International Journal of Research Studies in Science, Engineering and Technology
Volume 4, Issue 2, 2017, PP 9-17
ISSN 2349-4751 (Print) & ISSN 2349-476X (Online)

Resource Audit: Enhancing the Performance of Business Processes using Audit Analytics

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Abstract:*The main objective of the paper is to present how data can be used to increase the long term efficiency and effectiveness of our responses to Audit Risk (Risks of Material Misstatement &significant risks) as well as drive detailed, value adding insights to clients relating to the performance of their business processes and controls. The use of Audit Analytics may also contribute to audit quality by enabling auditors and specialists to perform more effective and efficient audit procedures. We may also identify valuable insights that can be communicated to management and those charged with governance.*

Keywords: *Analytics, risk indicators, audit, performance, management, JEL classification: C38, D49*

1. Introduction and Literature Review

Knowing what companies are facing more and more process risks each day, audit analytics is becoming a mandatory internal or external activity.

The key to the success of data analytics is the ability to improve audit detection risk, reduce substantive based procedures, and to add value to company. By applying a data driven approach regarding risk and internal control we are able to identify all transactions and situations that we would not like to show up in the our sample because the internal control system should have caught these. This allows us is to really focus on those areas where the risk is.

Going beyond the traditional audit, Audit Analytics will provide insights in several topics. Examples are Analytics of customer behavior and customer profitability, Analytics of supply chain management, optimization of procurement process and cash flow forecasting.

2. Methodology

From a methodological point of view, Audit Analytics provides insight into the general ledger by testing based on analysis of financial data. This provides unique insight for your business and results in efficiency savings compared to more traditional controls testing.

2.1. Audit Analytics Provides

- Selection of relevant sub-administrations
- Selection of relevant controls and required insight
- Performing an effective and efficient audit
- Greater insight in business processes

2.2. Benefits of using Analytics on Audit Engagements

- Audit tests may be performed on the entire population and not just on a sample of items, thereby increasing the persuasiveness of the resulting audit evidence
- Analyses of data not available using manual techniques may assist in identifying and assessing risks of material misstatement, including significant risks
- Certain significant risks may be more effectively addressed by exploratory data analysis than by manual procedures
- Time spent gathering and documenting information may be reduced

- Speed, accuracy, and repetitive nature of techniques may contribute to improving efficiency and effectiveness of the audit procedures. Results may identify trends in the underlying data that can be used to support audit conclusions and also generate meaningful insights that may be communicated to management and those charged with governance

3. Audit Analytics Life Cycle

3.1. The Life Cycle of the Audit Analytics Contains

3.1.1. Plan

- Identify scope and timing
- Incorporate specialists in discussions
- Determine coverage desired
- Define data and documentation requirements

3.1.2. Wrap-up

- Retain working paper documentation
- Apply data retention standards
- Review lessons learned and identify future modifications

3.1.3. Acquire data

- Request and obtain data
- Reconcile data
- Perform data quality assessment

3.1.4. Analyze

- Develop and execute analysis logic
- Troubleshoot issues and refine logic
- Format output

3.1.5. Review

- Review analysis logic
- Review output
- Confirm quality of output

3.1.6. Report

- Interpret results
- Draw conclusions
- Prepare documentation

4. Example Tests by Business Process Cycles

As we mentioned in the methodology part, Audit analytics involves more than just one execution.Thus, we will present two practical examples where audit analytics is bringing added-value for the company.

4.1. Accounts Payable

4.1.1. Benefits

Accounts Payable is a typical area for analytics due to availability of the data. Clients often are able to provide underlying A/P and vendor data with minimal effort. Reports and metrics can often be recalculated with minimal effort.

4.1.2. Example Tests for this Cycle:

Vendor Master Tests

- Identify duplicate vendors (name, address)
- Identify outlier credit terms
- Identify payments to unapproved / inactive vendors or employees
- Identify changes in master data
- Summarize transaction activity (number and amount of transactions) and identify unusual trends

Payable Testing

- Conduct reconciliation of interconnected process transactions (purchase orders to invoices, invoices to payments, and payments to check register)
- Automate subsequent disbursement testing and testing for unrecorded liabilities
- Identify transactions processed out of order (payment date prior to invoice date)
- Re-perform and reconcile aging reports
- Analyze impact of percentage change in purchases / price by vendor
- Analyze cost differences by same product and vendor / locations over time
- Trend debit note activity to identify anomalies or cut off issues

4.2. Fixed Assets (Property, Plant & Equipment)

4.2.1. Benefits

Fixed asset testing can benefit from the usage of analytics to re-compute balances and from profiling techniques to identify anomalies in the fixed asset registry.

4.2.2. Example Tests for this Cycle:

Fixed Asset Registry Testing

- Conduct key words search on ledger to identify possible capitalized or expensed items
- Identify cost and net book value less than or equal to zero
- Identify fixed assets with no associated useful life
- Identify duplicate fixed assets (serial numbers, tag numbers or descriptions)
- Identify active locations with no fixed assets
- Identify fixed assets at closed locations
- Identify assets not disposed after end of useful life or before end of useful life
- Identify assets additions, disposals, and transfers throughout the year

Fixed Asset Related Recalculations

- Recalculate depreciation for fixed assets
- Compare the current year-end fixed asset data to prior year-end data, comparing data elements to identify differences (useful life)
- Compare asset expenditures to additions to asset register to test for completeness

5. Statistic Methods used in Internal/Mandatory Legal Audit

Traditional internal audit, the legal mandatory audit and especially analytic audit are riling more and more on statistic methods and econometrical analysis. Analytics audit is treating detailed statics methods as machine learning and text mining analytics. In the traditional audit we are using an adequacy of Simple Linear Regression model.

As we know in statistics, the regression analysis is a "statistical technique" for modeling the relationship between variables.

If:

- X= the "predictor" or regressor variable, and
- Y= the "response" variable.

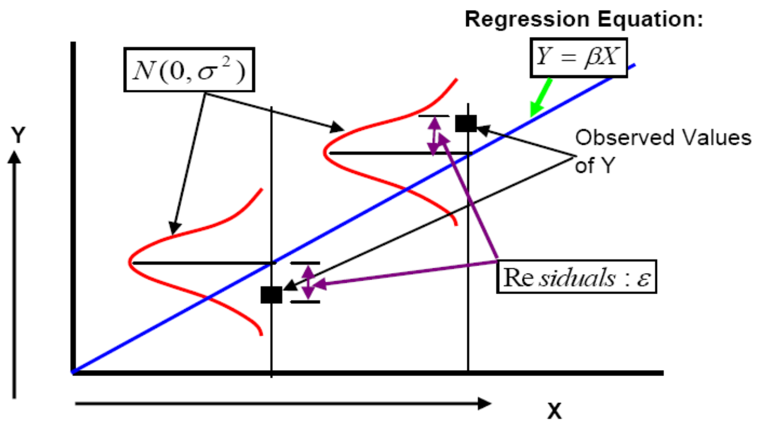
The linear relationship between X & Y can be represented as a $Y = \beta_0 + \beta_1 x + \varepsilon$

Where are the regression coefficients? It is important to note that if the range of X does not include zero, then has no practical interpretation and the regression equation reduces to: $Y = \beta x + \varepsilon$

Since the above equation involves only one regressor variable, it is called a "simple" linear regression model. The parameter is estimated from sample data using a "method of least squares" where the value of is chosen in a fashion such that the sum of the squares of the difference between the observed value in the sample and the fitted value is minimized and the fitted linear regression model is: $\hat{Y} = \beta x$

Since the data points do not fall exactly on a straight line, as shown in fig-1 below, there will be a difference between the observed value in the sample and the fitted value , and this difference is called the "residual". Mathematically the i th residual is: $\varepsilon_i = Y_i - \hat{Y}_i = Y_i - \beta x$

Analysis of these residuals plays a crucial role in investigating the adequacy of the fitted regression model and in detecting departures from the underlying assumptions.



The total variation of the response variable Y_i can be represented as: $Y_i - \bar{Y} = (\hat{Y}_i - \bar{Y}) + (Y_i - \hat{Y}_i)$.

This after some mathematics reduces to : $\sum(Y_i - \bar{Y})^2 = \sum(\hat{Y}_i - \bar{Y})^2 + \sum(Y_i - \hat{Y}_i)^2$

Symbolically, this is written as the Sum of Squares (SS): $SS_T = SS_R + SS_{Res}$

Where SS_T (Total Sum of Squares) is the total variability in the response variable "Y", and SS_R (Regression Sum of Squares) & SS_{Res} (Residual Sum of Squares) respectively are the portions of the total variability that is explained and not explained by the regressor variable "X".

A "coefficient of determination" ($R^2 = \frac{SS_R}{SS_T}$) is defined as the proportion of the total variation of "Y" explained by the regressor variable "X". It is also useful to note that the "coefficient of determination" is just the square of the correlation coefficient between "Y" and "X". (i.e. $\rho = \sqrt{R^2}$)

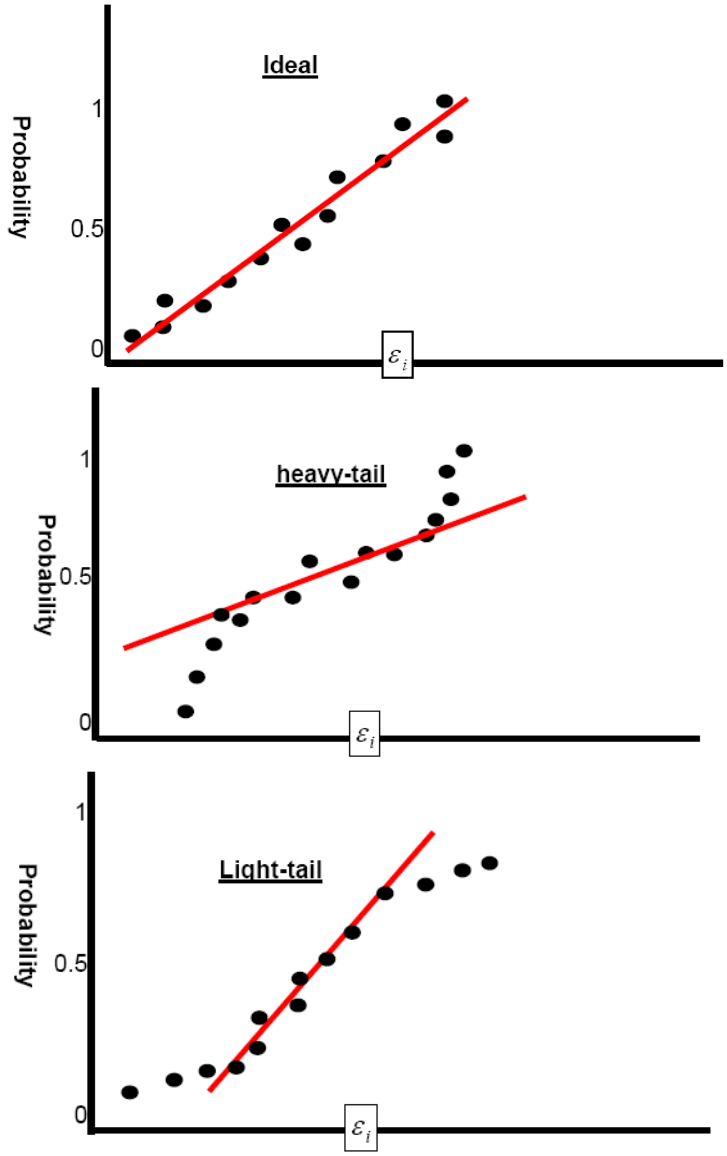
6. Methods for Diagnosing Violations of Basic Regression Assumptions in Audit:

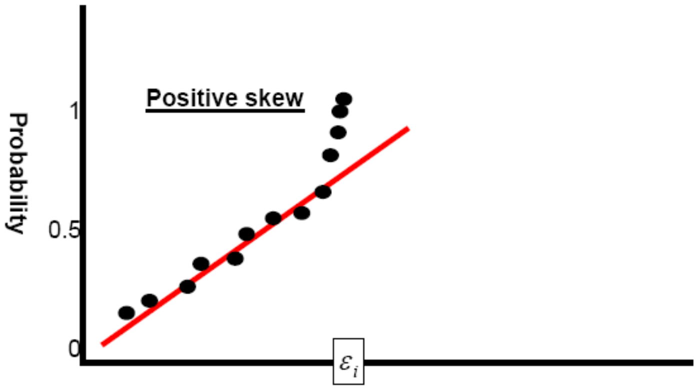
These methods are primarily based on study of the model residuals. Sometimes it is useful to work with the scaled residuals. "Standardized residuals" are residuals scaled by the average variance of the residuals and hence have mean zero and approximately unit variance. "Studentized residuals" have constant variance of 1 regardless of the location of x when the form of the model is correct.

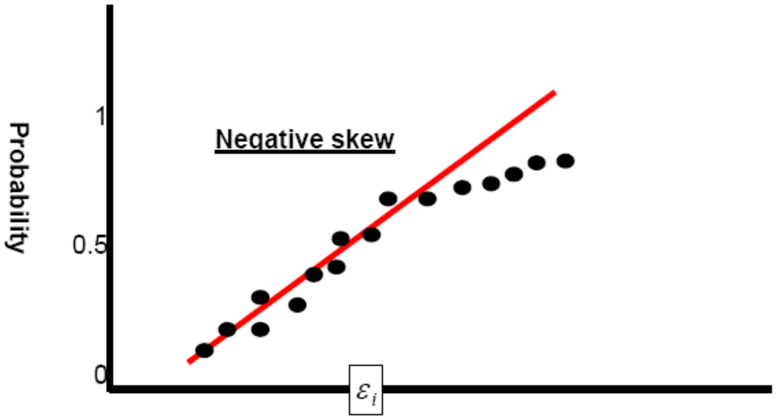
Graphical analysis of residuals is a very effective way to check the adequacy of the underlying regression assumptions. Most regression software packages can generate residual plots. It is often a good idea to plot both the original residuals and one or more of the scaled residuals.

Normality : Small departures from the normality assumption does not affect the model greatly, but gross nonmorality is potentially more serious as the "t" and "F" statistics and confidence and prediction intervals depend on normality assumptions.

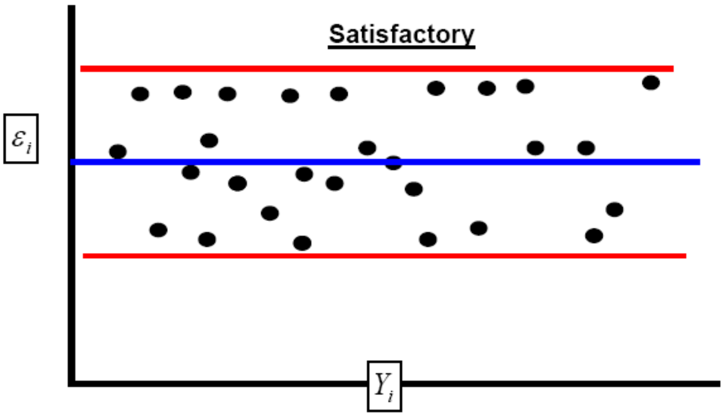
A simple way to check for the normality assumption is to construct a normal probability plot (most regression software can generate this). This is a graph designed so that the cumulative normal distribution will plot as a straight line. The straight line is usually determined visually with emphasis on the central values (0.33 & 0.67 cumulative probability points). Substantial departures from a straight line indicate that the distribution is not normal. The following figures show the "idealized" normal probability plot along with plots which cannot be considered to be normal. Because samples taken from a normal distribution may not plot exactly as a straight line, the sample size should be at least greater than 32 to produce normal plots that are stable enough to be easily interpreted.

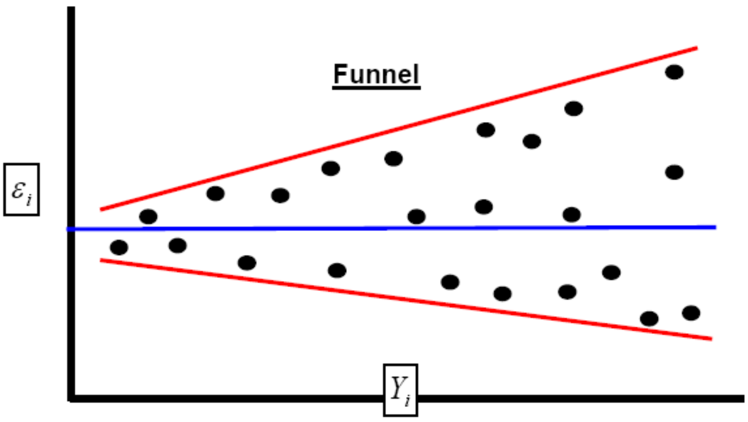


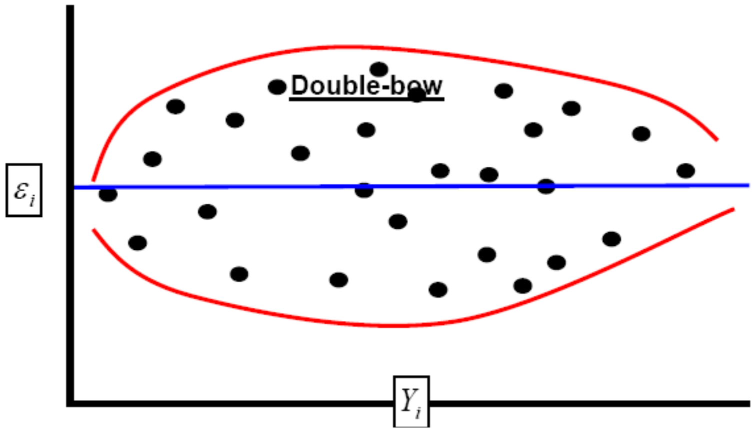


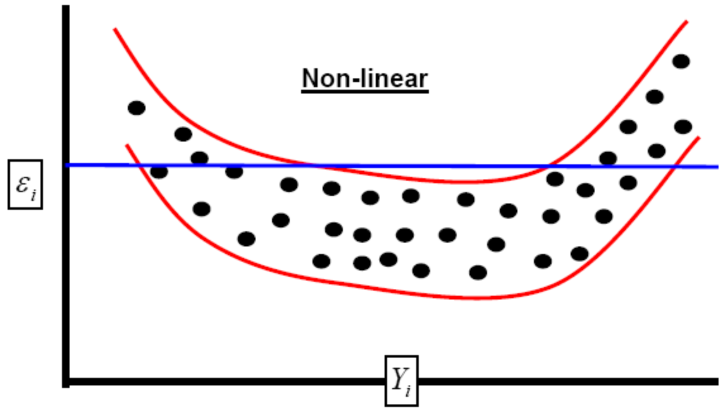


Constant Variance: Plot of the residuals versus the corresponding fitted value is useful for detecting several common types of model inadequacies. If the plot as shown in the figures below can be contained in a horizontal band, then there are no obvious model defects. A curved plot as shown in the last figure below indicates non-linearity.

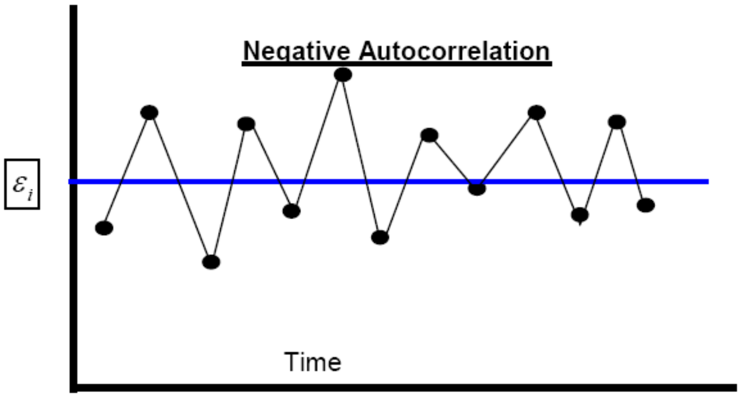


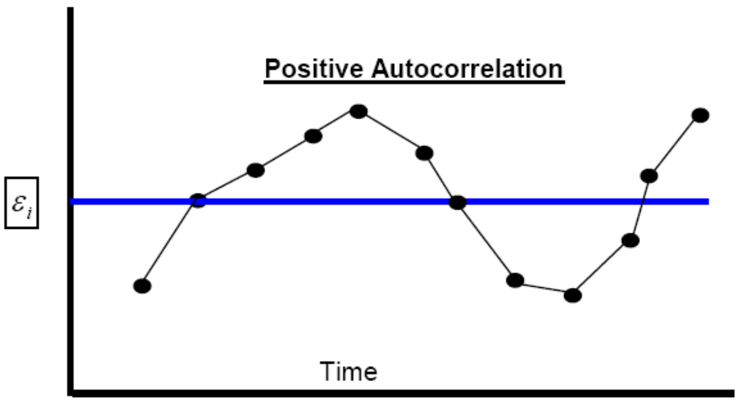






Independence: A plot of the residuals against time order should ideally fluctuate in a more or less random fashion. If it appears that the residual at one time period is correlated with those at other time periods as shown in the figures below then the residuals exhibit autocorrelation. Presence of autocorrelation is a potentially serious violation of the basic regression assumptions. Various statistical tests can be used to detect the presence of autocorrelation. The Durbin Watson test is the most commonly used test and is based on the assumption that the errors in the regression model are generated by a first-order autoregressive process.





7. Methods for Dealing with Model Inadequacies

When the residuals in the linear regression model $Y = \beta X + \varepsilon$ are normally distributed, the method of least squares is a good parameter estimation procedure. However if the observations follow a longer or heavier tail than normal, the heavy tailed error distributions often generate "outliers" that pull the least-square fit too much in one direction. In this case other estimation techniques like "robust regression" methods should be considered. A "robust regression" procedure is one that dampens the effect of observations that would be highly influential if least squares were used.

"Leverage" points (data points which does not affect the estimation of the regression coefficients but can dramatically increase R^2, and "Influence" points (data points that has noticeable impact on the model coefficient) can be identified through "deletion diagnostics" like "Cook's distance" or other measures like DFFITS and DFBETAS. Deleting or retaining a "Leverage" or "Influence" point is dependent on judgment, the number of such points identified and their actual impact on the model. A "compromise" between deleting and retaining an observation is to use "robust regression" techniques which "downweights" observations in proportion to residual magnitude or influence.

For first order auto correlated data it is necessary to recognize the autocorrelative structure in the model and devise an appropriate parameter estimation method. There are a number of estimation procedures that can be used. One of the most commonly used methods is the "first–differences approach" which assumes a correlation $\rho = 1$ yielding the transformed variables $Y_t^{'} = Y_t - Y_{t-1}$ and $X_t^{'} = X_t - X_{t-1}$. $Y_t^{'}$ & $X_t^{'}$ are then regressed through the origin.(For prices (assumed to be lognormally distributed) $Y_t^{'}$ & $X_t^{'}$ could be represented by the log returns of successive data points).

8. Observations

Regression models need to be examined to check if they comply with the basic assumptions of least square regressions. If the regression assumptions do not hold, possibilities of making suitable transformations (first-difference approach) and alternate models (robust regression) need to be explored.

Regression models are intended as interpolation equations over the range of the regressor variables hence the model should never be used to extrapolate beyond the original data (i.e. the data used to estimate the model).

The statistic R^2 should be used with caution. The magnitude of R^2 depends on the range of variability in the regressor variable. Generally, R^2 will increase as the spread of the X's increase and decrease as the spread of the x's decrease provided the assumed model is correct. Thus, a large value of R^2 may result simply because X has significant variability. On the other hand, R^2 may be small because the range of X is too small to allow its relationship to y to be detected. Further, R^2 is not a measure of the appropriateness of the linear model, it is quite possible for the R^2 value to be large even when "X" and "Y" are "non-linearly" related.

The regression equation determined should be validated: The stability of the regression coefficients should be examined by fitting the model for various time spans.

Fresh data could be used to establish the models performance.

When it is not possible to get fresh data, the existing data could be split into two parts, one part "estimation data" could be used to derive the regression equation and the other part "prediction data" could be used to study the predictive capability of the regression model

9. Conclusions

Audit Analytics and statistics methods used in audit are not representing a necessity anymore for a company. Nowadays, it is a must that each company has to integrate in order to enhance the performance of their business process.

Continuous control monitoring through audit analytics is the key of identification of opportunities for continuous improvement of business processes and evaluation of organization-driven risks;

Conducting information systems, compliance, accounting, financial and investigative analytic audits will reduce risks inside the company and it will improve the day-to-day work of the employees and thus it will improve the global performance of the company;

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