Audit Sampling Techniques

• Sampling for Controls/Compliance
  • Yes/No or They Did/They Didn’t?
  • Attribute Sampling (AS)

• Sampling for Monetary Misstatement
  • How much discrepancy exists on our books?
  • Monetary Unit Sampling (MUS)
  • Classical Variable Sampling (CVS)
Attribute Sampling

• Related to MUS in sample size calculation
• Efficient for low error rates
• IDEA will plan and evaluate samples
• Random or Stratified sample selection methods
MUS vs. CVS Recommendations

• Do you have a lot of errors? CVS
• Do you have very few errors? MUS
  • Sampling unit is in error if off by a penny or more
  • A lot ≈ 5% or more of population has an error
• Do you require a small sample size (i.e. <= 100)? MUS
• Do you expect a good amount of understatements? CVS
  • Due to its use of PPS sample selection, MUS biased toward detection of overstatements
• Do you have a mixture of negative and positive values? CVS
  • If the number of errors turns out to be high, the MUS high error rate evaluation method cannot evaluate negative amounts along with positive amounts together
• Do you have zero dollar items? CVS
  • MUS will not select items with $0 amounts
Goals of Monetary Unit Sampling

- To provide an adjustment factor that the auditor can use to say what the most likely true dollar value of the population is: Most Likely Error (MLE)

- To judge whether total possible population error exceeds the auditor’s threshold of material error: Upper Error Limit (UEL)
  - Materiality Threshold, which the auditor decides on a priori

- Use two MUS Statistics:
  - Most Likely Error: Point estimate of the total error in the population based on the sample errors
  - Upper Error Limit: Greatest possible total error that can exist in the population based on sample errors and basic precision:
    \[
    \text{UEL} \geq \text{Threshold} \rightarrow \text{Material Error} \\
    \text{UEL} \leq \text{Threshold} \rightarrow \text{No Material Error}
    \]
UEL, MLE and Materiality Threshold

Population Error ($)

Materiality Threshold

No Material Error Projection

Material Error Projection

Sample Errors

Sample Errors

Statistical Judgment of Basically How Precise the Sample Can Be
Workflow of Audit Sampling

1. Define your sampling objective
2. Define the population from which to sample
3. Plan and Extract the sample
4. Audit the sample items for correctness
5. Evaluate the sample to project findings back to the population
Define Sampling Objective

• The object of sampling is to make guesses about the population, draw a sample to test your hypotheses and then see if you’re correct
• What’s your materiality threshold?
  • What is the maximum amount of error you are willing to accept before you recommend structural change in the control/book-keeping process?
• What do you want to use the sample to conclude?
  • Company controls are weak?
  • Company controls are strong?
  • Monetary records are well kept?
  • Monetary records are poorly kept?
• For which areas of the data do you want to make conclusions?
  • Certain payment types, vendors, domestic business, foreign business, everything?
Define Population

• A sample only says something about the population from which it was drawn
• Remove/extract unwanted items from the data
  • Low risk items
  • Items outside the objective scope
  • Items that affect overall material value of the population (e.g. reversals)
  • Items you don’t want in your sample
Plan the Sample

- Based on your sample objectives
- Confidence level
- Tolerable Error
- Expected Error
- Predicted Sum of Tolerable Taintings
- Basic Precision Pricing (BPP)
MUS Planning

You may accept the population at the 95.00% confidence level when no more than 1.140000 total taintings are observed in a sample of size 57.

This is the minimum sample size that will allow you to draw the above conclusion.
### Choice of Confidence Level

Tolerable Sampling Risk (aka $\beta$)

<table>
<thead>
<tr>
<th>Reliance on Analytical Review</th>
<th>Reliance on Controls</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>Low</td>
</tr>
<tr>
<td>None</td>
<td>.05</td>
</tr>
<tr>
<td>Moderate</td>
<td>.07</td>
</tr>
</tbody>
</table>

Confidence Level = 1 – Tolerable Sampling Risk

- Increase the confidence level = Increase the sample size
- Decrease the confidence level = Decrease the sample size
Tolerable Error

• The higher the number the less precise the estimate (counter-intuitive)
  • Basic Precision increases
  • Upper Error Limit increases
• Set this to be (somewhat) less than your materiality threshold to allow for unfavorable point estimators
• Governs the amount of basic precision in the results
• Increase the tolerable error = decrease the sample size
• Decrease the tolerable error = increase the sample size
Expected Error

• The amount of error you most likely expect to see in the population and the sample
  • An error is ANY difference between recorded and audit amounts
• Based on the auditor’s confidence in the accuracy of bookkeeping
  • ERP (enterprise resource planning) System
  • Manually entering information into Excel
  • Paper and pencil record keeping
  • How many levels of checks/balances do they have?
• Increase the expected error = increase the sample size
• Decrease the expected error = decrease the sample size
• Setting Expected Error to Zero means the sample has no tolerance for any errors
  • Upper Error Limit will breach the materiality threshold
Sum of Tolerable Taintings (STT)

- A tainting is the absolute percentage difference between recorded book-entry amount (BA) and the true audit amount (AA)
  \[ tainting = \left| \frac{BA - AA}{BA} \right| \]
- STT tells you how much total percentage error you can have before exceeding the Upper Error Limit
- STT is controlled by the Expected Error
  - Higher Expected Error = Higher STT
  - Lower Expected Error = Lower STT
Basic Precision Pricing (BPP)

- Basic Precision is the Upper Error Limit when no errors are found in the sample
  - Governs how much the sample can say about the population: larger samples can say more than smaller samples
  - Basic Precision = *Basically How Precise the Sample Can Be*
- BPP determines the weight of the errors and functions as an upper bound for the most allowable individual tainting
- BPP can be set during both the Planning and the Evaluation stages
- Uses:
  - BPP can be used to raise or lower basic precision to achieve changing tolerable misstatement materiality objectives
  - To lower sample size if one verifies prior to sampling that there is a ceiling on the amount of tainting that can occur for any one item
  - Lower BPP = smaller sample size
  - Higher BPP = larger sample size
Extract the Sample

Monetary Unit Sampling - Extract

- **Extraction type**
  - Fixed interval
  - Cell selection

- **High value handling**
  - High values in sample as aggregate
  - High values in database

  High value file name: High Values Chosen Only Once

- **Numeric field to sample:** AMOUNT
- **Sample interval:** 193,269.96
- **Random number seed:** 9,456
- **Change high value amount:**
  - 193,269.96

There are 4 items with a value of 0. Items with a value of 0 will have a 0% chance of being selected.

<table>
<thead>
<tr>
<th>Total</th>
<th>Records</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive values</td>
<td>11,016,387.76</td>
</tr>
<tr>
<td>Negative values</td>
<td>(2,517,611.32)</td>
</tr>
<tr>
<td>Absolute values</td>
<td>13,533,999.08</td>
</tr>
</tbody>
</table>

File name: MUS Sample of Bank Transactions
MUS Sample Extraction Employs PPS

• Items are selected via *Probability Proportional to Size* (PPS) Sampling

• PPS Sampling: The probability of selecting an individual physical unit, such as an invoice, is proportional to its size
  • The larger the dollar value of the item, the more likely it is to be selected for the sample
  • Sample contains few, if any, smaller dollar units that don’t affect materiality all that much
Fixed Interval vs. Cell Selection

Figure 6.6
High Value Amounts

- In MUS, the default cutoff is the sampling interval.
- High value items are not subject to statistical projection and the associated errors are added directly to the bottom line (i.e., Most Likely Error and Upper Error Limit).
- In Sample as Aggregate option will potentially duplicate the selection of any items greater than the sampling interval:
  - Estimated sample size will be retained.
- In Database option will eliminate the generation of duplicates by removing items to another IDEA database prior to selecting the sample:
  - Estimated sample size could be lower now that large dollar amounts are removed from the population.
Double-Check the Sample
Go Audit the Sample Items

• Scrutinize the sample for unwanted items before performing the in-depth audit of the items
  • Make sure you properly defined the population
  • Check for unwanted invoice numbers, type codes, dates out of scope, et cetera
• Find verifiable proof using physical invoices, bills of lading or other proof from vendors, etc.
Evaluate the Sample
Evaluation

• Goal is to see if Upper Error Limit exceeds the materiality threshold and obtain the Most Likely Error

• The MUS evaluation method can be used to evaluate samples that were prepared using other sample planning techniques (e.g. random sampling, stratified random sampling)
Three Types of Evaluation

• Single Sample “Cell” Evaluation
  • Low error rate
    • Supplies separate Overstatements and Understatements calculations
  • High error rate
    • Allows you to set Precision limits to Upper Or Upper and Lower
    • Cannot accommodate negative and positive values together (use CVS in this case) so items must be either all positive or all negative
    • Useful when number of errors approaches or exceeds 20
    • Uses Classical Variable Sampling techniques to evaluate
    • Will not break down overstatements versus understatements

• Multiple Sample “Stringer Bound” Evaluation
  • Can be used to evaluate a single sample as well as several samples
  • More conservative: produces a slightly higher Upper Error Limit, increasing the chance of exceeding the materiality threshold
<table>
<thead>
<tr>
<th>MUS - Low Error Rate Summary</th>
<th>MUS - High Error Rate Summary</th>
<th>MUS - Combined Sample Evaluation Summary</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Confidence Level</strong></td>
<td>95.00</td>
<td>95.00</td>
</tr>
<tr>
<td><strong>High Value</strong></td>
<td>193,244.96</td>
<td>193,244.96</td>
</tr>
<tr>
<td><strong>Sampling Interval</strong></td>
<td>103,421.82</td>
<td>103,421.82</td>
</tr>
<tr>
<td><strong>Value of the sampled population excluding high values</strong></td>
<td>5,593,10,77</td>
<td>7,426,376.84</td>
</tr>
<tr>
<td><strong>Total value of high value items</strong></td>
<td>11,016,397.84</td>
<td>11,016,397.84</td>
</tr>
<tr>
<td><strong>Conclusion</strong>: Based on the sample, the most likely total investment in the population is 110,278.91. You can infer with confidence of 95.00% that the total error in the population is between 53,342.73 and 110,278.91. You can infer with a confidence of 95.00% that the total investment in the population does not exceed 110,278.91. You can infer with a confidence of 95.00% that the total investment in the combined population does not exceed 110,278.91.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Low Error Rate Evaluation

**MUS - Low Error Rate Summary**

<table>
<thead>
<tr>
<th>Confidence Level</th>
<th>95.00</th>
</tr>
</thead>
<tbody>
<tr>
<td>High Value</td>
<td>193,269.96</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sample Size</th>
<th>Overstatements</th>
<th>Understatements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gross most likely error</td>
<td>173,184.22</td>
<td>7,566.11</td>
</tr>
<tr>
<td>Net most likely error</td>
<td>165,618.11</td>
<td>-165,618.11</td>
</tr>
<tr>
<td>Total Precision</td>
<td>571,698.16</td>
<td>522,208.97</td>
</tr>
<tr>
<td>Gross upper error limit</td>
<td>744,882.37</td>
<td>529,775.07</td>
</tr>
<tr>
<td>Net upper error limit</td>
<td>737,316.27</td>
<td>356,590.86</td>
</tr>
</tbody>
</table>

**Results for High Value Items**

<table>
<thead>
<tr>
<th>Number of high value items</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of errors</td>
<td>1</td>
</tr>
<tr>
<td>Value of errors</td>
<td>99,925.00</td>
</tr>
</tbody>
</table>

**Results Including High Value Items**

| Total number of items examined | 21 |
| Number of errors               | 2 |
| Gross most likely error        | 273,109.22 | 7,566.11 |
| Net most likely error          | 265,543.11 | -265,543.11 |
| Gross upper error limit        | 844,807.37 | 529,775.07 |
| Net upper error limit          | 837,241.27 | 256,665.86 |

**Conclusion:**

Based on this sample, the most likely total overstatement in the population is 273,109.22, and the most likely total understatement is 7,566.11. You can infer with a confidence of 95.00% that the total overstatement in the population does not exceed 844,807.37, and that the total understatement in the population does not exceed 529,775.07.
High Error Rate Evaluation

MUS - High Error Rate Summary

Confidence Level: 95.00
High Value: 193,269.96
Value of the sampled population excluding high values: 3,580,010.77
Total value of high value items: 7,436,376.99
Value of the sampled population including high values: 11,016,387.76

Sampling Interval: 188,421.62
Precision Limits: Upper and lower

Results Excluding High Value Items

- Number of errors: 19.00
- Most likely error: -241,868.90
- Total Precision: 136,797.39
- Lower error limit: -105,071.51
- Upper error limit: -378,666.29

Results for High Value Items

- Number of high value items: 2
- Number of errors: 1.00
- Value of errors: -99,925.00

Results Including High Value Items

- Total number of items examined: 21.00
- Number of errors: 20.00
- Most likely error: -341,793.90
- Lower error limit: -204,996.51
- Upper error limit: -478,591.29

Conclusion:
Based on this sample, the most likely total misstatement in the population is -341,793.90. You can infer with a confidence of 95.00% that the total error in the population is between -204,996.51 and -478,591.29.

WARNING: This sample contains fewer than 20 errors. You have selected high error rate evaluation, which is recommended for samples containing 20 or more errors. You may wish to use the low error rate evaluation instead.
Multiple Sample Evaluation

MUS - Combined Sample Evaluation Summary

<table>
<thead>
<tr>
<th>Results Excluding High Value Items</th>
<th>Overstatements</th>
<th>Understatements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Combined Sample Size</td>
<td>19</td>
<td>19</td>
</tr>
<tr>
<td>Number of errors</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Gross most likely error</td>
<td>10,651.91</td>
<td>7,566.11</td>
</tr>
<tr>
<td>Net most likely error</td>
<td>3,085.80</td>
<td>-3,085.80</td>
</tr>
<tr>
<td>Total Precision</td>
<td>527,850.29</td>
<td>526,216.03</td>
</tr>
<tr>
<td>Gross upper error limit</td>
<td>538,502.20</td>
<td>533,782.13</td>
</tr>
<tr>
<td>Net upper error limit</td>
<td>530,936.09</td>
<td>523,130.22</td>
</tr>
</tbody>
</table>

**Results for High Value Items**

<table>
<thead>
<tr>
<th></th>
<th>Overstatements</th>
<th>Understatements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of high value items</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Number of errors</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Value of errors</td>
<td>99,925.00</td>
<td>0.00</td>
</tr>
</tbody>
</table>

**Results Including High Value Items**

<table>
<thead>
<tr>
<th></th>
<th>Overstatements</th>
<th>Understatements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total number of items examined</td>
<td>21</td>
<td>21</td>
</tr>
<tr>
<td>Number of errors</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Gross most likely error</td>
<td>110,576.91</td>
<td>7,566.11</td>
</tr>
<tr>
<td>Net most likely error</td>
<td>103,010.80</td>
<td>-103,010.80</td>
</tr>
<tr>
<td>Gross upper error limit</td>
<td>638,427.20</td>
<td>533,782.13</td>
</tr>
<tr>
<td>Net upper error limit</td>
<td>630,861.09</td>
<td>423,205.22</td>
</tr>
</tbody>
</table>

**Conclusion:**

Based on the combined sample, the most likely total overstatement in the combined population is 110,576.91, and the most likely total understatement is 7,566.11. You can infer with a confidence of 95.00% that the total overstatement in the combined population does not exceed 638,427.20, and that the total understatement in the combined population does not exceed 533,782.13.
Demo
Questions
Sample Size Estimates are Not Proportions

“Over a certain population size (generally when the population is at least 100 times the sample size), the sampling confidence becomes completely independent of the population size. This independence from population size is often puzzling to newcomers to sampling. Think of it this way. It takes only one swallow to determine how salty the ocean is. The size of the required swallow is not dependent on the size of the ocean (although marginally greater assurance would be theoretically possible if one drank half the ocean...).” – Dollar-Unit Sampling by Leslie, Teitlebaum & Anderson
Thank you for your time today!

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