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Risk Management, Qualtity Control & Statistics, part 2

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These statistical techniques, used consistently and without bias, can efficiently provide great insight into quality, taking you some way towards managing enterprise risk.

This is the second part of a two-part series.

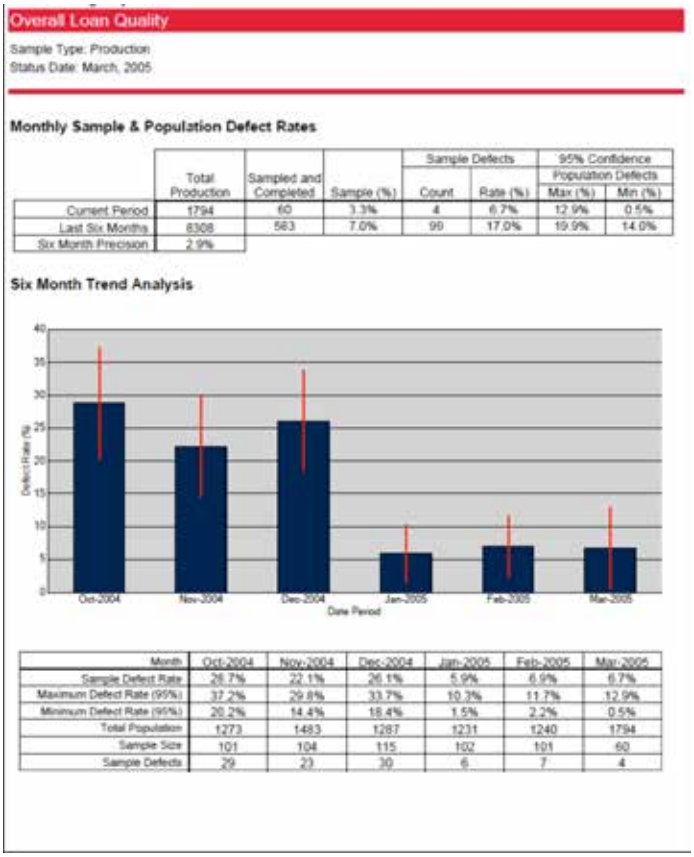
Basic Statistical Terms

Statistical sampling in loan QC involves the drawing of a limited sample of units from a larger population of units, with the intention of making inferences about the population, with more or less precision and confidence.

Using a simple example to illustrate: you grab a fistful of marbles (the sample) from a bag full of marbles (the population). Based on the characteristics of the marbles in your fist, you can make educated guesses (inferences) about the marbles in the population. Based on the number of marbles in your fist relative to the number of marbles in the bag, your guess can be within a more or less narrow range (precision) and you can be more or less sure that your inference is repeatable (confidence).

These basic statistical terms should be understood by both the QC department and the senior managers for whom they generate QC reports. But it is up to the QC department to ensure the statistical validity of their sampling and auditing. That is, to be sure that statistical samples are being drawn randomly from the appropriate populations, that no statistical bias is being introduced, and that the proper inferences are being made. To extend our marble illustration: be sure that the bag contains the right marbles, that you are not cherry-picking your marbles from the bag, and that your assessment of the marbles is consistent.

Finally, recognize that there are also sources of non-statistical bias. Watch for incomplete loan reviews for all sampled loans, non-response (missing files), gross vs. net defect rates, exclusion of adverse (targeted) selections, and inconsistency in file review standards.➢


Overall Loan Quality

Sample Type: Production
Status Date: March, 2005

Monthly Sample & Population Defect Rates

	Total Production	Sampled and Completed	Sample (%)	Sample Defects		95% Confidence Population Defects	
				Count	Rate (%)	Max (%)	Min (%)
Current Period	1794	60	3.3%	4	6.7%	12.9%	0.5%
Last Six Months	8308	583	7.0%	99	17.0%	19.9%	14.0%
Six Month Precision	2.9%						

Six Month Trend Analysis

Month	Oct-2004	Nov-2004	Dec-2004	Jan-2005	Feb-2005	Mar-2005
Sample Defect Rate	26.7%	22.1%	26.1%	5.9%	6.9%	6.7%
Maximum Defect Rate (95%)	37.2%	29.8%	33.7%	10.3%	11.7%	12.9%
Minimum Defect Rate (95%)	20.2%	14.4%	18.4%	1.5%	2.2%	0.5%
Total Population	1273	1483	1287	1231	1240	1794
Sample Size	101	104	115	102	101	60
Sample Defects	29	23	30	6	7	4

Figure 2. Quality Trend Report shows observed sample defect rates (blue bars) and inference to the population at a given precision and confidence (red lines on top of blue bars.)

Focused Reporting

Once you have consensus about what to measure and how metrics are defined, visualize the kinds of reports you wish to produce. This will drive your sampling.

There are still QC operations that generate reports as thick as a phone book about each finding encountered in a QC cycle. Commonly known as data dumps, such reports arguably do more harm than good since it's up to the audience to winnow out the information that matters and to make a judgment about how much it matters. No wonder QC reports have been so roundly ignored.

Your own reports should be succinct, easy to interpret, actionable, timely and accurate. Make liberal use of charts, graphs and illustrations, which can convey information quickly, concisely and in context. Include an executive summary at the front of the report package that highlights the most important quality results and trends. Support this with trend and findings reports so that significant results can be traced back to sources and root causes.

Statistical Sampling Strategy

The guiding principle for statistical sampling in loan QC is to minimize random sampling and emphasize risk-based (aka "targeted" or "discretionary") sampling. This offers the most efficient way to effectively monitor your quality.

You can gain additional efficiencies if your audits of randomly sampled loans are similar to audits of your targeted samples, in which case you can credit the audits performed under random samples towards the required counts for targeted samples. This means certain loan audits count both towards a randomly sampled audit and a targeted audit – a great way to leverage your auditing capacity.

To take advantage of this leverage, begin with the highest level, least granular layer of sampling (e.g., a statistically derived random sample drawn from a population of all loans originated in the month of March). This establishes an overall quality benchmark. It also meets many regulators' and/or investors' minimum requirements for random statistical samples.

Then draw appropriately sized random samples from targeted sub-populations, (e.g., only retail channel originations,) while crediting qualifying loans that were sampled in the first sample (retail loans) towards the count required for the second sample. As your samples drill deeper into more granular populations (e.g., new products, new loan officers, appraisers on a watch list, risky states, etc.), be sure to give yourself credit for earlier samples that qualify for later samples.

This approach is particularly useful if you have a mandate to regularly sample from every unit in a particular class. For example, some enterprises require that at least one loan must be sampled every month from each broker sending loans to a lender. Almost invariably, this is an exercise in futility because any samples drawn will both be too small and drawn from too small a population to be meaningful. But organizations are filled with well-intentioned distortions like this. If you are forced to do this sort of review, leave the sampling for it to the very end. A large number of qualifying loans will already have been sampled

in early sample layers and the net number you need to sample will be reduced. In combination with this, consider sampling a larger number of loans, less frequently, and from a smaller subset of individual brokers. So sample a statistically valid number of loans, quarterly instead of monthly, from one broker region per calendar quarter.

Estimating the Required Statistical Sample Size

While you could manually calculate estimated sample size, calculators exist online that ease the burden. Be sure to understand how each calculator derives its sample size; they may be intended for different audiences, use different assumptions, or use different inputs.

The inputs for statistical sample size estimation are: population size, precision, confidence, and expected quality (or defect rate). A higher defect rate means a larger statistical sample size, all else being equal. So by lowering defect rates, organizations not only reduce the costs of poor quality, they also reduce the number of audits required. A worthy goal.

A suitable statistical sample size calculator for loan QC (for example at http://bit.ly/1ncoFzM) should achieve a 2% statistical precision at a one-sided 95% confidence level on an annual basis. This has become the industry standard.

Drawing Conclusions

QC's objective is to make valid inferences about various populations from which loans have been sampled. Whether these populations are entire servicing portfolios, originations from a geographic area, pre-funded loans in the pipeline, appraisers on a watch list, or newly introduced loan products, the idea is to gauge the quality of the particular population. Yet many lenders simply report on the results of their sampled audits, without making any inferences to the population at all. Without the extra step of making inferences, audit reporting is far less meaningful and reliable.

Making inferences is one thing, making the right inferences is another. If your goal is to achieve a 2% statistical precision at a one-sided 95% confidence ▻

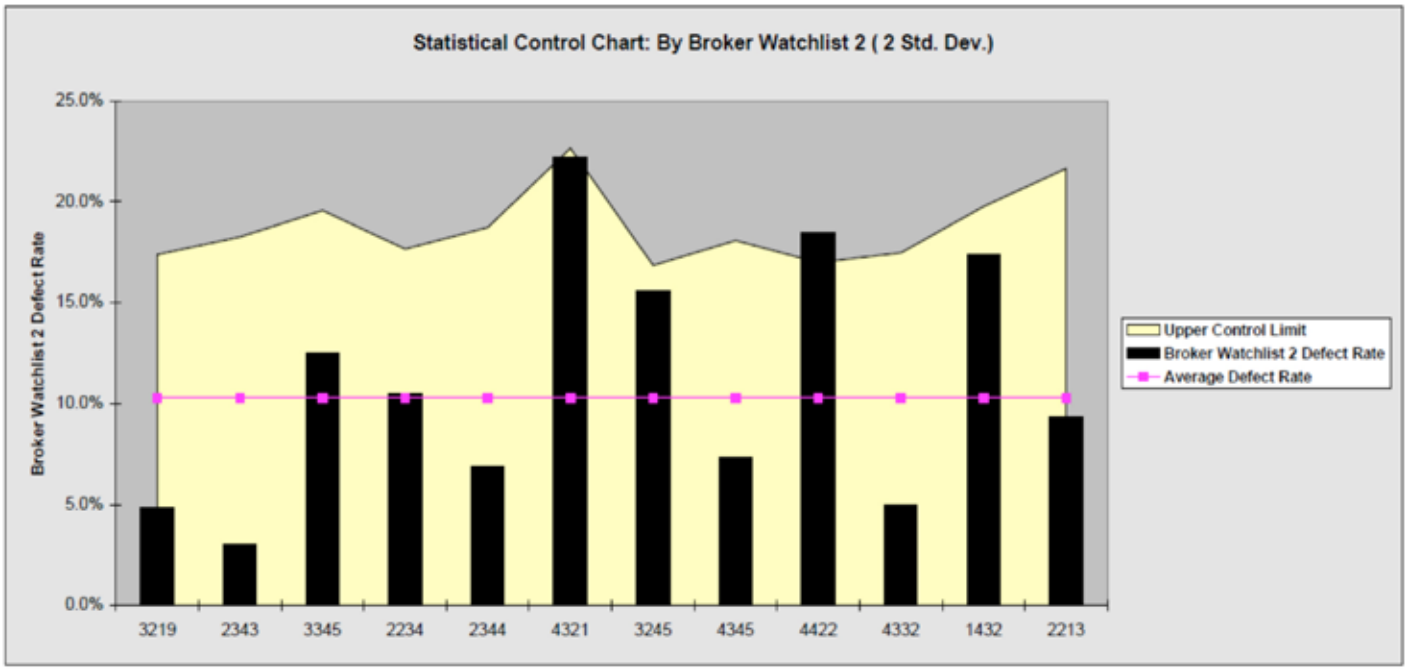


Figure 3. Statistical Control Chart showing several brokers with above average defect rates but only one outlier (#4422) above the upper control limit, or "out of statistical control."

interval on an annual basis, then you are looking to make a statement such as this: "Our random sample of 26 loans from this population of 10,000 loans yielded a defect rate of 5%. So if we were to randomly sample the same number of loans a total of 100 times, then 95 of those times [95% confidence] the defect rate of the population from which we drew will have a defect rate of 7% or less [2% precision at one-sided confidence interval.]"

If this had been a two-sided 95% confidence interval, a larger number of loans would have been sampled and we would have been in a position to say that the defect rate was in a range between 3% and 7% (i.e., 5% observed defect rate plus or minus the 2% precision level we set). However, in loan QC, we are interested in the likely maximum defect rate so we can benefit from the lower sample size required for a one-sided confidence interval.

Two additional points about drawing conclusions in this sort of statistical analysis: one is that in order to confirm statistical precision, it is necessary to calculate the confidence interval after reviews are complete. This involves solving the same statistical formula used in sample size estimation (where an expected incidence rate or defect rate was used), except solving for the confidence interval with the observed defect rate.

The other point regards confidence intervals (or "control limits"), which are used in statistical control charts to separate the signal from the noise. In auditing a sample of broker loans, you may find that several may have higher than average defect rates. But much of this variation may be the noise of randomness. It is the outliers whose defect rates are statistically significant – or beyond the upper control limit – that merit further examination. 95% and 99% confidence, equating to two and three standard deviations respectively, are two accepted thresholds of confidence. At 95% confidence, we are saying that there is an unlikely 5% chance that a defect rate outside the upper control limit is attributable to statistical randomness. Instead, there is likely to be something worth investigating.

These statistical techniques, used consistently and without bias, can efficiently provide great insight into quality, taking you some way towards managing enterprise risk. With the level of uncertainty and diversity of risk that is prevalent in the industry today, that is a step in the right direction.

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