

53. Other divisions are made on the basis of ATO knowledge regarding the characteristics of different businesses. As with the culling of data, as described in step 2 above, the objective is to produce like groups. From a statistical point of view, this qualitative approach should improve the homogeneity in a quantitative sense of the groupings.

54. The second basis uses key-words in an attempt to improve the groupings. This is another method to classify businesses into like groups. The example given in the Small Business Benchmarks document is the classification of entities with the same ANZSIC code into sub-groupings of Restaurants and Cafes.

55. The identification of relevant words such as “restaurant”, “coffee shop”, or “café” in a business description or name, allows the division of those businesses which have the same business industry code. In addition, the use of key words can also be used to classify businesses regardless of the business industry code.

56. For the 2010-11 benchmark year, there were 492,441 entities following the completion of the culling described in step 2. After the key-word process and the resultant assignment to benchmark industries, there were 403,908 entities remaining (i.e. a further 18% reduction).

57. Clearly the process of the selection of appropriate key words, and the division into particular sub-groups necessarily involves judgement on the part of the relevant staff of the ATO. However, I believe this is done in a sensible manner which assists in the production of benchmark groupings that contain sufficiently homogeneous groups of entities in terms of their essential business characteristics.

58. I understand that in the application of the benchmarks, and the identification of businesses for potential investigation, an equivalent process is followed. This ensures the business entity does indeed belong in the relevant industry and turnover range.

Step 4 – Calculation of the ratios

59. Section 2.4 of the SBB document describes the calculation of the benchmark ratios. The ratios are calculated on two bases; first, from the Income Tax Return, and second from Activity Statements.

60. For the Income Tax return ratios, all ratios use turnover (revenue from goods and services excluding GST) as the denominator. The benchmark ratios are:

- Total expenses / Turnover
- Cost of Sales / Turnover
- Labour / Turnover
- Rent / Turnover
- Motor Vehicle Expenses / Turnover

61. For the Activity Statement ratios, all ratios use the denominator of Total Sales (including GST), aggregating across a complete financial year. The benchmark ratios are:

- Non-capital purchases
- GST-free sales

62. Clearly some ratios are relevant to a lower proportion of businesses (e.g. GST-free sales). In turn, as the steps below shall outline, publishing of ratios depends on their being sufficient observations for a business industry and turnover range. Accordingly, the ratios with lower numbers of observations are less likely to be published as benchmark ratios.

63. The SBB document provides several descriptions of logical steps taken to ensure data integrity. In order to gain a better understanding of the source of the financial ratios we requested, and received, pro-forma blank copies of the relevant Income tax returns and activity statements. This enabled us to better understand some of the adjustments and checks used by the ATO.

Step 5 – Calculate and remove the outliers

65. Outliers are those observations that are considered to have values that are significantly different from the majority of other observations in the dataset.

66. The method to remove the outliers is the Mahalonobis Distance technique. In broad terms this technique is useful for identifying distance measured from a central point in an n-dimensional space.

67. As outlined in step 5, above, the possible ratios calculated from both tax returns and activity statements for a particular industry are:

- Cost of sales / turnover
- Total expenses / turnover
- Rent / turnover
- Motor vehicle expenses / turnover
- Non-capital purchases / total sales
- GST-free sales / total sales

68. In theory, each business' ratios could be compared with the distribution of all ratios for an industry as a whole. A distance measure would consider the degree to which the combined ratios differ from those of the industry. If the distance measure is higher than some pre-determined level, that business' ratios would all be excluded on the basis that in aggregate they are significantly different from those of the industry.

69. This is not the approach taken to removing outliers in the derivation of SBB. Rather than the exclusion of outliers occurring across all ratios combined for a business, each ratio is considered separately, with distance calculations being made for each individual ratio for a business.

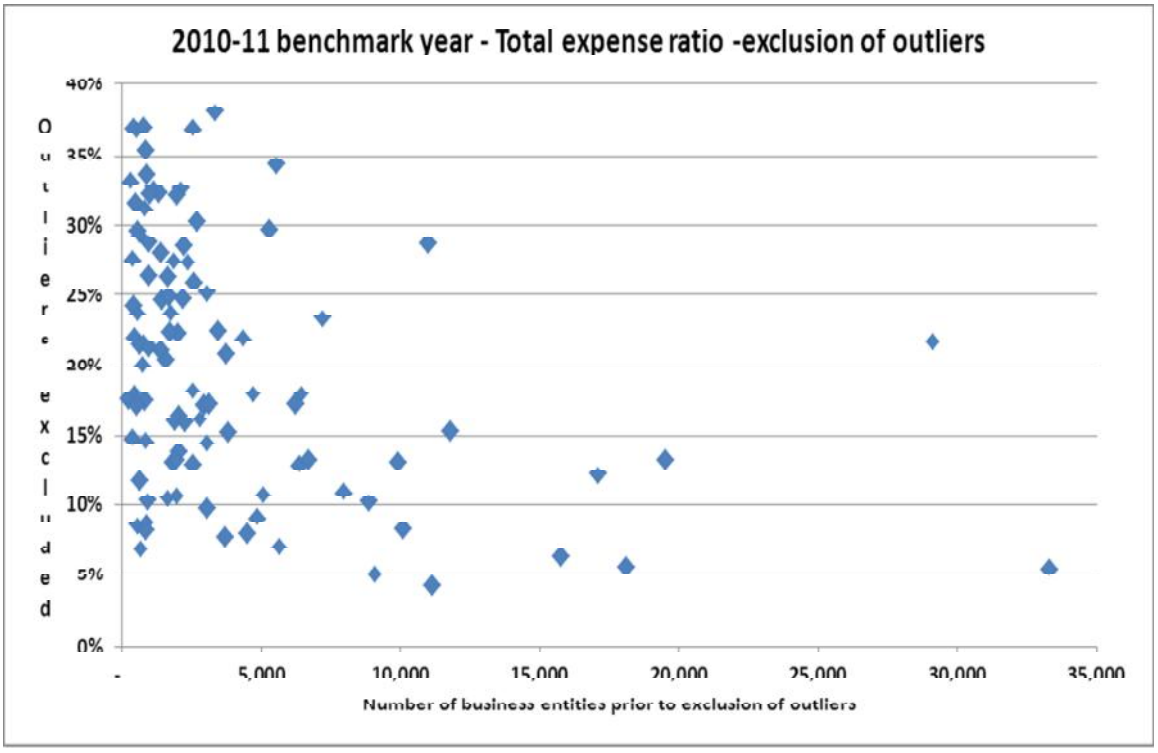
70. So for a given ratio, say Total expenses / turnover, a distance is calculated for each business' individual ratio. The ratio is excluded if the Mahalanobis distance is greater than two.

71. I make the following observations:

- It is possible to graph each ratio, for example, the ratio of total expenses / turnover could be graphed against turnover i.e a two dimensional graph. If a line was fitted to this relationship, distance from this line would achieve a similar (though not equivalent) result. This approach would effectively remove outliers if their standard deviation from the fitted line was greater than some pre-determined value.
- While the distance measures may be calculated without any judgement being involved, it is still necessary to apply some judgement in choosing the level.
- Given the calculations utilise a two dimensional calculation of distance, a symmetrical distribution and a distance threshold of 2, is expected to lead to the exclusion of 15-16% of observations as outliers. The data in Appendix B, where numbers pre and post outliers are shown result in such an exclusion across all 102 industries.
- As shall be seen later in step 7, further ratios are excluded from calculation when the ranges are calculated, with yet more exclusions prior to the publication of ratios. Accordingly, if this particular step was not performed a portion of the outliers would be excluded at a later step. It is important to note that the exclusion of the outliers at this step is made on the basis of the relationship between the ratio and turnover; that is an individual ratio will be excluded if it differs markedly from "typical"

ratios for that level of entity turnover. The exclusions in step 7 are made on a different basis.

- While we have not received detailed data regarding the outliers excluded in this step, we have observed scatter plots of the Total Expenses / Turnover ratio in the IGT report, the SBB document, and for data we requested to assess steps 6 and 7 (below). In each case we can observe significant proportions of ratios at or close to 100%. Given the clusters near this value, it is unlikely such values would be considered outliers; rather it is expected that excluded outliers would tend to be the lower values for the Total Expenses / Turnover ratio.
- It is stated in the SBB document that outlier exclusion may be "extreme cases, mistakes or not part of the population intended to be benchmarked". It should be remembered that outliers could also reflect entities engaged in the type of cash economy avoidance activities that the benchmarking is meant to detect. While it is appropriate to exclude these outliers from the development of published benchmarks, it would still seem correct to then assess these individual ratios against the benchmarks. For such ratios that are significantly above the published ranges, this could provide an indication of further investigation.
- Not surprisingly, as shown in the graph below it is those industries with fewer business entities that tend to have relatively more outliers excluded. Those industries with fewer entities will have greater relative variability in individual ratios.



Step 6 – Assign Turnover Ranges to Benchmark industries

72. The process of division of each of the 102 industries into turnover ranges involves some judgement as to the bounds of each range. Each industry has either two or three ranges which may be used for the publication of ratios.

73. In Step 2, above, it was noted that by definition, those businesses with turnover below $30,000 were excluded. This stage of the exclusion process eliminated a significant number of observations. However, examination of the published ranges, shows the lowest range (for 2010) as $50,000, with many industries having a low range of $65,000. So the published ranges, whether an average or a band for a particular industry and turnover range, exclude even more data than indicated in Step 2 (above).

74. For the 102 industries, the distribution of the bottom end of the lowest range are as follows:

Start point of lowest range	Number of industries
$50,000	36
$65,000	57
$75,000	4
$100,000	4
$400,000	1
Total	102

75. From discussions with the ATO, I understand the decision regarding this "floor" level of turnover for each benchmark industry is a matter of judgement, taking into consideration relevant aspects of each individual industry.

76. One aspect considered in the choice of the "floor" level is the threshold for GST registration. This threshold is the point at which a business entity must register for GST, although some businesses below the threshold still register for GST. I understand that prior to 30 June 2007, the threshold for GST registration was $50,000. Since then it has been $75,000. The first published benchmarks considered both these thresholds.

77. In general, retail businesses are expected to have higher turnover than service based businesses where the turnover reflects a greater proportion of labour on the part of the provider. As such retail businesses will tend to have a higher starting point (say, $65,000). Other industries, by their nature typically have a higher turnover (e.g. pubs), so have higher starting points.

78. For the top of the lowest range, and in turn the higher ranges, there is some judgement involved for the relevant analysts. While primarily looking at the Total Expenses/Turnover range, analysts look at scatter plots of the ratios by Turnover. I understand they are looking for ranges whereby the data within each range shall be "alike" and distinct from the other ranges. Apart from "eyeballing" the scatter plots, there are other considerations that influence the choice of range, including having sufficient entities in each range to increase statistical validity. It is also desirable to have homogeneity within each range (step 8).

79. In looking at this step, and the following step (7), we have three broad aims, (i) gain a better understanding of the assignment of turnover ranges and its statistical validity, (ii) test the establishment of turnover ranges, and (iii) gain insight into the sensitivity of the published bands of ratios to the turnover ranges.

80. In order to achieve these objectives, we chose six relevant industries (two smaller, two medium, and two larger), and requested some underlying data from the ATO.

81. The requested data was provided for the following industries

- Entertainment media retailing (smaller)
- Ice cream retailing (smaller)
- Beauty services (medium)
- Sports, camping and fishing retailing (medium)
- Electrical services (larger)
- Plumbing services (larger)

82. The initial data provided showed Sales (Turnover) for each relevant business as well as ratios based on tax return information, being the Total Expense ratio, and the Cost of Goods Sold ratio. We were also provided with relevant data for ratios from the Activity statement.

83. This was the extent of the information provided for the six industries, so no data was provided that could identify an individual entity. In order to further protect the confidentiality of the data, Sales were stratified into bands of $5,000, rather than the raw dollar amount being provided. Given the stratification of the data into bands of Sales is consistent with the classification of the data into turnover ranges, the lack of precise turnover data has no effect on our analysis.

Step 7 – Calculation of the Benchmark Ranges

84. The process of establishment of benchmark ranges is described in the SBB document.

85. Having chosen ranges, as described in Step 6, the process for each range is as follows:

- Calculate arithmetic mean of ratios in each range
- Having calculated the mean, calculate the absolute difference of each ratio from the mean within the range
- Choose a range that represents 30% of the population within that range – the range is not necessarily symmetrical around the mean. As it minimises the aggregate absolute differences calculated in the preceding step, it will include the mean, but won't necessarily have an equal number of observations above and below the mean. Round the top and bottom points (i.e. ratios) of each range to the nearest percentage point. The rounding means the ranges can be greater or less than 30% of that range's population.

86. Initially we replicated the published ratios for each of the six industries. We were able to re-produce the results as provided when adopting the same ranges as selected by the ATO analysts. These ratios are shown in Appendix A, below.

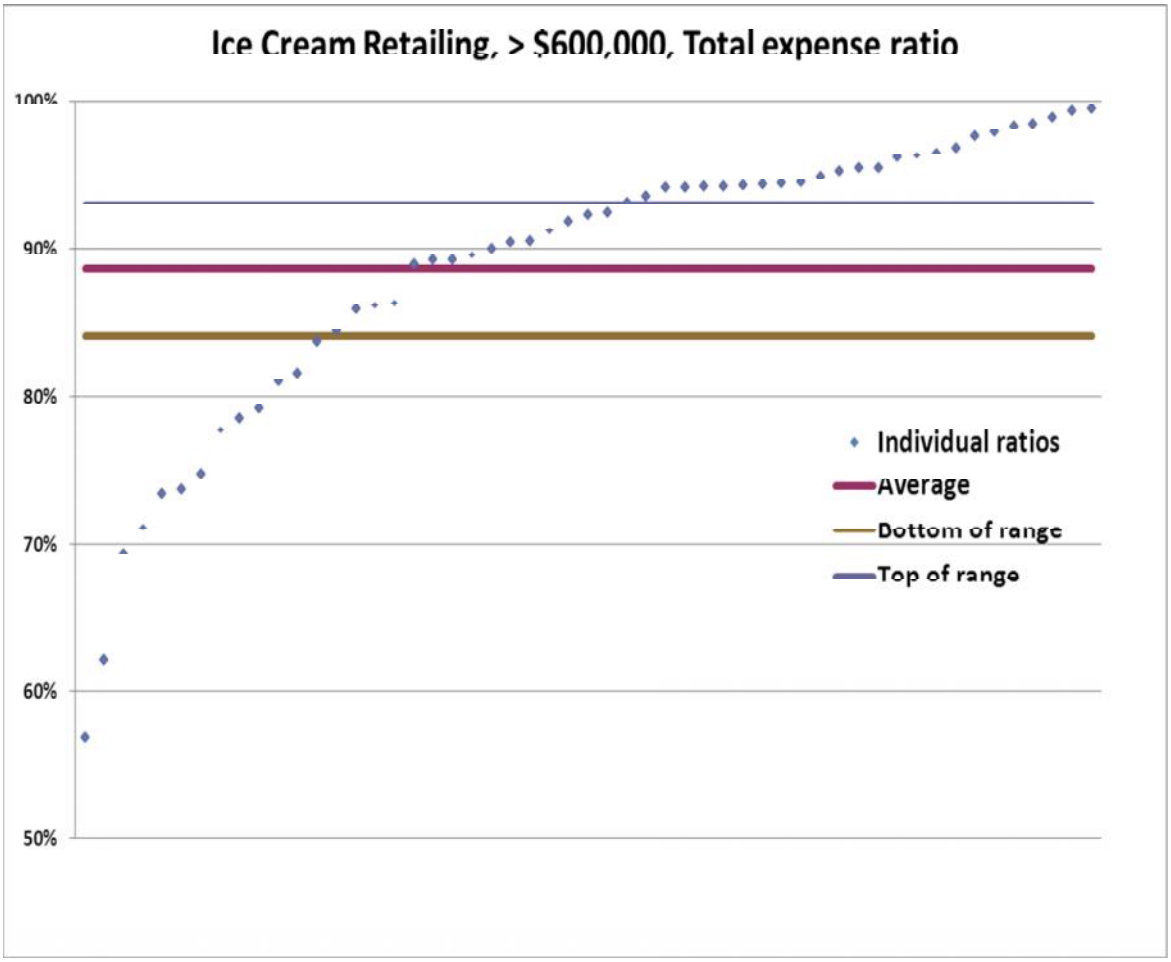
87. We also were able to check these ratios against those published on the Small Business Benchmarks pages of the ATO website.

88. As noted above, the published ranges are rounded to the nearest percentage, which can result in more or less than 30% of the population in the published range. For example, the medium range for the Total expenses ratio for Ice Cream retailing covers about 34% of the medium range population.

89. The decision to make the published range cover about 30% of a turnover range's population is a policy decision, but we note that given it is a relatively narrow range, there are many observations that are outside the range.

90. It should be remembered that for a ratio such as Total Expenses /Turnover, entities with ratios below the mean are not a cause for concern unlike those with high values for this ratio. Entities with a low value are effectively declaring relatively high profit margins compared to their peers so are less likely to be in breach. It is the entities with higher Total Expenses /Turnover ratios that are of greater concern.

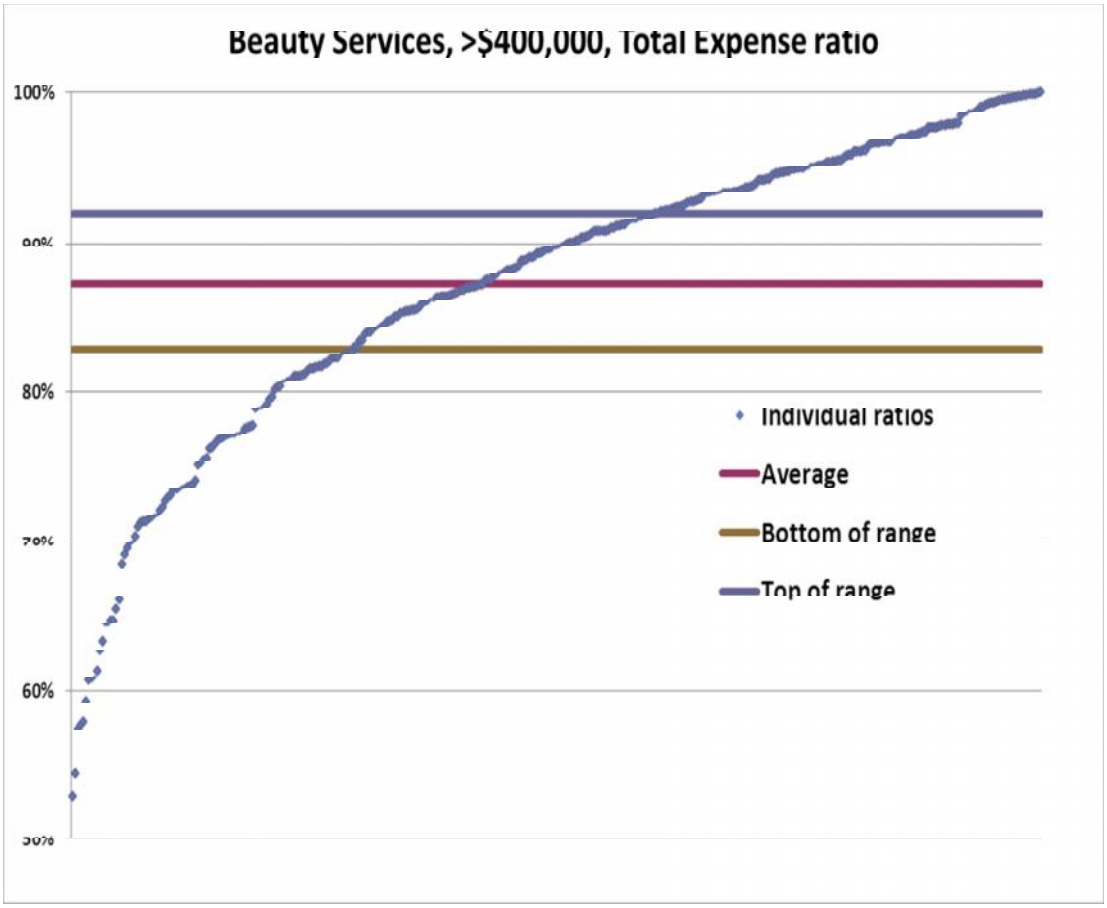
91. The graph below shows a plot of the individual Total Expenses /Turnover ratios for the "High" turnover range (greater than $600,000) for Ice Cream Retailing. The horizontal lines show the average, as well as the upper and lower bands for the published ratios (84% to 93%).



92. As the plot of the individual ratios for each entity show, the progression is not smooth and symmetrical. The published range captures the observations surrounding the mean, but as this range is intended to cover only 30% of the range population, there are many entities' ratios outside the range. Concentrating on those entities with ratios above the top of the published range, there are 24 entities (out of a population of 53) with ratios above the range.

93. Ice Cream retailing is an industry with relatively low numbers of members; indeed the "High" range population is only just above the minimum threshold (of 50) for publication for a key benchmark ratio (Step 8).

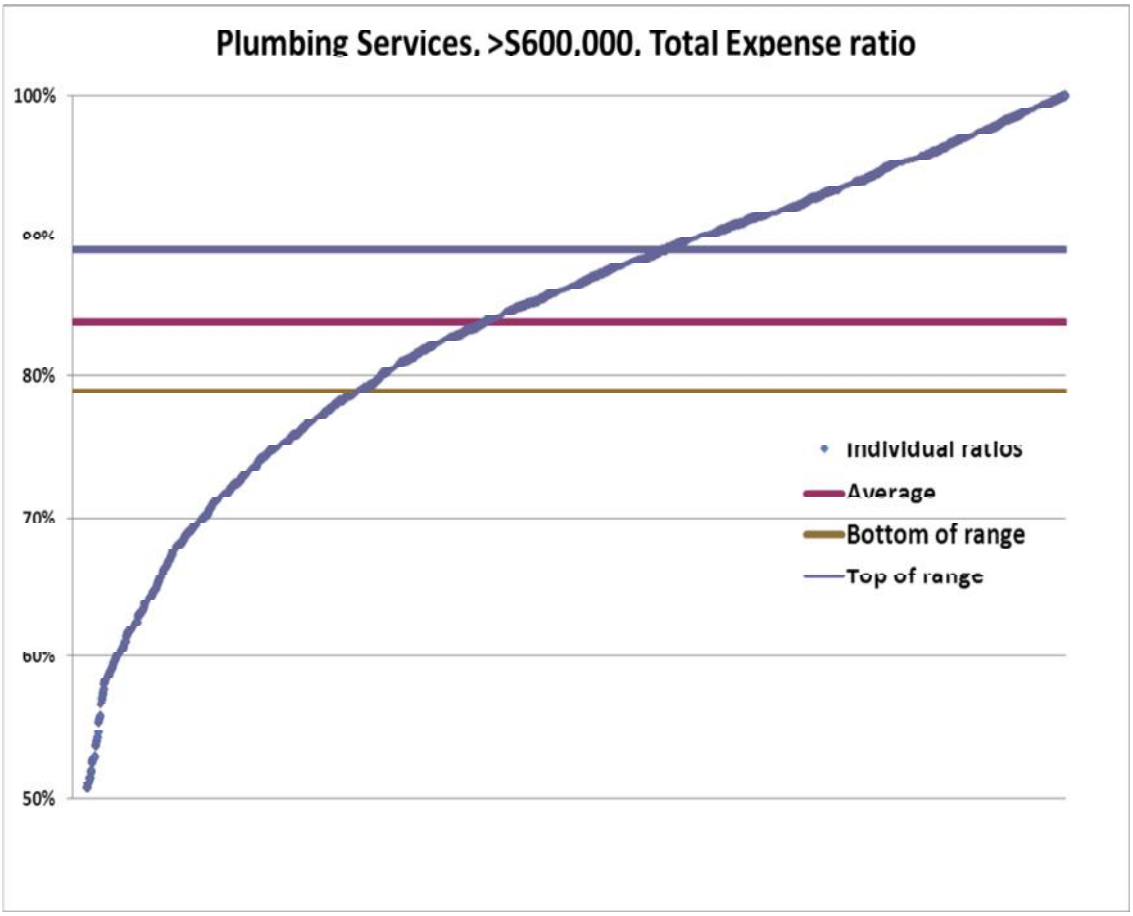
94. A similar graph may be derived for Beauty Services. As one of the selected "medium-sized" industries, the "High" range (more than $400,000 turnover) for Beauty Services contains 355 entities in the population for the Total Expenses /Turnover ratio.



95. Nevertheless, it may be observed that there are 130 entities with Total Expenses /Turnover ratios higher than the top of the published range. This represents about 37% of the "High" population for the Total Expenses /Turnover ratio.

96. For a selected “Large” industry, such as Plumbing Services, there are even greater numbers of entities within the population. For the “High” range (more than $600,000 turnover) for Plumbing Services, there are 2,114 business entities.

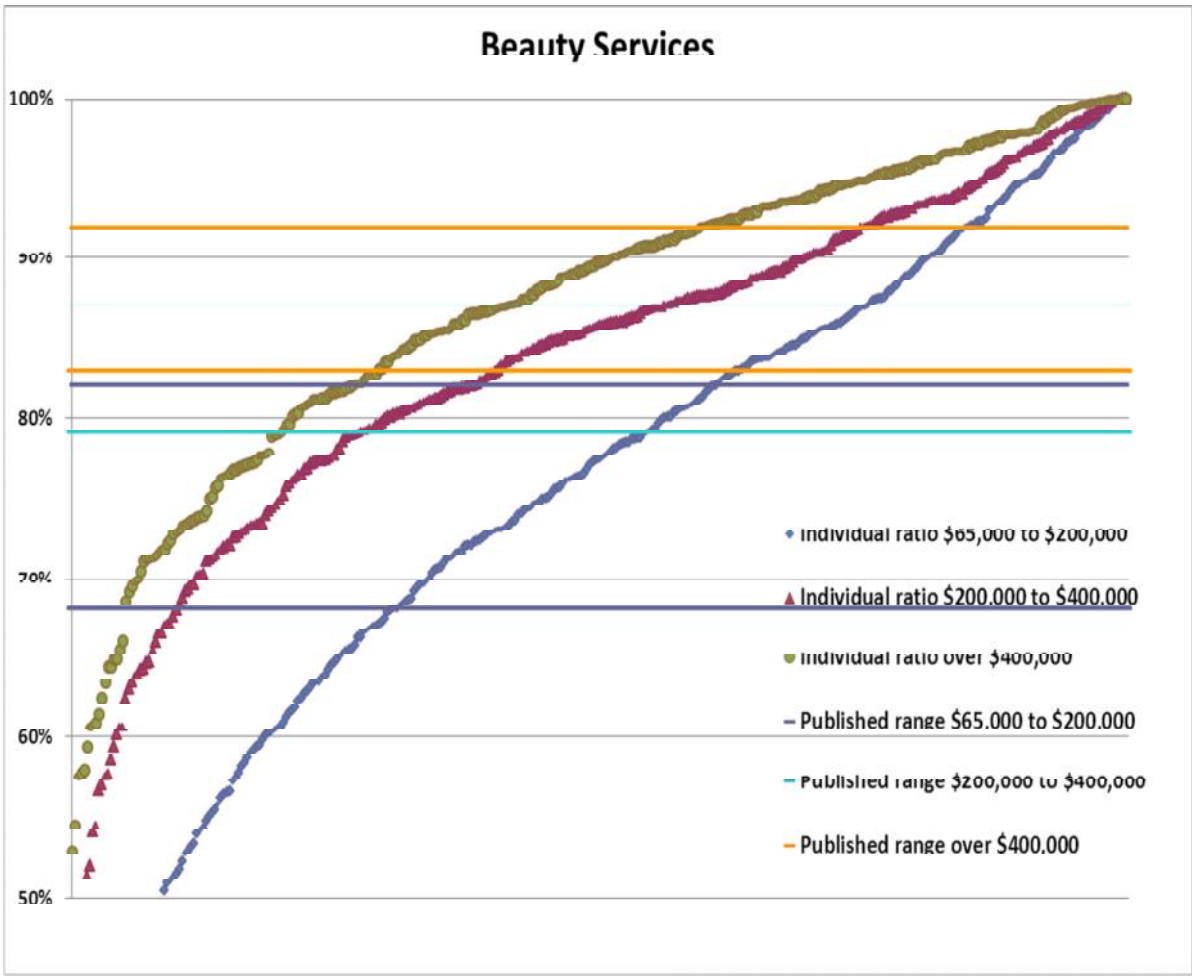
97. The distribution of ratios as shown in the plot below appears to be a lot smoother than the previous graphs. This reflects the larger number of entities.



98. For Plumbing Services there are 810 entities (or about 38%) that have Total Expenses /Turnover ratios higher than the upper threshold of the published ratio.

99. It may be observed that the published range in each of the three graphs above is quite narrow, as it is selected to only encompass 30% of the observations within each range. The top and the bottom of the range are selected so the 30% range minimises the differences in absolute value from the average. In other words, rather than take 15% on each side of the average, the range is effectively shifted slightly so a flatter part of the distribution will form the range.

100. In general, the "High" range for the Total Expenses /Turnover ratio exhibits a greater degree of variability that the "Low" or "Medium" range. The graph below is adjusted to show the three ranges on the same axes for the "Low", "Medium" and "High" ranges.



101. The "Low" range ($65,000 to $200,000 turnover) contains the highest population. It may be observed that this range is relatively less skewed than the "Medium" ($200,000 to $400,000 turnover) or "Large" (over $400,000 turnover) ranges. The "Low" range also has a wider range (68% to 82%) than the "Medium" or "Large" range.

102. The percentage of entities with Total Expenses / Turnover range higher than the top end of the published range are 38% for the "Low" range, 41% for the "Medium" range, and 37% for the "High" range.

103. Our analysis has confirmed the correct calculation of averages and ranges for the Total Expenses / Turnover, and Cost of Sales / Turnover benchmarks; that is the calculations are in accordance with the description provided in the SBB document. Further the resulting benchmarks are the same as those published on the ATO website.

104. The decision to publish ranges (provided the tests of step 8 are met) that reflect a band containing 30% of the range population is a policy decision. However, this choice has implications, in that high proportions of entities exhibit ratios that are higher than the published bands.

105. In making a comparison between an individual business entity's ratio and the published benchmark, relevant staff of the ATO must be aware of the large proportions of entities that are higher than the published ranges. If using the ratio (together with other measures) to select an entity as a candidate for audit, it would seem reasonable to only select entities with ratios significantly above the published ratios.

106. Clearly the use of benchmark ratios cannot be a sole indicator of breaches regarding the cash economy, but it is reasonable to expect that entities with a higher probability of breach would exhibit a higher Total Expenses / Turnover or Cost of Sales / Turnover ratio.

107. In order to capture just the top 5% in each range for Beauty Services, the top end of each range would be as follows:

Beauty services – top of range

Key benchmark ratio	**Annual turnover range**		
	$65,000 - $200,000	$200,000 - $400,000	More than $400,000
Cost of sales/turnover published	25%	24%	24%
Only 5% of population higher	41%	37%	35%
Total expenses/turnover published	82%	87%	92%
Only 5% of population higher	97%	98%	99%

108. In statistical terms, the calculations of the ranges is valid, but the analysis above shows the relationship between the chosen ranges (broadly reflecting 30% of the population) and the subsequent use. In applying the ratios, particularly to identify potential audit targets, it would not be reasonable to choose a business entity with a ratio slightly above the published band.

109. The distribution and skewness of ratios within each turnover range determines the width of ranges that capture differing proportions of the population. The preceding table shows differing amounts between the top of the published bands and a band designed to exclude only the top 5% of individual ratios.

110. The ATO may consider the publication of other bands for internal use, particularly for audit targeting. These could be constructed on the basis of traffic lights, whereby bands could be calculated reflecting red, amber or green risk profiles.

111. From their past experience, the ATO may be able to reach an appropriate "a priori" expectation of the proportion of businesses in an industry that shall require further investigation. This proportion could then be used as the basis to calculate ranges of ratios for ATO internal use. Such ranges could better formalise the identification of entities whose ratios are "significantly outside the published ranges".

Alternative range testing

112. As stated earlier, the establishment of turnover ranges (generally "Low", "Medium" and "High") requires some judgement. In order to better understand the impact of the chosen ranges, we re-calculated the average and "published" ratio ranges, after changing the turnover ranges.

113. The results are shown in Appendix A, following the Key benchmark ratios which were published, and confirmed in our calculation.

114. An analysis of these alternative calculations yields few surprises. The "published" ratios vary from the actual published ratios as would be expected; a greater turnover range leads to a greater range of ratios in the 30% band surrounding the mean.

115. These alternative calculations confirm the view that while the statistical methodology and calculation is correct, the usage of the ratios is circular. Ratios should only be used for benchmarking the relevant industry and turnover range for which they have been derived.

Step 8 – Normality and Homogeneity Testing

116. The selection of key benchmark ratios and secondary benchmark ratios for publication is dependent on normality and homogeneity testing.

117. Given the earlier steps of the culling of the starting population, the exclusion of outliers, the further exclusion of entities with turnover from $30,000 to the bottom end of the "Low" range, and the classification into 2/3 turnover ranges, the final groupings for analysis and potential publication have been significantly adjusted. Accordingly it would be surprising if a large number did not meet the normality and homogeneity tests, at least for those industries with larger populations.

118. It is those industries and turnover ranges with smaller populations that could fail these tests, leading to a decision not to publish the benchmark ratios.

Step 9 – Review of the Benchmark Ratio Output – Quality Assurance and Other Testing

119. This step involves several tests to provide confidence of correct calculation, and accordance with expectation. The steps include:

- Comparison with previous year's benchmarks, on the expectation there would not be significant variation in the space of a year.
- Size and spread across the benchmark range, whereby those ranges that are relatively wide are investigated further.
- Trends of the benchmark ratios across a turnover range. For most industries it would be reasonable to expect consistent patterns across the three turnover ranges (e.g. middle range between low and high ranges). Any discrepancies are investigated.

120. These processes are sensible, and another indicator of the thorough approach taken by the ATO in the derivation of the Benchmarks.

Step 10 – Preparation of Industry Names and Overviews
Step 11 – Preparation of Documents for Publication
Step 12 – Small Business Benchmark Publication Approval

These steps are primarily policy decisions without statistical methodology implications.

Appendix A – Turnover ranges: 2010 Financial year

1. Entertainment media retailing

Confirmation of calculations, published on Small Business Benchmark website

Entertainment media retailing – key ratio population counts

	Low	Medium	High
Total expenses	142	85	51
Cost of sales	152	113	69

Entertainment media retailing – key benchmark ratios and turnover ranges

Key benchmark ratio	Annual turnover range		
	$65,000 - $350,000	$350,000 - $1,000,000	More than $1,000,000
Income tax return			
Cost of sales/turnover	41% - 59%	42% - 62%	55% - 65%
Average cost of sales	50%	52%	59%
Total expenses/turnover	72% - 85%	86% - 94%	90% - 94%
Average total expenses	79%	90%	92%

Alternative calculations, with varied annual turnover ranges

Entertainment media retailing – key ratio population counts

	Low	Medium	High
Total expenses	154	86	62
Cost of sales	157	114	83

Entertainment media retailing – key benchmark ratios and turnover ranges

Key benchmark ratio	**Annual turnover range**		
	$50,000 - $300,000	$300,000 - $900,000	More than $900,000
Income tax return			
Cost of sales/turnover	40% - 59%	44% - 62%	52% - 65%
Average cost of sales	49%	53%	58%
Total expenses/turnover	70% - 82%	84% - 94%	89% - 94%
Average total expenses	76%	89%	92%

2. Ice cream retailing

Confirmation of calculations, published on Small Business Benchmark website

Ice cream retailing – key ratio population counts

	Low	Medium	High
Total expenses	65	148	53
Cost of sales	113	177	64

Ice cream retailing – key benchmark ratios and turnover ranges

Key benchmark ratio	**Annual turnover range**		
	$65,000 - $250,000	$250,000 - $600,000	More than $600,000
Income tax return			
Cost of sales/turnover	30% - 39%	30% - 34%	30% - 32%
Average cost of sales	34%	32%	31%
Total expenses/turnover	80% - 85%	86% - 92%	84% - 93%
Average total expenses	82%	89%	89%

Alternative calculations, with varied annual turnover ranges

Ice cream retailing – key ratio population counts

	Low	Medium	High
Total expenses	**57**	**148**	**75**
Cost of sales	**103**	**179**	**93**

Ice cream retailing – key benchmark ratios and turnover ranges

Key benchmark ratio	**Annual turnover range**		
	$50,000 - $200,000	$200,000 - $500,000	More than $500,000
Income tax return			
Cost of sales/turnover	29% - 40%	30% - 35%	29% - 32%
Average cost of sales	34%	33%	31%
Total expenses/turnover	77% - 83%	84% - 91%	86% - 93%
Average total expenses	78%	87%	90%

3. Beauty Services

Confirmation of calculations, published on Small Business Benchmark website

Beauty services – key ratio population counts

	Low	Medium	High
Total expenses	**1,160**	**516**	**355**
Cost of sales	**1,002**	**559**	**376**

Beauty services – key benchmark ratios and turnover ranges

Key benchmark ratio	Annual turnover range		
	$65,000 - $200,000	**$200,000 - $400,000**	**More than $400,000**
Income tax return			
Cost of sales/turnover	**17% - 25%**	**17% - 24%**	**18% - 24%**
Average cost of sales	**21%**	**21%**	**21%**
Total expenses/turnover	**68% - 82%**	**79% - 87%**	**83% - 92%**
Average total expenses	**75%**	**83%**	**87%**

Alternative calculations, with varied annual turnover ranges

Beauty services – key ratio population counts

	Low	Medium	High
Total expenses	1,231	878	244
Cost of sales	985	926	256

Beauty services – key benchmark ratios and turnover ranges

Key benchmark ratio	**Annual turnover range**		
	$50,000 - $150,000	$150,000 - $500,000	More than $500,000
Income tax return			
Cost of sales/turnover	16% - 25%	17% - 23%	18% - 25%
Average cost of sales	21%	20%	21%
Total expenses/turnover	64% - 79%	79% - 87%	83% - 92%
Average total expenses	72%	83%	87%

4. Sports, camping and fishing retailing

Confirmation of calculations, published on Small Business Benchmark website

Sports, camping and fishing retailing – key ratio population counts

	Low	Medium	High
Total expenses	379	721	675
Cost of sales	447	869	827

Sports, camping and fishing retailing – key benchmark ratios and turnover ranges

Key benchmark ratio	**Annual turnover range**		
	$65,000 - $250,000	$250,000 - $750,000	More than $750,000
Income tax return			
Cost of sales/turnover	54% - 65%	56% - 65%	60% - 65%
Average cost of sales	59%	60%	62%
Total expenses/turnover	78% - 88%	84% - 91%	89% - 94%
Average total expenses	83%	87%	91%

Alternative calculations, with varied annual turnover ranges

Sports, camping and fishing retailing – key ratio population counts

	Low	Medium	High
Total expenses	**706**	**548**	**568**
Cost of sales	**829**	**664**	**697**

Sports, camping and fishing retailing – key benchmark ratios and turnover ranges

Key benchmark ratio	Annual turnover range		
	$50,000 - $400,000	**$400,000 - $900,000**	**More than $900,000**
Income tax return			
Cost of sales/turnover	**54% - 65%**	**57% - 65%**	**59% - 65%**
Average cost of sales	**60%**	**61%**	**62%**
Total expenses/turnover	**80% - 89%**	**85% - 92%**	**89% - 94%**
Average total expenses	**84%**	**89%**	**91%**

5. Electrical services

Confirmation of calculations, published on Small Business Benchmark website

Electrical services – key ratio population counts

	Low	Medium	High
Total expenses	7,957	3,787	3,094

Electrical services – key benchmark ratios and turnover ranges

Key benchmark ratio	**Annual turnover range**		
	$50,000 - $200,000	$200,000 - $500,000	More than $500,000
Income tax return			
Total expenses/turnover	54% - 69%	65% - 79%	78% - 88%
Average total expenses	61%	72%	83%

Alternative calculations, with varied annual turnover ranges

Electrical services – key ratio population counts

	Low	**Medium**	**High**
Total expenses	**9,930**	**2,717**	**2,191**

Electrical services – key benchmark ratios and turnover ranges

Key benchmark ratio	Annual turnover range		
	$50,000 - $300,000	**$300,000 - $700,000**	**More than $700,000**
Income tax return			
Total expenses/turnover	**55% - 70%**	**70% - 83%**	**80% - 89%**
Average total expenses	**63%**	**76%**	**85%**

6. Plumbing services

Confirmation of calculations, published on Small Business Benchmark website

Plumbing services – key ratio population counts

	Low	Medium	High
Total expenses	**5,745**	**5,521**	**2,114**

Plumbing services – key benchmark ratios and turnover ranges

Key benchmark ratio	Annual turnover range		
	$50,000 - $150,000	**$150,000 - $600,000**	**More than $600,000**
Income tax return			
Total expenses/turnover	**50% - 67%**	**66% - 79%**	**79% - 89%**
Average total expenses	**59%**	**72%**	**84%**

Alternative calculations, with varied annual turnover ranges

Plumbing services – key ratio population counts

	Low	Medium	High
Total expenses	7,287	3,529	2,564

Plumbing services – key benchmark ratios and turnover ranges

Key benchmark ratio	**Annual turnover range**		
	$50,000 - $200,000	$200,000 - $500,000	More than $500,000
Income tax return			
Total expenses/turnover	53% - 69%	68% - 79%	78% - 88%
Average total expenses	**61%**	**74%**	**83%**

Appendix B - Exclusion of outliers

Industry Group	2011 Financial year			2010 Financial year		
	Number after outliers excluded	Number before outliers excluded	Proportion excluded	Number after outliers excluded	Number before outliers excluded	Proportion excluded
Total	334,662	397,540	16%	340,727	403,236	16%
Air conditioning, refrigeration and heating services	3,771	4,578	18%	3,868	4,714	18%
Alarm installation services	1,576	1,926	18%	1,613	1,918	16%
Architectural services	7,226	8,052	10%	7,095	7,963	11%
Automotive electrical services	1,994	2,342	15%	1,926	2,289	16%
Bakeries and hot bread shops	2,476	3,000	17%	2,453	2,962	17%
Barber and men's hairdressing	650	696	7%	620	666	7%
Beauty services	2,984	3,810	22%	2,972	3,754	21%
Blocklaying services	548	621	12%	537	587	9%
Book retailing	644	926	30%	606	913	34%
Bottle shops and liquor retailing	760	1,089	30%	782	1,161	33%
Bricklaying services	8,725	9,244	6%	8,620	9,078	5%
Cabinet makers	5,429	6,676	19%	5,289	6,445	18%
Cake shops and patisseries	468	601	22%	446	585	24%
Carpentry services	30,396	32,190	6%	31,484	33,314	5%
Carpet laying services	3,694	4,059	9%	4,142	4,500	8%
Catering services	1,454	1,899	23%	1,562	2,012	22%
Cement rendering	820	908	10%	810	888	9%
Chicken shops	395	515	23%	371	476	22%
Child care services	3,988	4,516	12%	4,555	5,103	11%
Chiropractic and osteopathic services	2,686	2,953	9%	2,775	3,076	10%
Cleaning services - building and other industrial	14,180	15,179	7%	14,773	15,764	6%
Cleaning services - carpet, rug and furniture upholstery	913	999	9%	846	943	10%
Clothing retailing	3,594	5,381	33%	3,641	5,541	34%
Coffee shops	4,006	5,854	32%	3,738	5,321	30%
Computer retailing	1,643	2,235	26%	1,667	2,216	25%
Concreting services	7,981	8,916	10%	7,975	8,880	10%
Confectionery retailing	255	358	29%	224	335	33%
Courier services	8,403	9,583	12%	8,626	9,926	13%
Craft shops	405	621	35%	337	533	37%
Delicatessen	684	870	21%	609	777	22%
Delivery services	2,545	2,909	13%	2,236	2,568	13%
Dental specialists	577	634	9%	558	632	12%
Dental surgeons	5,325	6,027	12%	5,577	6,400	13%
Discount and variety stores	339	430	21%	330	436	24%
Domestic appliance repair and maintenance	1,687	1,917	12%	1,589	1,829	13%
Driving schools and instructors	1,506	1,710	12%	1,496	1,671	10%
Electrical and electronic product retailing	1,560	2,173	28%	1,610	2,252	29%
Electrical services	16,317	18,914	14%	16,952	19,536	13%
Entertainment media retailing	356	550	35%	340	497	32%
Fence construction	2,456	2,962	17%	2,360	2,813	16%
Fish and chips shops	791	945	16%	752	880	15%
Fish and seafood retailing	518	668	22%	499	635	21%
Floor covering retailing	1,341	1,752	23%	1,359	1,782	24%
Florists	1,069	1,482	28%	1,079	1,432	25%
Footwear retailing	684	962	29%	695	975	29%
Fruit and vegetable retailing	1,354	1,756	23%	1,343	1,731	22%
Fuel retailing	1,388	1,907	27%	1,349	1,859	27%
Furniture removalists	692	870	20%	683	827	17%
Furniture retailing	1,450	2,140	32%	1,439	2,133	33%
Garden supplies retailing	1,457	2,080	30%	1,347	1,984	32%
Gift stores	1,006	1,453	31%	908	1,341	32%
Glazing services	1,789	2,068	13%	1,758	2,038	14%
Grocery retailing and convenience stores	3,486	4,426	21%	3,398	4,352	22%
Hairdressers	9,378	11,121	16%	10,007	11,808	15%
Hardware and building supplies retailing	1,770	2,417	27%	1,727	2,378	27%
Health and fitness centres	2,314	3,016	23%	2,687	3,468	23%
Health food retailing	445	629	29%	408	580	30%
Homewares retailing	622	908	31%	674	994	32%
Ice cream retailing	302	470	36%	263	417	37%
Kebab shops	198	249	20%	198	240	18%
Landscape construction	5,554	6,413	13%	5,836	6,728	13%
Laundry and dry-cleaning services	1,279	1,615	21%	1,271	1,599	21%
Lawn mower retailing	340	412	17%	341	400	15%
Lawn mowing and garden services	8,698	9,472	8%	9,256	10,089	8%
Machinery and equipment repairs and maintenance	1,417	1,642	14%	1,678	1,935	13%
Manchester and other textile goods retailing	1,025	1,446	29%	1,009	1,403	28%
Meat and poultry retailing	2,172	2,643	18%	2,097	2,563	18%
Motor vehicle parts and batteries retailing	644	856	25%	706	959	26%
Motor vehicle retail	1,678	2,617	36%	1,617	2,561	37%
Musical instruments retail	292	416	30%	292	403	28%
Newsagents	2,017	2,705	25%	1,925	2,601	26%
Painting services	16,728	17,791	6%	17,086	18,115	6%
Panel beating and smash repairs	5,171	6,335	18%	5,156	6,229	17%
Pest control services	1,728	1,908	9%	1,759	1,969	11%
Pets and pet supply retailing	550	818	33%	578	840	31%
Pharmacy	2,680	3,096	13%	2,604	3,145	17%

Appendix B - Exclusion of outliers

	2011 Financial year			2010 Financial year		
Industry Group	Number after outliers excluded	Number before outliers excluded	Proportion excluded	Number after outliers excluded	Number before outliers excluded	Proportion excluded
Physiotherapy services	3,216	3,467	7%	3,417	3,703	8%
Picture framing retailing	474	563	16%	440	531	17%
Pizza shops	851	1,116	24%	766	973	21%
Plastering and ceiling services	10,567	11,114	5%	10,661	11,140	4%
Plumbing services	14,637	16,782	13%	15,034	17,122	12%
Printing	2,333	3,140	26%	2,298	3,070	25%
Printing support services	1,230	1,671	26%	1,210	1,642	26%
Pubs, taverns and bars	2,035	3,437	41%	2,083	3,364	38%
Restaurants	7,204	10,216	29%	7,855	11,005	29%
Road freight transport services	22,647	29,270	23%	22,795	29,125	22%
Roofing services, including roof tiling, guttering and me	4,410	4,876	10%	4,425	4,870	9%
Sports and physical recreation instruction	2,755	3,271	16%	2,614	3,055	14%
Sports, camping and fishing retailing	1,888	2,638	28%	1,895	2,717	30%
Stationery goods retailing	473	633	25%	459	649	29%
Takeaway food services	5,047	6,696	25%	5,518	7,203	23%
Tiling services	5,474	5,920	8%	5,272	5,669	7%
Timber floor sanding	804	873	8%	806	878	8%
Tobacco retailing	386	461	16%	386	471	18%
Towing services	575	744	23%	598	748	20%
Toy and game retailing	491	744	34%	496	788	37%
Tutoring and coaching	2,939	3,481	16%	3,243	3,824	15%
Tyre retailing	1,080	1,367	21%	1,119	1,418	21%
Veterinary services	1,728	2,014	14%	1,720	2,060	17%
Video and other electronic media rental and hiring	627	964	35%	547	846	35%
Watch and jewellery retailing	1,348	1,755	23%	1,276	1,698	25%