Annex 13
Review of core tourism statistics – New Zealand Tourism Research Council. [1]

Recommendation 51 of the full report indicates "Investigate whether the methods of expenditure estimation used in the Domestic Travel Survey can be applied to the International Visitor Survey".

The following paragraphs have been presented as supportive arguments.

"The usual estimator given a complex sample design is the 'rate-up' estimator (also called the Horvitz-Thompson or 'simple expansion' estimator) which takes the sample values and multiplies them by the inverse of the selection probability. Often more accurate estimates can be obtained for the same sample size by using auxiliary information and a (typically regression) model relating the auxiliary information to the variable(s) of interest. Such estimators are commonly called model-assisted estimators. Examples of them include the post-stratification estimator and the ratio estimator. In the former case we assume a 'cells means' regression model, where the dummy variables are defined by the post-stratification cells, that is, regressor X_j for observation i is 1 if observation i is in the post-strata j and zero otherwise. In the latter, we assume a linear regression on the auxiliary variable with no intercept and where the residual error structure is heterogeneous, in particular, the variance of the residuals is proportional to the value of the auxiliary variable.

A key feature of the 'rate-up' estimator is that it is unbiased so that the measure of accuracy is simply its sampling variance. However the 'regression' estimators are biased (typically because they involve ratios of random variables) with the bias usually proportional to the inverse of the sample size; that is, as the sample size increases the bias becomes very small relative to the sampling variance. With these 'regression' estimators the measure of accuracy is the mean square error: sampling variance plus sampling bias squared. Clearly the mean square error of an unbiased estimator is simply its sampling variance.

Hence it can be the case that a 'regression' estimator has much smaller sampling variance than the 'rate-up' estimator but its mean square error is greater than that of the 'rate-up' estimator because the 'regression' estimator has a large bias.

Total expenditure is estimated in the IVS using post-stratification cells defined by a combination of the visitor's country of last permanent residence, and which airport the visitor is leaving from. In the process of producing forecasts of tourism data McDermott-Fairgray suggested that an improved estimator of total expenditure would be obtained by using average length of stay and average daily expenditure; in effect an expenditure per day model".

Harry Smith (2000) reviewed these and other competing estimators. His conclusion was that, in part, the differences between the current estimate and the expenditure per day method was due to the latter estimator having a larger bias because of very small cell sizes. This work suggests that detailed analysis is needed

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before moving from the 'rate-up' estimator or simple post-stratified estimator with large cell sizes to more complicated model assisted estimators. Apparent gains in reduced variance can easily be offset by increases in bias. Moreover, Harry Smith's work considered one year of the IVS. It is likely that more complicated models will show instability across years, for example the models might change from year to year.

The response rate for detailed expenditure is very low in the International Visitor Survey (approximately 20%). Using the limited data available for imputing or calculating mean cost factors may introduce considerable bias. Thus there is a need for obtaining expenditure data from other sources to supplement the data collected.

A methodology similar to that used in the Domestic Travel Survey could be used to estimate transport costs. It may also be possible to estimate expenditure for some categories based on the activities undertaken (by deriving mean cost factors for the main activities). The recall of activities undertaken is generally more reliable than the recall of expenditure, and this methodology may provide more reliable estimates than the current method of applying estimates of average daily spend across diverse destinations.