MULTISTATE TAX COMMISSION

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Statistical Sampling Procedures

Purpose

The purpose of this document is to provide taxpayer's with an overview of the statistical sampling procedures used by the Commission when conducting statistical samples. For a more detailed description of our procedures the taxpayer should refer to the *MTC Sampling Manual* (available at www.mtc.gov).

If you have concerns about any of these details, please let us know about them as soon as possible. It is best to discuss these issues prior to the selection of the sample items. Also, input is greatly appreciated on any of these topics.

Refining the Population

From the download of data, decisions are made on what to sample, what to ignore, and what to examine on a detailed basis. Refining the population to the items of interest is highly recommended and does not introduce bias into the random sampling process. What is important to remember is that it is acceptable to use judgment in removing items from the population and randomly sampling what remains. A random sample of the remaining population is still a random sample. What is not acceptable is projection of tax differences to items removed from the population prior to sampling.

a) Handling of Negative Items

A negative item does not refer to a tax credit. A negative item is an invoice, invoice line item or other sampling unit that reduces the invoice or book value of the underlying transaction recorded in the books and records. Often, these are called "accounting adjustments". Such items could be correcting entries, adjusting entries, voided invoices, credit memos and the like. Ideally, any "negative" unit should be matched with any corresponding "positive". Removal of all negatives and matched positives from the population prior to sampling is the preferred method. Any remaining unmatched negatives will be removed from the population prior to sampling. If an error is found on any "unmatched positive" remaining in the population which has a corresponding negative not in the population, it may be reduced by the negative to offset the error.

b) Removing Items Not Relevant To the Audit Examination

Frequently data downloads contain information from business units, cost centers and/or locations that are not under audit or are not of concern. These should be removed prior to sampling. Leaving these items in the population will require larger sample sizes to achieve acceptable precision.

c) Removing Items Likely Not In Error

Some transactions from relevant business units, cost centers and/or locations are believed to have little or no error prior to sampling. These can also be removed. However, if either the taxpayer or auditor has reasonable doubts whether or not certain types of items are likely to contain error, it is suggested that these items remain in the population to be sampled. Tax error is defined as either overpayment or underpayment of tax. Any items removed prior to sampling can be reviewed on an actual basis or separately sampled.

d) Removal of High Dollar Items

A high dollar threshold is established for the items of interest. Anything equal to or over this amount will be reviewed on an actual basis. Any error found on these items is adjusted on an item by item basis, without projection. This group of high dollar items is sometimes referred to as the "detail stratum". The detail stratum is excluded from the final evaluation of the sampled strata, and handled separately from any of the sample units.

e) Removal of Low Dollar Items

In addition to a high dollar threshold, a low dollar cutoff can be established. Anything under this amount is generally ignored and not reviewed. These amounts are deemed immaterial to the overall audit.

Stratification

After removal of items that will not be sampled, the remaining population will be stratified. The reason for stratifying is to obtain better precision from the samples. Generally, anywhere from two to six strata is desired, in addition to the detail stratum. An independent random sample is pulled from each stratum. However, at the end of the audit examination, an "overall" conclusion is reached for all sampled strata.

Stratification can be done based on a quantity (such as invoice amount or GL distribution amount) or a quality (such as location, time period, or cost center). Most of the time, stratification is on dollar amount.

a) Establishing Strata Boundaries

When stratifying on amount, strata can be established on some proportional method or on a traditional method referred to as "Cumulative Square Root of the Frequency". This method is common in sampling and the preferred method of setting strata boundaries. This approach is not easily defined, except to detail the procedure as follows:

- First the population is sorted by amount and broken up into many classes (e.g., invoices $50 to $74.99, $75 to $99.99, $100 to $124.99, and so on). These classes can be of equal or non-equal width. In this example, the width of the classes is $25.

- The count of the number of items in each class is established.

- For each class, the square root of the count and square root of the width is computed.

- For each class, a product is obtained by taking the square root of the count and multiplying by the square root of the width.

- Beginning with the lowest dollar class, the product is accumulated through to the last class.

- This accumulated total dollar amount is divided by the number of strata to be sampled. Each stratum will be established by this number (say if the accumulated total is 1,200 and we want three strata, strata breaks would be established at the cells that are closest to 400 and 800).

This methodology allows the sample size to be allocated equally to each stratum. For example, if we have an overall sample size of 900 and we have three sampled strata; the sample size within each stratum will be 300. If the Cumulative Square Root of the Frequency is not used to set strata boundaries, then an extra step is required to set the sample size within each stratum (and the strata sample sizes will probably not be equal). This extra step is called "optimal allocation".

b) The Number of Strata Sampled

Generally, two to six strata will be necessary for sampling. In most instances, material gains in efficiency are not realized if more than four or five strata are established.

Sample Size

Sample size will generally be from 200 to 400 per stratum. Generally, a goal of 30% or better precision is used to set sample size. Sample size must be set significantly higher if better precision is desired. Note that there is also a rule of thumb concerning sample size and precision:

To achieve a two-fold increase in precision, such as when 15% precision is desired and 30% was attained; the sample size needs to be quadrupled. For example, if the sample was initially 400, it would have to be increased by 1,200 for a new total of 1,600.

In some cases, the achieved precision will be less than desired (in general, the Commission would like to achieve at least 30% relative precision). In that case, either the Commission or the taxpayer can request an increase in sample size in an effort to improve precision.

Selecting the Sample

Each stratum is sampled independently using random number sampling. The Multistate Tax Commission uses the MTC Sampling Software to obtain random numbers. When a set of random numbers is produced, a seed number is generated. This seed can be used to recreate or increase the sample size. The Commission's policy is to sample without replacement.

Estimation

In arriving at the projected total taxable adjustment, the sample results will be evaluated using four estimation methods: mean-per-unit, difference, ratio, and regression. The estimator providing the best precision (measured in absolute dollar terms, not relative precision) will be the method used to project provided the estimator meets other criteria. In some limited cases, ratio and regression estimators will

not be used to project the total taxable amount adjusted even if they provide the lowest estimate of precision. These special rules do not apply to mean-per-unit or difference estimation.

Ratio and regression estimation is subject to more stringent statistical requirements than mean-per-unit or difference estimation. Special rules apply that restrict the availability of ratio or regression estimation. The special projection criteria for ratio and regression, along with all formula used to make the projections for each of the estimators, are available in Appendix G of the MTC Sampling Manual.

The primary restriction involves the Coefficient of Variation (CV) of three estimated amounts derived from the sample:
- Invoice (Book) value,
- Audited value, and
- Difference value

The CV of the sample mean for the book values must always be below 10% and either the CV of the sample mean for the audited or difference values has to be below 10%. Mean-per-unit or difference estimation may be used if this standard is not met.

Also note that the formulas expressed in this appendix are in accordance with the estimation formula in many other common statistical sources, including Sampling Techniques (William Cochran, John Wiley and Sons, 1977), Statistical Auditing (Donald A Roberts, AICPA, 1978), and Sampling: Design and Analysis (Sharon Lohr, Duxbury Press, 1999).

Statistical Evaluation and Projection

The MTC Sampling Manual states that the final evaluation of the audited sample results should be made using a 2-sided 90% confidence level. If the sample evaluation in fact achieves relative precision of 30% or better, the projected total taxable adjustment can be made at the point estimate. However, if relative precision of at least 30% is not achieved, the sample must be reevaluated using a 1-sided 95% confidence level. In this case the projected taxable adjustment that will be recommended is the confidence limit closest to zero provided both confidence limits (upper and lower) are of the same sign.

In the case where the confidence limits are not of the same sign or where relative precision is at 100% or greater, no projection of the sample will be done. Also, to project into a stratum, at least three nonzero errors must be observed in the sample for that particular stratum. Note where one or more strata have less than three nonzero errors, an overall projected taxable amount may be made from the other sampled strata having at least three nonzero errors. In addition to the projected taxable error, the actual error observed in the detail stratum or other strata not projected may also be adjusted.

Contrast other known major policies from other States/Agencies:
- *LCL @95% Confidence*
  - *Internal Revenue Service (Will use any of the 4 estimators)*
  - *Department of Health and Human Services (Difference Estimator Only)*
- *LCL @80% Confidence*
  - *Washington state (Will use any of the 4 estimators)*
- *LCL @75% Confidence*

- - *Tennessee (Difference Estimator Only)*
- *Point estimate with some precision goal*
  - - *California (Precision based on difference estimator, estimate based on ratio)*
    - *Wisconsin (Will use any of the 4 estimators)*
- *MTC's policy is a hybrid between IRS & Wisconsin*

Special Valuation Issues

Every sample unit selected in the sample must be valued for error. This could a debit, credit or zero. The valuation procedures should, in most instances, is the same as if the item was examined in a detailed (actual) audit. However, in some instances, sample items require special valuation procedures.

a) Missing Items

A missing item is a source document representing a sampling unit that has been drawn as a sample item and cannot be located. Missing invoices constitute a possible attribute or characteristic of an accounting population.

Valid sampling units cannot be replaced; however the sample may always be increased. It is recognized that missing items and other problems may occur. Simply replacing missing items with additional sample items is not acceptable. Replacing the sample containing the missing items with an entirely new sample is an option. However, if there were a significant number of missing items in the first sample, it is likely that another sample will also contain missing items.

If the source document cannot be located and a replacement is not available from the vendor (or customer); there are three basic options in valuing the sample unit. They are:

- The item may be accepted as reported with no adjustment based on auditor's judgment

- Partial adjustment based on alternative evidence or procedures

- The item may be considered unsubstantiated and totally adjusted

b) Corrections and Reclassifications

It is acceptable to consider evidence from outside the sample in determining the value of error for the sample unit selected. The transaction, related documents, and accounting entries should be followed to their logical conclusion.