AUDIT GUIDANCE STATEMENT **AGS 13**

Data Analytics in a Financial Statements Audit

AGS 13 was approved by the Council of the Institute of Singapore Chartered Accountants (ISCA) in August 2021. This Statement has been developed in collaboration with the Accounting and Corporate Regulatory Authority (ACRA).

The principles and guidance contained in this Statement are consistent with Singapore Standards on Auditing (SSAs) and should be read in conjunction with the SSAs.

Data Analytics in a Financial Statements Audit

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Introduction

1. Rapid advancements in technology and innovative practices have transformed the business landscape; companies are now operating in a complex environment with pervasive use of data and technology to drive business decisions.

2. Auditors are similarly leveraging on technology including data analytics tools to enhance the quality of their audits and more effectively deal with large volumes of data.

   It is imperative for the auditor to design sufficient appropriate audit procedures to evaluate whether the information produced by the entity ("IPE") which is used in DA is sufficiently reliable for the auditor's purpose as required by SSA 500 *Audit Evidence*, including determining the appropriate sample size and checking to the appropriate underlying source documents.

   Whilst the use of data analytics may address certain assertions effectively, it does not replace the need to perform other audit procedures to collectively address the risk of material misstatement as a whole. Such procedures include tracing to the underlying source documents which are necessary to address other assertions (e.g. occurrence and rights and obligations). Therefore, it is important that the auditor performs other audit procedures to collectively address the risk of material misstatement as a whole.

Scope

3. This Statement provides guidance on the key principles of the application of data analytics in the audit of financial statements, comprising the considerations prior to the use of data analytics, preparing data for use, relevance and reliability of data, use of data analytics, evaluation of results and other relevant considerations.

4. This Statement is intended to guide auditors in the application of data analytics in the performance of financial statement audits, providing practical examples on how data analytics may be effectively used in different phases of the audit in accordance with Singapore Standards on Auditing ("SSAs").

5. SSA 220[1] sets out the specific responsibilities of the auditor regarding quality control procedures for an audit of financial statements. Certain elements regarding the use of data analytics may need to be addressed by an audit firm's quality control procedures such as considering the competency and capabilities of the engagement team members and the use of appropriate tools and software. While the Statement has included some guidance on the considerations at the firm level, the impact of these considerations on the application of data analytics in the audit of financial statements are beyond the scope of this Statement.

6. The capture, storage and processing of entity data presents audit firms with challenges in relation to data security and data protection. Firms shall establish policies and procedures designed to ensure that they comply with applicable legal and regulatory requirements relating to the confidentiality of information received in the course of the engagement, in accordance with SSQC 1[2]. The discussion of these matters is beyond the scope of this Statement.

7. The discussion of the use of data analytics in performing tests of controls is beyond the scope of this Statement.

[1] SSA 200, *Quality Control for an Audit of Financial Statements*
[2] SSQC 1, *Quality Control for Firms that Perform Audits and Reviews of Financial Statements, and Other Assurance and Related Services Engagements*

8. The guidance in this Statement is limited to the use of data analytics as defined in paragraph 11 and does not consider the use of other automated tools and techniques.

Requirements of SSAs

9. The SSAs require the auditor to obtain reasonable assurance about whether the financial statements as a whole are free from material misstatement, whether due to fraud or error.

10. It should be noted that the ability to test 100% of a population through data analytics does not imply that the auditor is able to provide something more than a reasonable assurance opinion or that the meaning of "reasonable assurance" changes.

Definition

11. For purposes of this Statement, data analytics, when used to obtain audit evidence in a financial statements audit, is defined as "the science and art of discovering and analysing patterns, deviations and inconsistencies, and extracting other useful information in the data underlying or related to the subject matter of an audit through analysis, modeling, and visualization for the purpose of planning or performing the audit[3]".

Types of data analytics

12. Generally, data analytics can be categorized as the following:[4]

    (a) Descriptive Analytics

        Descriptive analytics is the examination of data or content to answer the question "What happened?" and is often characterized by traditional business intelligence and visualizations such as pie charts, bar charts, line graphs, tables, or generated narratives.

    (b) Diagnostic Analytics

        Diagnostic analytics is a form of advanced analytics which examines data or content to answer the question "Why did it happen?" and is characterized by techniques such as drill-down, data discovery, data mining and correlations.

    (c) Predictive Analytics

        Predictive analytics is a form of advanced analytics which examines data or content to answer the question "What is going to happen?" or more precisely, "What is likely to happen?", and is characterized by techniques such as regression analysis, forecasting, multivariate statistics, pattern matching and predictive modeling.

    (d) Prescriptive Analytics

        Prescriptive analytics is a form of advanced analytics which examines data or content to answer the question "What should be done?" or "What can we do to make _____ happen?", and is characterized by techniques such as graph analysis, simulation, complex event processing, neural networks, recommendation engines, heuristics, and machine learning.

    Data analytics that are commonly used in a financial statements audit are descriptive and diagnostic analytics.

[3] Paragraph 6, *Exploring the Growing Use of Technology in the Audit, with a Focus on Data Analytics*, issued by the International Auditing and Assurance Standards Board (IAASB) in September 2016.

[4] The descriptions here are based on Gartner's IT Glossary: www.gartner.com/it-glossary/

Phases of the audit

13. As required by SSA 315 (Revised)[5] and SSA 330[6], audit evidence to draw reasonable conclusions on which to base the auditor's opinion is obtained by performing:

    (a) Risk assessment procedures; and

    (b) Further audit procedures, which comprise:

        (i) Tests of controls, when required by the SSAs or when the auditor has chosen to do so; and

        (ii) Substantive procedures, including tests of details and substantive analytical procedures.

14. It is further noted that the audit procedures described in SSA 500[7], namely, inspection, observation, external confirmation, recalculation, reperformance, analytical procedures and inquiry may be used as risk assessment procedures, tests of controls or substantive procedures, depending on the context in which they are applied by the auditor.

15. The principles in paragraphs 13 and 14 remain unchanged in the context of application of data analytics, regardless of the type of data analytics applied.

16. A single data analytic may achieve more than one objective, for example, the same analytics may serve effectively as a risk assessment procedure as well as a substantive analytical procedure.

Linking types of data analytics to phases of the audit

17. The auditor should consider the objectives of the data analytics and the phase of the audit in which the data analytics is intended to be applied in order to decide which type of analytics would be more relevant. For example, descriptive analytics are usually more relevant when performing risk assessment to aid the auditor in understanding what has transpired during the period in order to identify and assess risks of material misstatements. This is illustrated under Appendix A *Examples of Data Analytics used in Risk Assessment Procedures*.

Considerations prior to use of data analytics at the firm and engagement levels

Technological Resources

18. Technological resources are increasingly being recognised as an input to the assurance process.

19. The inappropriate use of technological resources may, however, increase the risk of overreliance on the information produced for decision-making purposes, or may create threats in complying with relevant ethical requirements, for example, requirements related to confidentiality. Accordingly, policies and procedures have to be in place to ensure that such technological resources are used appropriately.

[5] SSA 315 (Revised), *Identifying and Assessing the Risks of Material Misstatement through Understanding the Entity and its Environment*
[6] SSA 300, *Planning an Audit of Financial Statements*
[7] SSA 500, *Audit Evidence*, paragraphs A14 – A25

Quality Management at Firm Level

20. When implementing a data analytics tool at the firm level, it is necessary for the firm to determine that the data analytics tool operates appropriately. This determination would typically involve consideration of whether:

- The data inputs are complete and appropriate and confidentiality of the data is preserved;
- The tool operates as designed and achieves the purpose for which it is intended;
- The outputs of the tool achieve the purpose for which they will be used;
- The general IT controls necessary to support the tool's continued operation as designed are appropriate and effective;
- There is the need for specialised skills to utilise the tool effectively, including the training of individuals who will use the tool; and
- There is the need to develop procedures that set out how the IT tool operates.

21. The firm's policies or procedures may also specifically prohibit the use of certain technological resources (e.g., software that has not yet been specifically approved for use by the firm) or may include requirements to seek approval to use a new technological resource.

22. The firm's policies or procedures may set forth required considerations or responsibilities for the engagement team when using firm approved technology to perform audit procedures and may require the involvement of individuals with specialized skills or expertise in evaluating or analyzing the output.

Quality Management at Engagement Level

23. In some circumstances the firm's policies or procedures may not specifically deal with the use of a specific technological resource (e.g., complex spreadsheets developed by the engagement team or obtained from outside the engagement team or the firm). In these circumstances, the engagement partner should similarly consider the factors listed under paragraph 20 and apply professional judgment in considering whether the use of the resource on the audit engagement is appropriate in the context of the engagement, and if so, how it is to be used.

Data Security and Confidentiality at Firm Level

24. Under the Code of Professional Conduct and Ethics for Public Accountants and Accounting Entities issued by ACRA (ACRA Code), a public accountant is required to comply with principles of confidentiality – to respect the confidentiality of information acquired as a result of professional and business relationships and, therefore, not:

(a) disclose any such information to third parties without proper and specific authority, unless there is a legal or professional right or duty to disclose, or

(b) use the information for the personal advantage of the public accountant or third parties.

25. Concerns by audited entities include data security breaches which may result in loss of confidentiality (or for some types of data, privacy) when the auditor has imported the entities' data into the auditor's systems.

26. Essentially, entities need to have confidence that their data will be held and processed securely, so that they can fulfil their own legal and regulatory obligations by making the data available to the auditor. The implementation of appropriate policies and procedures in relation to data

security is, therefore, a necessary part of the effective deployment of data analytics in financial statements audit.

27. It is thus important to recognize that the advent of the use of data analytics does not introduce any new requirement, but rather it is increasing the significance of confidentiality as a fundamental principle given the expansive scale of entity's data that is required for any meaningful use of data analytics in a financial statement audit.

28. The firm's responses to address the confidentiality of client information will need to address all possible locations of client information within the firm, including engagement documentation, emails, firm servers or hard copy. Additional clauses may need to be considered in engagement letters to address legal issues relating to data security, confidentiality and the use of tools or software and the firm's data-handling and security protocols should be continuously reviewed by the firm to ensure that such clauses continue to remain relevant.

29. It should also be noted that whilst the unprecedented volumes of data involved has called for change in risks relating to data storage and retention, the criteria for preparing sufficient and appropriate audit documentation remains unchanged. For this, the auditor should refer to the principles in SSA 230[8] and guidance on documentation under paragraphs 127 – 130.

Human Resources at Firm Level

30. Competence is the ability of the individual to perform a role to a defined standard and goes beyond knowledge of principles, standards, concepts, facts, and procedures; it is the integration and application of technical competence, professional skills, and professional ethics, values and attitudes.

31. In accordance with SSA 620 *Using the Work of an Auditor's Expert*, the auditor's responsibility over the audit opinion remains unchanged, even if there is a separate specialist team that performs data analytics for the auditor or provides support to the auditor in performing data analytics.

32. Time and investment in training should thus focus on changing the auditor's mindset to gathering audit evidence from the use of data analytics compared to traditional techniques as well as basic understanding of IT (such as understanding of databases, table structure and data types) to be able to come up with relevant and effective audit procedures using data analytics.

33. For data analytics technology and tools that are developed centrally for use by engagement teams at the audit firm or network level, the audit firm should provide appropriate training and user guidance to those who intend to use them.

Preparing Data for Use

Data Acquisition

34. As effective and efficient data capture is among the critical success factors for the use of data analytics, engagement teams should ascertain at an early stage whether the quality of the data that the entity's management can provide is appropriate to support the analytic employed.

35. Engagement teams may lack the required IT knowledge to extract the relevant data in the required format from entities' systems or organise the data extracted by the client's IT personnel into a suitable format for use in data analytics. Where this is the case, the use of specialist staff and standard scripts for data capture and loading data analytics tools is a good practice to ensure that accurate data is obtained in a usable format.

[8] SSA 230, *Audit Documentation*

36. Examples of situations which may warrant certain data transformation include the following:

(a) where date format from different systems in an organization varies, for example “yyyy-mm-dd” format in one system and “dd-mm-yyyy” format in another, or

(b) where leading and trailing zeroes in an inventory item code may need to be removed to ensure proper comparison to another data source that may not have such leading and trailing zeroes.

37. The auditor should consider the matters set out under paragraph 128 when documenting the approach taken in transforming the data from its raw form to any format used in subsequent data analytics activity. This is not dissimilar to the principles of para 8 of SSA 230 where the documentation should enable an experienced auditor to understand how data transformation was done.

38. Whilst some data error issues are relatively easy to resolve, the nature of certain matters identified may cause doubt regarding the quality of data that is intended for use by the auditor. For example, in cases where it is not expected for certain data fields to have blanks or null values, the presence of such items may indicate that the controls over data are not operating effectively, and accordingly such data may not be suitable for use in the audit until the entity takes appropriate actions to correct the records.

Considering Relevance and Reliability of Data

39. SSA 500 Audit Evidence states that the auditor shall consider the relevance and reliability of the information to be used as audit evidence.

(a) Relevance refers to the logical connection with, or bearing upon, the purpose of the audit procedure and, where appropriate, the assertion under consideration.

(b) Reliability of the information is influenced by its source and its nature, and the circumstances under which it is obtained, including the controls over its preparation and maintenance where relevant.

Relevance of Data

40. With the limitless possibilities around data analytics, the relevance of data becomes increasingly important as the data being analysed need to be relevant to the audit procedures responding to the risk of material misstatement at the assertion level of the class of transaction or account balance under consideration. One example where relevance is in question is where the data analytics provide interesting insights to management but does not produce adequate audit evidence.

Reliability of data

41. Majority of data utilized in data analytics is IPE, and as such, the auditor is required to evaluate whether the information is sufficiently reliable for the auditor’s purposes, including as necessary in the circumstances below:

(a) Obtaining audit evidence about the accuracy and completeness of the IPE; and

(b) Evaluating whether the IPE is sufficiently precise and detailed for the auditor’s purposes.

42. In determining the approach that the auditor may use in determining whether data is sufficiently reliable, the purpose for which data analytics is being performed (for example, whether as a risk assessment procedure, test of controls, substantive analytical procedure, or test of details) needs to be considered.

43. For example, if data analytics is used to perform further audit procedures, the extent of testing the data underlying the further audit procedures would likely be greater than when testing the data intended to be used in the data analytics used as risk assessment procedures. These procedures to test the underlying data would not be dissimilar to the approach taken for traditional audit procedures as set out in SSA 500 and may include:

- Obtaining audit evidence on the accuracy and completeness of the IPE through procedures performed concurrently with the actual audit procedures applied to the IPE when obtaining such audit evidence is an integral part of the audit procedure itself; or

- Testing the controls over the preparation and maintenance of the IPE.

44. In the event that the IT general controls are ineffective, the auditor should assess its impact on using data analytics in the audit.

Using Data Analytics in an Audit

45. Data analytics can be applied to the following phases of the audit:

(a) Risk assessment; and

(b) Further audit procedures.

46. There is no “bright line” distinction between data analytics used in performing risk assessment procedures and those used in performing further audit procedures. A data analytic may be used to perform further audit procedures (i.e. test of controls or substantive procedures) if it provides sufficient appropriate audit evidence that a risk of material misstatement has been addressed. The factors to consider in making the determination of whether a data analytic is used to perform risk assessment procedures or further audit procedures may include:

- The purpose of the procedure (i.e. whether the data analytic is directly responsive to the identified risk of material misstatement); and

- The level of precision in the procedure (e.g. whether the expectation is sufficiently precise to identify a misstatement).

Basic Steps in Using Data Analytics in an Audit

47. Figure 1 below sets out five basic steps for use in planning, performing and evaluating the results of data analytics used in various aspects of the audit (Risk Assessment Procedures, Substantive Analytical Procedures and/or Test of Details).

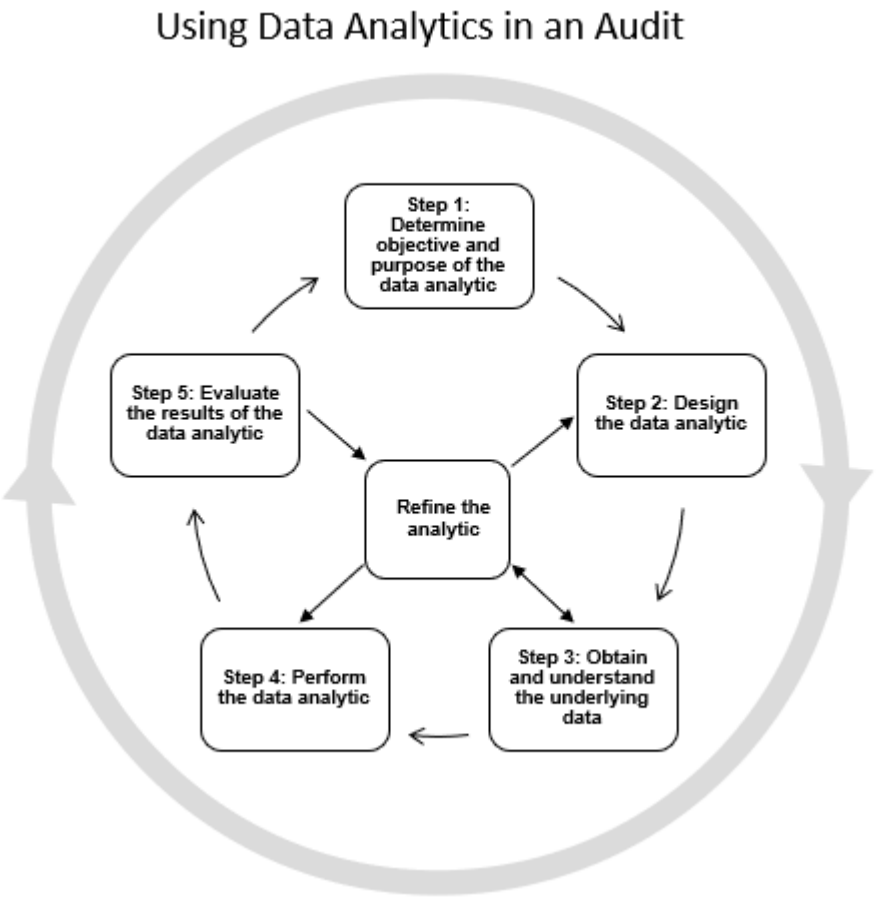


Figure 1: Basic Steps in Using Data Analytics in an Audit

48. The application of the basic steps in Figure 1 is illustrated in performing risk assessment procedures in paragraph 54 to paragraph 68.

49. The use of data analytics is an iterative and non-linear process. Each engagement team may have different judgements about the order in which the steps and procedures to execute a data analytic are performed. While Figure 1 demonstrates a linear process, the auditor might decide to perform certain steps and procedures concurrently or in a different order than those set out above.

50. Relevant documentation requirements when performing each step and related procedures such as those set out under SSA 230 and SSA 315 (Revised) should be complied with.

Risk Assessment Procedures

51. When using data analytics in performing risk assessment procedures, the auditor should refer to the concepts and definitions found in SSA 315 (Revised)[9].

    Appendix A sets out the following examples on the use of data analytics in performing risk assessment procedures:

    - Example 1: Profit Margin Analysis using a combination (statistical and non-statistical) approach

    - Example 2: General Ledger Account Balance Analysis using a non-statistical approach

[9] SSA 315 (Revised), *Risk Assessment*

52. SSA 315 (Revised) states that the auditor shall perform risk assessment procedures to provide a basis for the identification and assessment of risks of material misstatement at the financial statement and assertion levels.

53. Risk assessment procedures are 'the audit procedures performed to obtain an understanding of the entity and its environment, including the entity's internal control, to identify and assess the risks of material misstatement, whether due to fraud or error, at the financial statement and assertion levels.

Step 1: Determine the objective and purpose of the data analytic

54. The objective and purpose of the data analytic will first need to be determined as these will drive the design of the data analytic. For example, a data analytic may be designed very differently if its objective is to obtain an understanding of a new account balance versus a data analytic where the objective is to corroborate or challenge the auditor's understanding of existing accounts. This will further determine whether the analytic is exploratory or confirmatory in nature as discussed in paragraphs 58 and 59.

Step 2: Design the data analytic

55. With the objective and purpose of the data analytic in mind, the auditor can now determine the data population that is to be analyzed or tested. This will drive conversations with the entity to obtain and subsequently, understand the underlying data.

56. The audit engagement team considers the specific tools, techniques and types of visualizations that would achieve the intended objective of the risk assessment procedure. Some considerations in deciding which tool is the most appropriate to use when designing the data analytic include:

- Quality of the data received, including the extent of data preparation and cleansing required
- Data volume
- Complexity of the data analytic which includes the extent of customization required

57. The type of visualization (e.g., scatterplot, histogram) is dependent on the objective of the visualization (i.e., comparison, distribution, composition, or relationship); in some instances, a variety of visualization types is necessary. For example, a scatter plot may be used to determine whether there is a relationship between two variables, while a histogram may be used to show the distribution of items in a population.

58. A data analytic that is exploratory in nature is typically visualized without a clearly defined expectation. A broad look is taken to understand the data, identify patterns and trends; thus allowing the auditor to gain an understanding of a population and focus areas for risk assessment. This may be particularly applicable for a first year audit or for a new account balance.

59. By contrast, an analytic is confirmatory in nature if the data analytic is designed to corroborate or challenge something that the engagement team already believes to be true based on the information that was gathered through risk assessment procedures and professional judgement from prior audit experience. This allows the auditor to obtain fact-based evidence to support certain information that was gathered as part of risk assessment procedures.

Step 3: Obtain and understand the underlying data

60. Understanding the nature, purpose, and significance of the underlying data is important to plan procedures to evaluate whether the data is sufficient and appropriate for its intended purpose.

61. The considerations to be made when evaluating the relevance and reliability of the underlying data are discussed in paragraphs 39 to 43.

Step 4: Perform the data analytic

62. Notable items, commonly termed “outliers”, may be identified through the use of data analytic to perform risk assessment procedures. Outliers are items within the population that are different or unusual; it is critical to understand how and why outliers occur to perform a robust risk assessment.

63. Outliers can be identified using a statistical approach (i.e., determined using a boundary based on a “representative data point” or measure of central tendency) or a non-statistical approach (i.e. determined based on characteristics such as a monetary amount, percentage, or geographical location).

(a) Statistical approach

Statistical outliers are the data points that are "abnormally far" from the rest of the data points. Parameters are established to define a boundary and highlight the point(s) beyond which an item becomes an outlier. This is done by defining the "representative data point" (e.g., mean, median, or mode), also called the measure of central tendency, and define boundaries based on the distribution of the data.

(b) Non-statistical approach

It is also possible to identify outliers in a population using a non-statistical approach (i.e. not determining a statistically based "representative data point"). Outliers may be identified based on characteristics such as a monetary amount, percentage, geographical location, or other qualitative characteristics (or some combination of these). In contrast to the statistical approach, the determination of outliers is based on professional judgment and the specific facts and circumstances of the population being analyzed**.**

Appendix A provides case studies with examples of outliers identified using both a statistical and non-statistical approach.

64. Once outliers are identified, further procedures such as inquiry and corroboration should be conducted to obtain an understanding of the outliers. A large number of outliers may be identified where it is not practicable for the engagement team to address the items individually; for some audits the outliers could number in the hundreds or even thousands. In such cases the auditor may apply a grouping and filtering process to profile outliers based on their characteristics and possible risks at the assertion level.

65. The auditor should then subsequently design and perform procedures that appropriately respond to the risks identified (if any). The procedures to filter and sort the outliers, including the common characteristics identified should be documented in accordance with the paragraph 128, along with the procedures performed to address the risks associated with each group.

66. The results of the investigation into the outliers may provide new information that can be used to refine the analytic. The process of refining and re-performing the analytic is an iterative process and will continue until the auditor decides that the analytic needs no further improvement to achieve the objective of the procedure or that a different procedure is needed to achieve those objectives.

Appendix A provides illustrative examples including how outliers are identified and addressed.

Step 5: Evaluate the results of the data analytic

67. The results of the data analytic in risk assessment procedures may:

- Indicate a new risk of material misstatement not previously identified,
- Cause a change in the significance of the assessed risk of material misstatement, or

- Provide information useful in tailoring further audit procedures.

68. In evaluating the results of the data analytic, the engagement team should evaluate whether there is risk of material misstatement present in the "non-outlier" population and if so, design and perform further audit procedures to address those risks.

Further Audit Procedures

Substantive Procedures

69. This section discusses the matters related to the use of data analytics in performing substantive procedures and refers to the concepts and definitions found in SSA 330 and SSA 520[10].

70. Substantive procedures are audit procedures designed to detect material misstatements at the assertion level, and they comprise:

    i. Substantive analytical procedures, and
    ii. Test of details (of classes of transactions, account balances and disclosures).

    Appendix B sets out the following examples of the use of data analytics in performing substantive procedures:
    - Example 1: Substantive Analytical Procedure – Recalculation of Ferry Revenue
    - Example 2: Test of Details – Payroll Expenses
    - Example 3: Test of Details – Procurement Three Way Match

Substantive analytical procedures

71. Substantive analytical procedures are where the auditor uses analytical procedures as substantive procedures.

72. Substantive analytical procedures are generally more applicable to large volumes of transactions that tend to be predictable over time.

73. The use of data analytics enables higher precision and more effective substantive analytical procedures that incorporate external data as well as information produced by the entity that are more granular in nature. For instance, data analytics allow for the analysis of specific stock exchange indices at various specific points in time as well as individual sale transactions by customers.

74. The five basic steps in Figure 1 can be performed for use in planning, performing and evaluating the results of data analytics used to perform substantive analytical procedure.

75. As highlighted in paragraph 49, each engagement team may have different judgment about the order in which the steps and procedures to execute a data analytic are performed.

76. The following paragraphs discuss key concepts that affect the auditor's performance of one or more of the steps in Figure 1 when performing substantive analytical procedures.

Auditor's expectation

77. The auditor develops an expectation based on independent or audited data (financial or nonfinancial data) and compares it with recorded amounts for the purpose of concluding on the recorded amounts. The auditor's expectation should be sufficiently precise to detect a misstatement that, individually or when aggregated with other misstatements, may cause the financial statements to be materially misstated.

[10] SSA 520 *Analytical Procedures*

78. The development of the auditor’s expectation is based on the expectation that relationships among data exist and continue in the absence of known conditions to the contrary. With data analytics, the ability to assess and analyze large volumes of data (external or information produced by the entity) allows the auditor to develop more precise expectation than in the past.

Precision

79. A measure of the proximity of the auditor's expectation to the correct amount. The desired precision of the expectation varies according to the stage of the audit or the purpose of the analytical procedure. For example, precision is more important for analytical procedures used as substantive tests than for those used in planning. The effectiveness of analytical procedures depends on their precision and purpose.

80. For example, an auditor plans to test depreciation expense and decides that analytical procedures could be designed to serve as an effective substantive test. If the auditor requires a high level of assurance from the procedure, it is necessary to develop a relatively precise expectation, for example, by using individual asset cost and useful life as opposed to using each asset class and the asset class’ useful life. The level of precision in the expectation developed affects the ability of the auditor to correctly identify whether a given unexpected difference in an account balance is the result of a misstatement.

81. The auditor’s expectations are developed in such a way that a difference between the expectation and the recorded amount that exceeds the threshold may be indicative of a misstatement. It is important to develop sufficiently precise expectations and consider whether there are any offsetting differences in the substantive analytical procedures that may cause the financial statements to be materially misstated.

Level of Disaggregation

82. Expectations should be developed at the appropriate level of disaggregation. A disaggregated part is a portion of a population subject to examination for which the auditor determines he/she can develop a sufficiently precise expectation that is likely to identify a material misstatement. SSA 520 para A15 states that the degree to which data can be disaggregated affects whether the expectation developed is sufficiently precise to identify a misstatement. There are various ways a population can be disaggregated, such as by period, product line, location, amounts comprising transactions with distinct characteristics, combination of the above, or others.

83. Compared to expectations developed at a high level, expectations developed at a granular level typically have a greater chance of detecting material misstatements. There is a risk that a material misstatement could be obscured by offsetting factors when expectations are developed at an aggregated level. For example, the different financial performance of individual business units may be offset if analyzed at a company-wide level. Therefore, the auditor's expectation generally becomes more precise when the expectations are developed at a more detailed level.

84. The auditor should apply professional judgment to determine the appropriate level of disaggregation. It is important for the disaggregated part to be at a sufficient level of detail to identify a material misstatement.

Acceptable difference

85. SSA 520 paragraph A16 states that the auditor’s determination of the amount of difference from the expectation that can be accepted without further investigation is influenced by materiality and the consistency with the desired level of assurance, taking account of the possibility that a misstatement, individually or when aggregated with other misstatements, may cause the financial statements to be materially misstated. The auditor uses professional judgement to determine an appropriate threshold for identifying significant differences by considering the following factors in combination:

    - Performance materiality

- Effect of small populations or disaggregated amounts
- Precision of the expectation

86. SSA 330 requires the auditor to obtain more persuasive audit evidence the higher the auditor's assessment of risk. Accordingly, as the assessed risk increases, the amount of difference considered acceptable without investigation decreases in order to achieve the desired level of persuasive evidence.

87. Generally, expectations developed at a greater level of disaggregation would be more precise. Consequently, it may be useful to consider if it is appropriate to set a lower threshold when the use of data analytics allows expectations to be developed at a more precise level.

Significant difference

88. SSA 520 paragraph 7 states that, if the auditor identifies fluctuations or relationships that are inconsistent with other relevant information or that differ from expected values by a significant amount, the auditor shall investigate such differences by:

- Inquiring of management and obtaining appropriate audit evidence relevant to management's responses; and
- Performing other audit procedures as necessary in the circumstances.

The difference between an auditor's expectation and the recorded book value of an account may be due to any or all of the following three causes:

- A misstatement
- Inherent factors that affect the account being audited (for example, the predictability of the account or account subjectivity)
- Factors related to the reliability of data used to develop the expectation

89. The more precise the auditor's expectation is, the more likely the difference between the auditor's expectation and the recorded value will be due to misstatements. If the auditor believes that the difference is more likely due to factors related to the precision of the expectation, and a more precise expectation can be developed in a cost effective manner vis-à-vis performing additional procedures on the difference, the analytical procedure may be re-performed based on the new expectation, and the new difference would be calculated. Correspondingly, if the auditor rules out other factors that may affect the precision of the auditor's expectation, the unexpected difference may be a potential misstatement and will thus be evaluated as such.

90. The auditor usually obtains an explanation from management on possible reasons behind the significant difference observed from the data analytic. In such cases, additional audit evidence is obtained which either corroborates or contradicts management's explanation. The procedures used to obtain this audit evidence may depend, for example, on the nature of the account balance being audited and the explanation provided by management. Also, when the relevant population is disaggregated, a pattern in the differences may indicate that there is a common explanation for those differences, but that may not necessarily be the case.

91. Often, it may not be practicable to identify factors that explain the exact amount of a significant difference. However, the auditor performs the procedures required to obtain sufficient appropriate audit evidence to conclude that the amount of the unexplained portion of the significant difference does not indicate the existence of a material misstatement.

92. Based on the information obtained during investigation, the auditor considers if the data analytic needs to be further refined. If the auditor determines that the differences between the recorded amount and the auditor's expectation are resulting from factors that should have been incorporated as part of the design of the data analytic, the auditor may consider, if practicable, to refine the analytic. Whilst doing so, it is important for the auditor to remain professionally skeptical and avoid the tendency to search for and interpret results in a way that confirms the auditor's pre-existing beliefs or hypotheses.

Aggregation Risk

93. When performing substantive analytical procedures, if identified differences are less than the threshold (both individually and cumulatively), it is generally not required to investigate the difference further as it is not indicative of material misstatement and it can be concluded that the amount being tested is not materially misstated provided that there are no contradictory audit evidences from other related audit procedures performed.

94. In particular, it is important to consider aggregation risk (i.e., the risk that individual misstatements that are lower than our chosen threshold could represent a material misstatement in the aggregate) when evaluating the results of the substantive analytical procedure when using thresholds at a disaggregated level.

95. For example, a substantive analytical procedure of monthly depreciation expense is performed and the differences are compared to a threshold on a monthly basis. If the monthly differences trend in the same direction and are individually close to the monthly thresholds, the aggregated differences for the year may represent a multiple of performance materiality or materiality. The auditor should consider whether there is any aggregation risk that may exist that could indicate that the balance is materially misstated in the aggregate.

Test of details

96. In designing tests of details, the extent of testing is ordinarily thought of in terms of the sample size[11]. With the use of data analytics, however, test of details can be performed on 100 percent of the population as opposed to a sample of population. For example, recalculations, reconciliations and roll-forwards can be performed for 100 percent of items within the population using data analytics as opposed to a sample of items within the population which is the traditional approach.

97. While data analytics may be used in certain circumstances to perform tests of details, the auditor needs to exercise professional judgment in assessing the quality of audit evidence obtained.

98. One key consideration is that data analytics are typically performed on IPE which are generated internally by the entity. Based on the principles of paragraph A8 of SSA 500, more assurance is ordinarily obtained from audit evidence obtained from a source independent of the entity than those that are generated internally by the entity.

    For example, testing the occurrence of revenue recorded by using data analytics to perform a three-way match by tracing 100% of revenue recorded to information recorded in the entity's systems such as invoices, subsequent cash receipts recorded or debit balances in the debtor's sub-ledger may not, by itself, provide sufficient evidence over the assertion tested. To address this, other procedures may need to be performed to obtain corroborative audit evidence over the occurrence of revenue, which could include, for example, a combination of the following procedures where appropriate:

    - Analysis of sales trends to identify unusual trends;
    - Analysis to identify unusual customer purchasing pattern;
    - Tracing cash receipts to payor details to identify suspicious activities or transactions;
    - Vouching sales invoices to the underlying source documents (e.g. customer-acknowledged delivery orders).

99. As such, the auditor needs to carefully evaluate if sufficient appropriate audit evidence has been obtained from data analytics procedures and other collaborative audit procedures.

100. The five steps set out in Figure 1 is also applicable when using data analytics in performing tests of details. Again, each engagement team may have different judgement about the order in which the steps and procedures to execute a data analytic are performed.

[11] SSA 330, paragraph A47

101. The following paragraphs discuss key concepts that affect the auditor's performance of one or more of the steps in Figure 1. Discussion on these key concepts will only focus on those which are different from that in substantive analytical procedures.

Stratification[12]

102. When using data analytics to perform test of details procedures, the auditor may consider stratifying the account balance, class of transactions, or disclosure into smaller sub-populations and designing separate audit procedures for each sub-population if there are different characteristics within the population that would affect the data analytic.

103. A population can be stratified based on different characteristics (e.g., different risk of material misstatement, processes and controls, history of misstatements, or deviations). There may be sub-populations that warrant separate procedures (i.e., certain populations that the data analytic is not designed to address) and these sub-populations may be identified and removed upfront from the initial design of the data analytic as they are expected to behave differently from the rest of the population. If these sub-populations are not removed and separately addressed, they may show up as exceptions that are not misstatements i.e. "false positives", in the initial results of the data analytic.

104. When designing and performing the data analytic in substantive procedures for the first time, it is often that the auditor does not have the knowledge to remove such sub-populations upfront in the initial design of the data analytic. However, the auditor should refine the data analytic such that it does not continue to identify these false positives. Designing a data analytic can be an iterative process that requires refinement as the auditor evaluates the results of the data analytic.

Appendix B provides illustrative examples of how false positives are identified and removed to improve on a data analytic used in test of details procedures.

Precision

105. When using data analytics to perform test of details procedures, the data analytic needs to be sufficiently precise to provide the desired level of assurance that exceptions may be potential material misstatements, individually or when aggregated with other misstatements

106. A data analytic that is imprecise can lead to either of the following outcomes:

- The identification of a significant number of exceptions, leading to additional time spent investigating false positives that are unlikely to be misstatements.
- The failure to identify an exception that may be a material misstatement

Exception

107. When using data analytics to perform a test of details, the auditor defines what constitutes an exception for the specific test objective. The auditor often has an expected outcome in conducting the test of details. When differences are identified between the expected outcome and the actual outcome, such differences are referred to as exceptions.

108. For example, in order to test for occurrence of revenue, data analytics is used to match 100 percent of the sales orders, invoices, and shipping documents. The auditor's expected outcome is that the quantity per the purchase order and invoice will match that in the shipping document. Any differences are considered exceptions. The auditor then determines the appropriate nature and extent of further audit procedures to perform on the exceptions.

[12] SSA 530 *Audit Sampling* defines stratification as the process of dividing a population into sub-populations, each of which is a group of sampling units which have similar characteristics

109. Exceptions may or may not result in the identification of a misstatement. Therefore, additional investigation should be conducted in order to determine whether the exceptions represent misstatements.

110. The key difference between exceptions and outliers is that an exception represents an item that does not behave in accordance with an expected outcome, whereas an outlier represents data within the population that appears different or unusual. Investigation of an outlier may lead to the identification of an exception, but just as all exceptions are not misstatements, not all outliers are necessarily exceptions.

Threshold amount

111. The auditor determines a threshold amount for evaluating exceptions when using data analytics to perform test of details. Generally, as the data analytic allows for testing to be performed on 100 percent of a population, the auditor may determine the threshold amount to be less than or equal to an amount that is clearly trivial[13].

112. One of the first steps in evaluating exceptions is to determine whether the amount of the exceptions, individually, is in excess of the threshold amount. If the identified exceptions are less than the threshold amount and the auditor determined they are not qualitatively material, the auditor may determine that the exceptions do not need to be investigated and concludes that amount being tested is not materially misstated.

113. Alternatively, if the exceptions are greater than the threshold amount, further investigation is performed to understand the nature and cause of the exceptions and determine whether the exceptions are misstatements in the population.

Evaluating a large group of exceptions

114. The use of data analytics to perform test of details procedures may identify a large number of exceptions. Where applicable, the auditor can group and filter the exceptions into sub-populations.

115. For each sub-population identified, further procedures can be performed to determine which sub-populations contain:

a) False positives (e.g., sub-populations that should be refined from the analytic and separately tested, refer to section above under “Stratification”);

b) Possible misstatements that are clearly inconsequential (e.g., below the clearly trivial threshold) for which no further investigation is required; and

c) Possible misstatements that are not clearly inconsequential for which further investigation is required.

Further analysis and additional procedures can be performed on each sub-population group identified.

Sampling on each sub-population

116. Taking into account the particular circumstances encountered, the procedures performed on items in a sub-population group might include, for example, 100 percent testing, tests of specific items, or sampling. When sampling is used, the auditor would take appropriate measures to determine that sample items selected are representative of the entire population of the sub-population group, and the results of testing the sample can be projected to the entire population of the sub-population group.

[13] SSA 450 *Evaluation of Misstatements Identified During the Audit* defines a misstatement as “clearly trivial” when it is clearly inconsequential, whether taken individually or in aggregate and whether judged by any criteria of size, nature or circumstances

Considering qualitative factors

117. In conducting further analysis and investigation, the auditor considers both quantitative and qualitative factors. For example, matters may be quantitatively inconsequential individually and in the aggregate. However, the auditor considers whether qualitative factors such as the risk of fraud, management bias, or indications that controls on which the auditor is relying are not operating effectively.

118. Regardless of whether the exceptions are greater or less than the threshold amount, the auditor should consider the implications to the evaluation of controls. See section below on *Considering implications on evaluation of controls.*

Refining the analytics

119. Based on the new information arising from the investigation, the auditor considers if the analytics test needs to be refined and improved for example, to remove the false positives if it is practicable to incorporate the new information. Designing a data analytic may be an iterative process and may need refinement as the auditor evaluates the results of the data analytic.

120. An appropriately planned and performed data analytic will then identify a small number of possible misstatements. The auditor may be able to readily determine that some or all of these items are clearly inconsequential, whether taken individually or in the aggregate and whether judged by any criteria of size, nature, or circumstances.

121. When possible misstatements are not clearly inconsequential, the auditor may be able to manually (that is, without further use of a computerized analysis) perform additional procedures to obtain more information on the size, nature, and circumstances of occurrence of these items. This information would enable the auditor to identify which of the possible misstatements are, in fact, misstatements, and subsequently evaluate those misstatements as required.

Aggregation risk

122. When the auditor has identified a subpopulation to contain possible misstatements that are clearly inconsequential, the auditor should consider whether there is any aggregation risk such that an individual subpopulation may be clearly inconsequential, but when aggregated with other subpopulations of exception could represent a material misstatement.

Considering implications on evaluation of controls

123. The use of data analytics in performing a test of details may result in the identification of a material misstatement. SSA 330 states that a material misstatement detected by the auditor's procedure is a strong indicator of the existence of a significant deficiency in internal control. The reverse is not true; the absence of misstatements detected by substantive procedures, however, does not provide audit evidence that controls related to the relevant assertion being tested are effective.

124. The auditor should also consider the guidance in SSA 450 which states that a misstatement may not be an isolated occurrence. Evidence that other misstatements may exist include, for example, where the auditor identifies that a misstatement arose from a breakdown in internal control.

125. As stated in SSA 330, the concept of effectiveness of the operation of controls recognizes that some deviations in the way controls are applied by the entity may occur. Deviations from prescribed controls may be caused by such factors as changes in key personnel, significant seasonal fluctuations in volume of transactions and human error. The detected rate of deviation, in particular in comparison with the expected rate, may indicate that the control cannot be relied on to reduce risk at the assertion level to that assessed by the auditor.

126. When evaluating the results of the data analytic, the auditor compares the rate of exception as detected by the data analytic with the tolerable rate of deviation as set by management. In doing so, the auditor determines if the exceptions identified are indicative of a deficiency in internal control. If the exceptions are indicative of a control deficiency, the auditor would then evaluate the severity of the deficiency.

Documentation

127. In addition to the documentation requirements set out in the respective SSAs, the engagement team shall consider documenting the following items when using data analytics:

- The objective of the data analytic
- The source of the underlying data used in the analytic (including critical extraction criteria and/or key filters if applicable)
- Procedures performed to determine the relevance and reliance of the underlying data
- The design of the analytic and how it has met the objective
- The tools that were used to perform the data analytic
- Procedures performed to determine the reliability of the tools (if applicable)
- The results of the data analytic, which may include a screenshot of the visualization (if applicable)
- The analysis of the results which include the evaluation of outliers and exceptions, and ultimate conclusions

128. As with all audit documentation, the nature and extent of the documentation needs to be sufficient to enable an experienced auditor, having no previous connection to the audit, to understand[14]:

- The nature, timing, and extent of the audit procedures performed;
- The results of the audit procedures performed and the evidence obtained; and
- The significant matters arising during the audit, conclusions reached, and significant professional judgments made in reaching those conclusions.

129. One of the unique factors that applies to the use of data analytics is that many different iterations of the data can be viewed. It is neither necessary nor practicable for the auditor to document every iteration or drill-down option used when analysing the results of such an analytic. Rather, the focus should be on documenting what is relevant to the ultimate conclusions that were reached and the steps it took to arrive at the conclusions.

It should not be required for the auditor to maintain the underlying data to perform the data analytic in the audit documentation. The data themselves do not represent audit documentation and therefore are generally not retained in the audit file. However, the auditor should maintain documentation with sufficient detail which allows the facilitation of reperformance of the analytics by an experienced auditor with no previous connection to the audit.

130. A common pitfall in the audit document is where the auditor does not document the results of the analytics where they corroborate with the auditor's understanding of the population. It is important to document the results of the analytics as it provides fact-based audit evidence to support the current understanding of the entity or specific population, and the conclusion of an unchanged audit approach.

[14] SSA 230 *Audit Documentation*, paragraph 8

Appendix A

Examples of Data Analytics used in Risk Assessment procedures

Notes:

1. ***The examples in this appendix illustrate how data analytics can be applied in risk assessment procedures.***

2. ***The examples that follow do not address the auditor's approach to consider the reliability of data used in each example. For further information regarding procedures to address reliability of data, refer to the relevant section of this Statement.***

3. ***In the following examples, if a step or a procedure noted in Figure 1 in this Statement is not relevant in the context of the particular example, no reference is made to that step or procedure. Also, in some examples, procedures are combined.***

Example 1: Profit Margin Analysis using a combination (statistical and non-statistical) approach

Background Information

In this example, the financial statements being audited are those of a retailer in the business of selling medical equipment. The company sells a total of 6 different specialized products.

Inventory is purchased from the retailer's holding company located overseas. During the start of each financial year, the management reviews each product's profit margin and sets the monthly master pricing for each product accordingly. The sales price and corresponding profit margin for each product is thereafter fixed for each month of the financial year. The approved sales prices and margins are updated and maintained in the master pricing listing.

Each product has its own dedicated team consisting of 1 sales manager and 1 sales officer. Each product's sales manager also reviews and approves sales discounts for different customers. The sales discounts are updated and maintained in the master discount listing.

Each product's sales officer prepares the sales invoices by keying in the sales price whilst referring to the master pricing listing and master discount listing. The sales invoices are also reviewed and approved by the product's sales manager.

Step 1: Determine objective and purpose of the data analytic

The auditor decided to use data analytics to assess the risk of material misstatement related to the accuracy of sales revenue. Material misstatements might result from pricing errors during the preparation of the invoice. This would require the entire population of sales, discounts and master pricing listing for the year on which the analytic can be applied and is likely to be exploratory in nature.

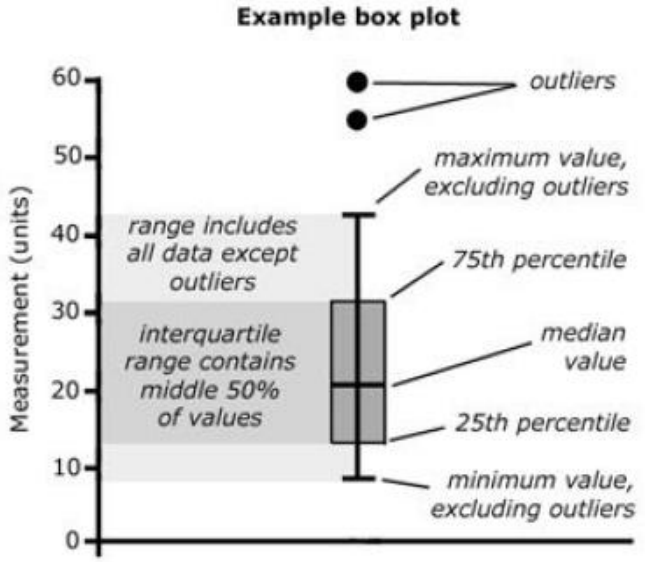
Step 2: Design the data analytic

The auditor decided that it would be useful to analyze the profit margin of each product. Using data disaggregated to the level of individual sales transaction, the auditor's objective is to identify transactions with a higher risk of material misstatement.

As it is the first year that the auditor is using data analytics in risk assessment procedures, the auditor works closely with the data specialist to ensure that the data specialist understood the objectives of the risk assessment procedures.

The auditor decided to use a box and whisker plot to visualize the profit margin of each sales transaction. As the sales transactions are a relatively homogenous population, the box and whisker plot will be useful in indicating where a distribution is skewed and whether there are potential unusual outliers in the dataset.

Outliers are determined statistically based on the box and whisker plot. The auditor was also advised by the specialist that in the absence of statistical outliers, there could still be items of audit interest i.e. non-statistical outliers that appear to be behaving differently from the rest of the population.



Step 3: Obtain and understand the underlying data

The auditor requested and was provided a sales report by the finance department. The sales report contains information on a transactional level for all sales that took place from 2017 to 2018, including the corresponding cost information for each transaction.

Other details such as customer details, product category and product code are also available. As one of the procedures to check the reliability of the report, the total sales figure per the sales report was reconciled to the trial balance and inventory movement.

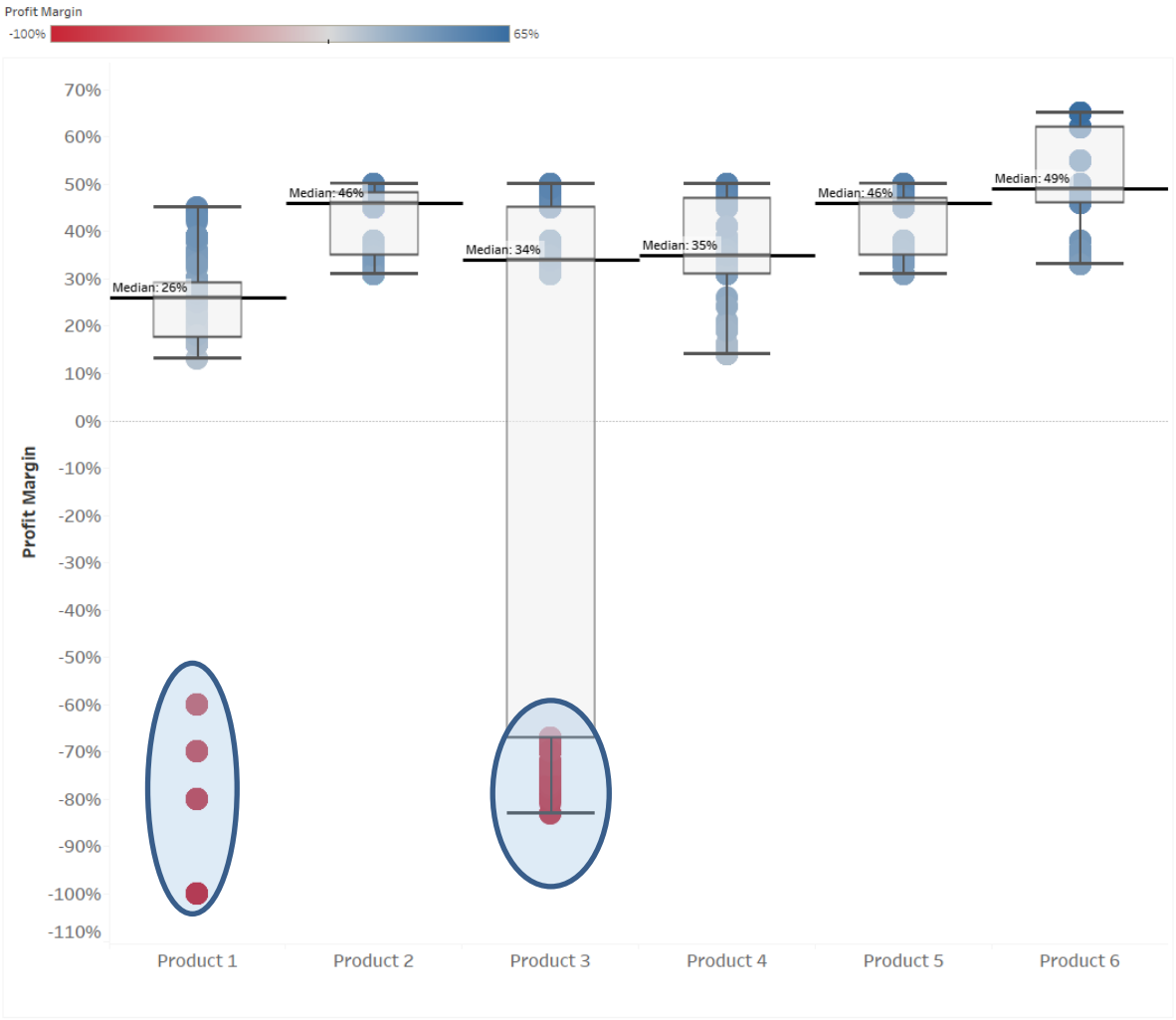


Figure 1 Preliminary results

Step 4 & 5: Perform the data analytic and evaluate the results of the data analytic

Figure 1 shows the preliminary result of the data analytics. Each point on the box and whisker plot represents a single sales transaction. Sales transaction occurring at a profit margin are represented by blue colored dots while sales transactions at a loss margin are represented by red colored dots depending on the quantum of the loss. The median sales margin for each product is indicated by a reference line.

The auditor noted that there are statistical outliers in Product 1 where sales transactions are at a loss margin (represented by dots lying below the lower whisker in Product 1).

Although there are no statistical outliers in Product 3, the auditor observed several sales transactions at a loss margin. Based on understanding from the management, there should not be any sales transaction at a loss margin. The auditor thus decided this group of transactions are non-statistical outliers and should be investigated further.

The visualization tool allows the auditor to drill and extract the detailed information for outliers noted above. The auditor then proceeded to identify and address these outliers, or groups of outliers, that had similar characteristics. The auditor found that the outliers fell into the following groups:

i. For the statistical outliers noted in Product 1, these are older versions of the product that were discontinued and thus priced at a loss in order to clear the inventory.

ii. For the non-statistical outliers noted in Product 3, these are sales transactions where sales prices are lower than what is approved in the master pricing listing

The auditor obtained an explanation from the sales office that the sales transactions under category (i) were for older and outdated versions of Product 1 that were being discontinued. These items were thus priced at a loss in order to clear the inventory. The auditor determined that there could be a new risk of material misstatement not previously identified where sales prices of discontinued products are not accurately recorded and proceeded to design and tailor further audit procedures to address the identified risk. The auditor also assessed that there could be potential risks of material misstatements relating to valuation of inventory for discontinued products and proceeded to design and tailor audit procedures to respond to the identified risk

For the non-statistical outliers under category (ii), the auditor understood from management that these were sales transactions in the month of January when there was a change in the sales officer for Product 3 and the new sales officer had made an error in entering the sales prices. The auditor also noted that the sales manager for Product 3 had not detected the error. Based on the results of the investigation, the auditor determined that there is a higher risk of material misstatement related to the accuracy of sales revenue for Product 3 and proceeded to design and tailor further audit procedures to address the higher risk for Product 3 sales.

To assess if the profit margin for the rest of the population is consistent with the auditor's understanding, the auditor proceeded to refine the analytic by excluding the statistical outliers identified in Product 1 and all sales transactions of Product 3.

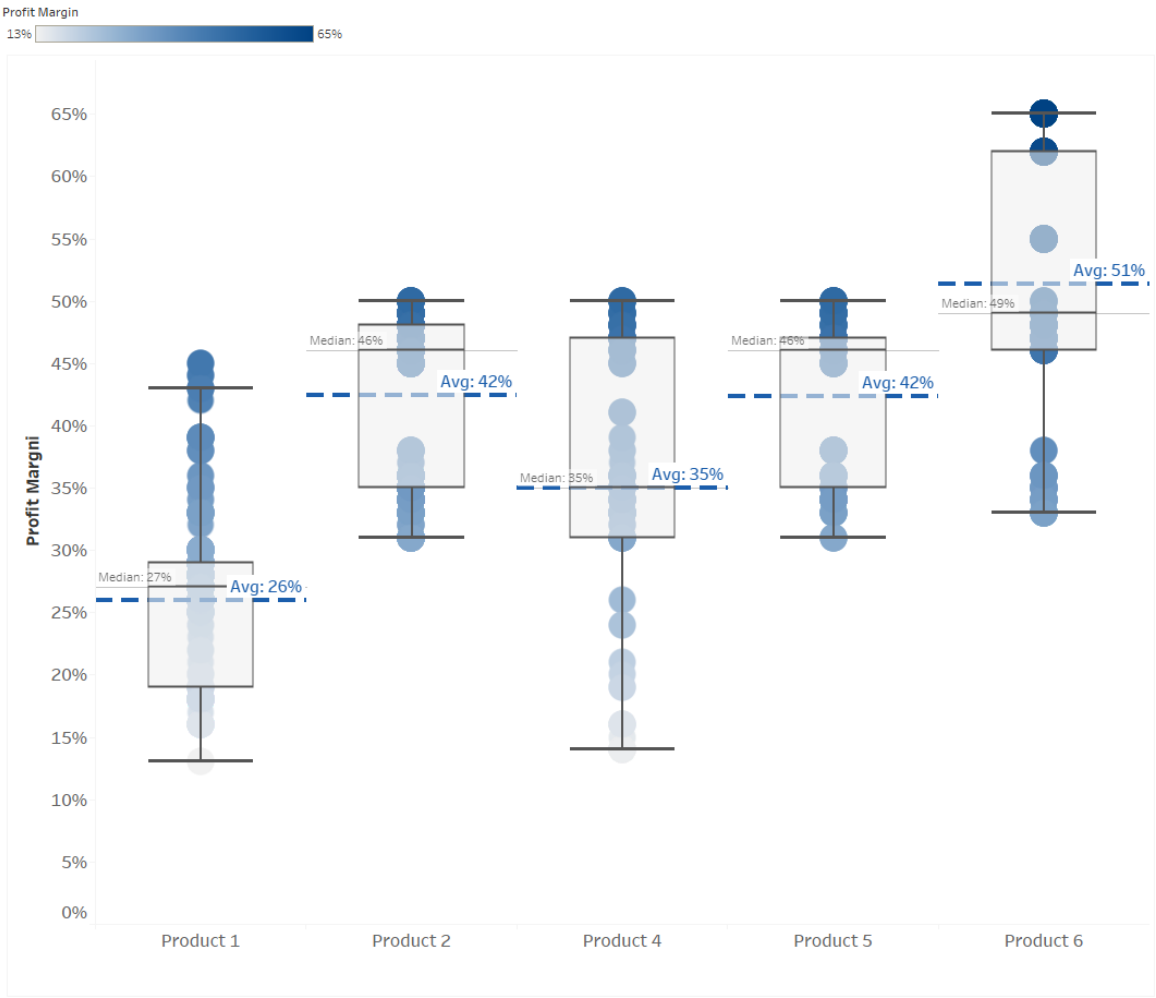


Figure 2 Refined analytics

Figure 2 shows the results of the refined analytics. It should be noted that transactions with the same profit margin will be presented as overlapping dots and can be identified by a darker shade of blue on the box and whisker plot. In addition to the reference line showing median profit margin, the auditor also decided to include the average profit margin as a reference line into the analysis, which can be identified by the blue dotted reference line in Figure 2. Based on the results of the refined analytic, the auditor noted that there are no statistical outliers. The auditor also reviewed the average profit margin for each product and noted that they are consistent with the auditor's expectation and not significantly different from prior year. For this population, the auditor assessed that the risk of material misstatement related to the accuracy of sales revenue remains unchanged from originally assessed. The auditor proceeded to design and tailor further audit procedures to address the risk for the rest of the population.

The auditor concluded that the objectives of the data analytics as set out in Step 1 have been met.

Example 2: General Ledger Account Balance Analysis using a non-statistical approach

Background Information

In this example, the financial statements being audited are those of a large private network and electricity service provider.

Step 1: Determine objective and purpose of the data analytic

The auditor decided to use data analytics to assess risks of material misstatement in the company's preliminary general ledger account balances. The specific objectives in using the data analytics are as follows:

- Analyze the preliminary balances in all the accounts in the company's general ledger to identify unusual changes from the previous year
- Use the results of the analysis to decide whether changes were needed in the planned nature, timing and extent of the following:
    - Other risk assessment procedures, focused on particular accounts and related assertions
    - Further audit procedures to be performed in response to assessed risks, including tests of controls and substantive procedures

The auditor considered pre-determined materiality and used professional judgment and skepticism in determining which general ledger account balances warrants additional consideration and in determining the nature and extent of the more detailed risk assessment procedures performed.

Step 2: Design the data analytic

The auditor decided that a bar chart comparing prior year and current year preliminary general ledger account balances will be useful to highlight unusual changes from the prior year. In deciding what would be considered an unusual change, the auditor considered information obtained from prior year audits and also made preliminary inquiries of management to understand significant changes in the current year that are likely to affect the account balances. The auditor decides that balances with a change of more than 20% will be considered as an unusual change.

Step 3: Obtain and understand the underlying data

The auditor obtained the preliminary general ledger for the current financial year from the management and relied on prior year audited accounts for comparative purpose.

Step 4 & 5: Perform the data analytic and evaluate the results of the data analytic

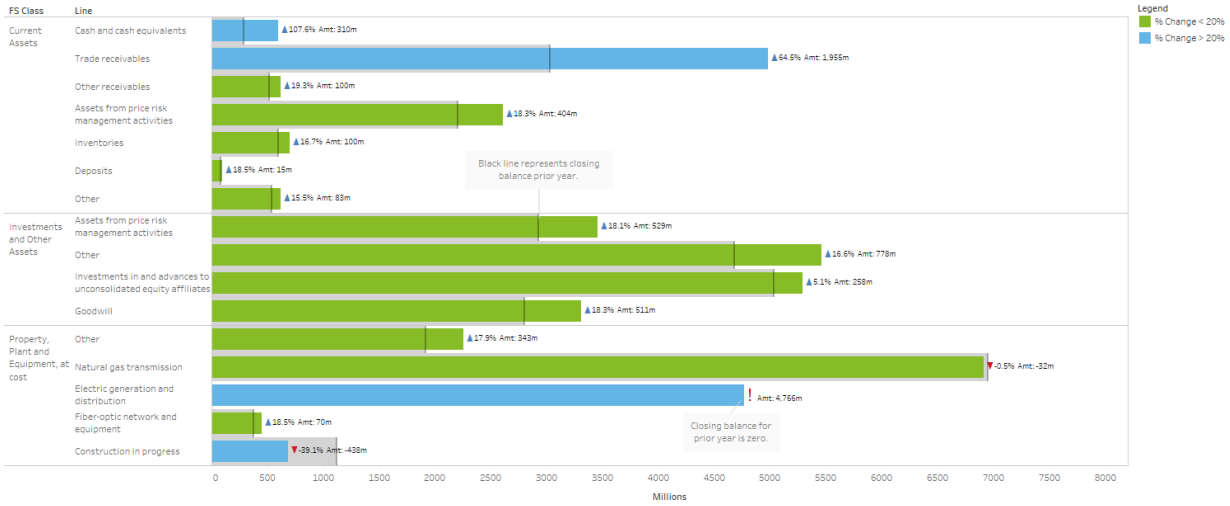


Figure 3 Percentage change in general ledger account balances

Figure 3 shows an extract of the graphic developed. The percentage change in the general ledger account balance between the current year and prior year is labelled for each account balance with a blue and red arrow indicating the direction of change (increase or decrease). For comparative purposes, the general ledger account balance for the prior year is indicated by a black line.

The auditor's decision on the threshold used to trigger performing more detailed risk assessment procedures is incorporated into the graphic. A change of 20% or more is represented by a blue bar that indicated that the change required further consideration. A change of less than 20% is represented by a green bar.

The auditor considered the significant changes shown in Figure 3 (those in blue) to be notable items. For example, there was a significant change in the Electric generation and distribution category under Property, Plant and Equipment. This appears to be a new category of fixed assets acquired during the year with no prior year balance. The information is in line with what the auditor understands from management; as an expansion of the current business the management has gone into a new business segment for electricity generation and distribution. The lower balance in construction-in-progress is also due to assets capitalized and put to use in the year to support the new business segment. The expansion of the new business segment is also the driver behind significant increases in trade receivables and cash and cash equivalents.

Using information in Figure 3, the auditor considered the effect on risks of material misstatement related to the respective general account ledger balances. This includes a consideration of the risks of material misstatements present in the “non-outlier” population (i.e. general ledger account balances with less than 20% change). The auditor’s discussion with management on the reasons behind the changes in the balances resulted in a more thorough understanding of the activity during the year. This in turn helped inform the auditor’s risk assessments and aided the auditor in planning appropriate procedures to respond to the risks.

The auditor determined that the objectives, as set out in Step 1 had been achieved.

Appendix B

Examples of Data Analytics used in Substantive procedures

Notes:

1. ***The examples in this appendix illustrate how data analytics can be applied in substantive procedures.***

2. ***The examples that follow do not address the auditor's approach to considering the reliability of data used in each example. For further information regarding procedures to address reliability of data, refer to the relevant section in this Statement.***

3. ***In the following examples, if a step or a procedure noted in Figure 1 in this Statement is not relevant in the context of the particular example, no reference is made to that step or procedure. Also, in some examples, procedures are combined.***

4. ***The audit software used to perform data analytics needs to be tested and approved for use by the audit firm and the engagement team such that the auditor can obtain reasonable assurance that the tools have performed as intended by testing the quality and audit control objectives over the software. The testing of such software is not discussed within this Statement.***

Example 1: Substantive Analytical Procedure – Recalculation of Ferry Revenue

Background Information

In this example, the financial statements being audited is that of a ferry operator. The company operates ferries across the Emerald Sea to ABC Island. The ticket fares are priced differently based on a combination of the following factors:

- Economy class or premium class
- One way trip or round trip

The ticket fare prices are published on the ferry operator's website and is available publicly.

Customers purchase and pay for the ferry tickets through the ferry operator's e-ticketing portal online. Tickets for ferries during the month is released on the 1st of each month. The e-ticketing portal is interfaced with the ferry operator's accounting system and the ferry revenue is calculated by the system and recognized at the end of each month.

Step 1: Determine objective and purpose of the data analytic

The auditor decided to use data analytics in substantive analytical procedures to provide audit evidence regarding ticket revenue. The assertions to be addressed were as follows:

- Occurrence - all ticket revenue transactions that have been recorded have occurred and pertain to the company.
- Completeness - all ticket revenue transactions that should have been recorded have been recorded.
- Accuracy- ticket revenue transactions are recorded at the correct amounts.
- Cutoff - ticket revenue transactions have been recorded in the correct accounting period.

This substantive analytical procedure was designed to respond to a moderate level of risk of material misstatement of ticket revenue.

Step 2: Design the data analytic

The auditor's expectation of ferry revenue is developed by taking the number of ferry tickets sold for each fare type multiplied by the published fare price. The calculations were aggregated to show total expected ferry revenue by month and total annual revenue for each of the fare type. The auditor's expected ferry revenue was then compared to the ferry revenue recorded in the company's accounts. The auditor decided that the desired precision for this procedure was 20% of performance materiality, as determined by the auditor using professional judgement. A difference between the auditor's expectation for ferry revenue for a month and the recorded amount of ferry revenue for a month was considered to be significant if it indicated the existence of a possible misstatement, that when aggregated with other misstatements, could exceed 20% of performance materiality.

The auditor decided that the following would be helpful in achieving the objective of procedure:

- A graphic that compares total expected revenue with total actual ferry revenue by month. The purpose of this graphic is to help identify particular months, if any, for which a more in-depth analysis may be warranted.
- A table that compares total expected revenue with total actual ferry revenue per fare type. The table will also contain information about the minimum, average and maximum actual fare price charged for each fare type. Disaggregating revenue by fare type provides the auditor with more transparency regarding the possible existence of a material misstatement. For example, it may enable the auditor to detect offsetting misstatements when an overstatement of ferry revenue for one fare type might be offset by an understatement of ferry revenue for another fare type. The information on minimum, average and maximum fare price will allow the auditor to check that prices charged for each fare type is in line with published prices on the website.

Step 3: Obtain and understand the underlying data

The auditor obtained a download of the ferry ticket sales from the e-ticketing portal. The data downloaded contained information for each ticket sales transaction including number of tickets and type of fares. The relevance and reliability of the report has been separately addressed in accordance with the requirements under SSA 500 *Audit Evidence*.

Step 4 & 5: Perform the data analytic and evaluate the results of the data analytic

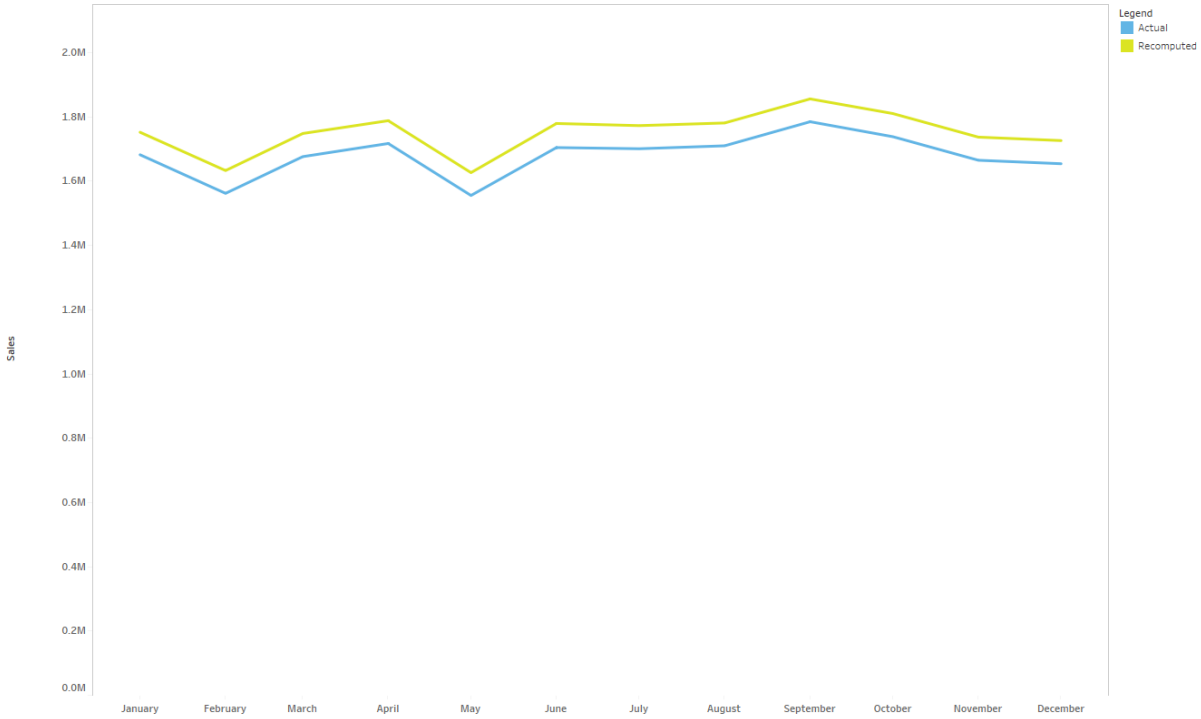


Figure 4 Expectation of ferry revenue

Table 1 Recomputation of ferry revenue

	Jan-18	Feb-18	Mar-18	Apr-18	May-18	Jun-18	Jul-18	Aug-18	Sep-18	Oct-18	Nov-18	Dec-18
Actual Revenue	1,682,184	1,562,046	1,676,361	1,717,243	1,555,531	1,704,555	1,700,929	1,710,105	1,784,997	1,738,422	1,665,063	1,654,292
Re-calculation	1,752,184	1,633,046	1,748,361	1,788,243	1,626,531	1,779,555	1,772,929	1,781,105	1,855,997	1,810,422	1,737,063	1,726,292
Variance	-70,000	-71,000	-72,000	-71,000	-71,000	-75,000	-72,000	-71,000	-71,000	-72,000	-72,000	-72,000
	Jan-18	**Feb-18**	**Mar-18**	**Apr-18**	**May-18**	**Jun-18**	**Jul-18**	**Aug-18**	**Sep-18**	**Oct-18**	**Nov-18**	**Dec-18**
Actual Revenue	1,682,184	1,562,046	1,676,361	1,717,243	1,555,531	1,704,555	1,700,929	1,710,105	1,784,997	1,738,422	1,665,063	1,654,292
Re-calculation	1,752,184	1,633,046	1,748,361	1,788,243	1,626,531	1,779,555	1,772,929	1,781,105	1,855,997	1,810,422	1,737,063	1,726,292
Variance	-70,000	-71,000	-72,000	-71,000	-71,000	-75,000	-72,000	-71,000	-71,000	-72,000	-72,000	-72,000

Table 2 Monthly variance

Ticket Type	# Sold	Actual Sales	Recomputed	Variance	Published Price	Minimum Price	Maximum Price	Average Price
Economy, One Way	378,211	3,668,647	3,782,111	(113,463)	10.00	8.00	10.00	9.46
Economy, Round Trip	441,246	8,383,679	8,824,925	(441,246)	20.00	16.00	20.00	18.97
Premium, One Way	116,732	1,996,114	2,101,173	(105,059)	18.00	14.40	18.00	17.68
Premium, Round Trip	175,098	6,051,377	6,303,518	(252,141)	36.00	28.00	36.00	35.79

The auditor developed an expectation for the ferry revenue. As shown in Figure 1, the auditor's expectation was higher than the actual revenue recorded for all months. Table 2 showed the variances for each month. For all the months, the differences from the auditor's expectations were considered significant and therefore were investigated.

From Table 1, the auditor noted that the auditor's expectation for all the fare types were higher than the actual revenue recorded. This indicates that there were no offsetting effect between the fare types. In addition, the auditor noted that minimum actual sales prices for each fare type were not in line and were lower than the published price. This could explain why the auditor's expectation was higher than the actual revenue recorded for all months.

The auditor performed further procedures to investigate the significant differences from expectations. These procedures included inquiries of management and obtaining audit evidence to corroborate or contradict responses received from management.

Based on the understanding obtained from management, it was revealed that the ferry operator started a membership program in the beginning of the year and members are able to purchase ferry tickets at a discounted price. The discounted ticket prices for members were not published on the website. The auditor sighted to the membership plan approved by the sales director and noted that the discounted ticket price for each fare type matched with the minimum ticket price observed in Table 2.

The management also provided the auditor with a revised download of the ferry ticket sales data with an additional column that indicated if the ticket was sold to a member. After separately addressing the reliability of the revised dataset, the auditor re-performed the analytic by incorporating discounted ticket price for member sales.

After the analytic was refined, the auditor noted that for each month of the year, the differences from the auditor's expectations were now considered insignificant and did not require further investigation. Similarly, the refined analytic also showed that the differences from the auditor's expectations for each fare type were also considered insignificant and did not require further investigation.

The auditor concluded that the objective of the data analytics as set out in Step 1 have been met. Based on obtaining sufficient appropriate audit evidence, the auditor concluded that there was no material misstatement of ferry revenue.

Example 2: Test of Details – Payroll Expenses

Background Information

In this example, the financial statements being audited is that of a medium sized trading company in the business of buying and selling sports related apparel and merchandises. The company employs a large number of sales employees who are responsible for contracting with customers.
The company have 2 payroll runs during each month:

- On the 8th of the month – for claims, allowances and other off-cycle payments due.
- On the last day of the month – for base salary

Step 1: Determine objective and purpose of the data analytic

The auditor decided to use data analytics in test of details procedures on payroll expenses. The objective of the analytics is to provide audit evidence on the occurrence for payroll expenses; payroll expenses are for employees who existed and is employed by the company during the pay period.

This test of details procedure was designed to respond to the level of risk of material misstatement of payroll expenses as assessed by the auditor. The auditor decided not to rely on the operating effectiveness of controls over the occurrence of the payroll process.

The auditor has performed the necessary risk procedures in this example and based on the risk assessment, identified that occurrence of payroll transactions relating to the new hires and resignees suggest a higher risk of material misstatements as compared to existing employees, and the testing of the payroll transactions relating to the existing employees are addressed by other procedures and is not within the scope of this example.

Step 2: Design the data analytic

To address occurrence of payroll expenses, the auditor designed the data analytic to review 100 percent of the payroll transactions in the year and flag out any transactions where the payment made to the staff was made:

i. Before first day of service for new hires; or
ii. After last day of service for resignees

All transactions flagged under the above two criterion are considered exceptions that are to be further investigated.

Using professional judgement and considering the risk level assessed, the auditor determined that the threshold amount for this procedure is to be less than or equal to an amount that is clearly trivial.

The auditor used an audit software to read and analyze the reports obtained from the company's HR department (see Step 3). The auditor decided that tables containing details of the exceptions will achieve the objective set out in Step 1.

Step 3: Obtain and understand the underlying data

To perform the analytic, the auditor obtained the following reports from the company's HR department:

1. Employee Master containing the following fields:
    - Employee ID
    - Department
    - Employee's First Day of Service
    - Employee's Last Day of Service (if applicable)

2. Monthly Payroll Records (12 reports in total, 1 for each month) containing the following fields:
    - Employee ID
    - Payment Date

The reliability of the reports has been separately addressed. For instance, the auditor has performed other procedures to address the risk of fictitious employees being included in the Employee Master file and that all employee IDs in the Monthly Payroll Records exist in the Employee Master, and vice versa.

Step 4 & 5: Perform the data analytic and evaluate the results of the data analytic

Table 1 – Payments before First Day of Service

Employee ID	Department	First Day of Service	Date of Payment	Amount
187698	Sales	01-Jul-18	28-Jun-18	2,600
189215	Sales	03-Aug-18	28-Jul-18	2,200

Table 2 – Payments after Last Day of Service

Employee ID	Department	Last Day of Service	Date of Payment	Amount
163878	Sales	31-Jan-18	8-Mar-18	1,536
166698	Sales	30-Mar-18	8-May-18	1,124
167369	Sales	01-Apr-18	8-Jun-18	2,739

The auditor performed the analytic and noted from Table 1 that there were 2 exceptions where payment was made before the new hire's first day of service for new hires. From Table 2, the auditor noted there were 3 exceptions where payment was made after the resignee's last day of service. The auditor proceeded to obtain explanations from management on the exceptions.

For the two new hires where payments were made before their first day of service, the auditor understood that the payments were salaries in advances. The scheme was available to employees who had moved to Singapore from overseas. The auditor corroborated the management's explanations by sighting to the published policy on the company's intranet. The auditor also verified the terms and conditions of the scheme stated and signed in the employee's employment contract. Based on the audit evidence, the auditor concluded that the two exceptions are not misstatements and no further investigative work is required.

For the three resignees where payments were made after their last day of service, the auditor understood that the company was obligated to withhold the employees' last month's salaries for tax clearance purpose. The auditor sighted to the signed employment contracts and employee particulars to verify that the employees are foreign citizens and also obtained copies of the tax filing the company had made to the tax authorities for their tax clearance purpose. After settling the tax liability, the company had paid the remaining sums due to the employees during the off-cycle payroll run on the 8th of the month. Based on the audit evidence, the auditor concluded that the three exceptions are not misstatements and no further investigative work is required.

The auditor concluded that the data analytic has achieved the objective of providing audit evidence regarding the occurrence of payroll expenses.

Example 3: Test of Details – Procurement Three-Way Match

Background Information

In this example, the financial statements being audited is that of a private company that manages garden attractions. The company manages a number of attractions including orchid gardens, eco farms and flower farms. The company's revenue is driven by both ticket sales and revenue from tours and farm stays.

The company uses an electronic procurement system. The procurement cycle summary is as per the following:

i. Raising a service/purchase order

The business user raises a request to the procurement department who will raise a service/purchase order within the company's procurement system. Depending on the value of the purchase, the order are then routed to the relevant authority for approval. All purchases are procured locally and denominated in Singapore dollar.

The company's main purchases are for maintenance and repair works for its facilities which includes landscaping services, cleaning works, security services and facility maintenance.

ii. Receiving goods and services

The business user is responsible for ensuring that goods and services procured for are provided by the vendors. The business user subsequently performs a receipt in the procurement system by entering the quantity of goods and services received against the service/purchase order. The value of the receipts is recalculated by the system by taking the unit price per the approved service/purchase order multiply by the receipt quantity entered.

When a receipt is performed in the procurement system, a journal is triggered automatically to recognize the expense and accrue for the liability.

iii. Processing and paying vendor invoices

Vendor invoices are sent to the payments department. The payments personnel checks the invoice quantity and prices against the approved service/purchase order and goods receipt quantity in the system. If the invoice details are a match, the payments personnel signs off on the vendor invoice and subsequently posts the invoice in the system.

Upon invoice posting, the system triggers an automatic journal to reverse the accrual posted in step (ii) and records the liability to pay for the vendor accounts payable.

At the end of the month, the company runs a system program to pick up all posted invoices for payments.

Step 1: Determine objective and purpose of the data analytic

The auditor decided to use data analytics in test of details procedures for maintenance and repair expenses in the year. The assertions to be addressed were as follows:

- Occurrence – all maintenance and repair expenses that have been recorded have occurred and pertain to the company.
- Accuracy – all maintenance and repair expenses are recorded at the correct amounts.

This data analytic was one of a number of procedures used to obtain evidence regarding the occurrence and accuracy of maintenance and repair expenses. This included evidence obtained from other

substantive procedures, such as confirmation of accounts payables with vendors (including details of vendor invoices).

This test of details procedure was designed to respond to the level of risk of material misstatement of maintenance and repair expenses as assessed by the auditor. The auditor decided not to rely on the operating effectiveness of system controls over the occurrence and accuracy of the procurement process.

Step 2: Design the data analytic

The auditor decided that the test of details would focus on the three-way match on the quantities and amounts between the service/purchase orders, goods receipts and vendor invoices.

For all the maintenance and repair expenses in the year, the auditor obtained the corresponding service/purchase orders, goods receipts and vendor invoices pertaining to the expenses. The data analytic would be used to compare the following:

- The quantity per the service/purchase order, goods receipt note, and vendor invoices to determine whether they all matched.
- The dollar value on the service/purchase order, goods receipt note, and vendor invoices to determine whether they all matched.

For the purpose of this testing, exceptions are identified where:

- Receipt quantity does not match with order quantity; or
- Vendor invoice quantity does not match with receipt quantity; or
- Receipt value does not match with order value; or
- Vendor invoice value does not match with receipt value

Aside from the scenarios listed above, the auditor noted other scenarios where there could be potential risk of material misstatements, for example, where invoice value is lower than receipt. The auditor has separately assessed and addressed these other scenarios which is outside the scope of this example.

As the data analytic is performed on 100 percent of the maintenance and repair expenses, the auditor determined that the threshold amount for this procedure is to be less than or equal to an amount that is clearly trivial.

Step 3: Obtain and understand the underlying data

To perform the analytic, the auditor used a data extraction tool to extract the following sets of data from the company's database.

Purchase Orders	**Goods Receipt Notes**	**Vendor Invoices**
• Vendor Code • Purchase Order Number • Purchase Order Line Number • Description • Unit of Measure • Quantity • Unit Price • Total Purchase Value	• Vendor Code • Purchase Order Number • Purchase Order Line Number • Goods Receipt Number • Goods Receipt Line • Unit of Measure • Quantity • Unit Price • Total Goods Receipt Value	• Vendor Code • Purchase Order Number • Purchase Order Line Number • Goods Receipt Number • Goods Receipt Line • Vendor Invoice Number • Vendor Invoice Line • Unit of Measure • Quantity • Unit Price • Total Vendor Invoice Value

The auditor also determined that other company database files would be accessed, including the vendor master file and general ledger for the maintenance and repair expense account.

The auditor used an audit software to check the numerical continuity of purchase orders, goods receipt notes, and vendor invoices documents and to address missing numbers. Audit software was also used to identify and address fields with no data or inappropriately formatted data prior to performing the data analytic.

Step 4 & 5: Perform the data analytic and evaluate the results of the data analytic

Table 1 Three-way match on quantity

Account	Three-way match on Quantity	Amount ($)	%
Maintenance & Repair Account	PO=GR=INV quantity	2,153,824	98.59%
	GR> PO quantity	30,785	1.41%
	INV>GR quantity	0	0.00%
Total expenses for Account		2,184,609	100.0%

Table 1 shows the results from the three-way match performed on quantity. The auditor noted that there were transactions where receipt quantity was higher than the corresponding order quantity. Even though the auditor has assessed the exception was of an amount less than or equal to an amount that is clearly trivial, the exception suggests that there could be other implications on the evaluation of controls and nature and extent of procedures to be performed by the auditor as receipt quantity is not expected to exceed order quantity. Therefore, the auditor considered this exception as qualitatively material to warrant further investigation.

Using the audit software, the auditor drilled down and extracted the details of the exceptions which was then shared with the management to obtain their explanations. Based on the understanding obtained, these are service orders raised for contracted labor for repair services for a facility at the orchid garden. At the time of raising the service order, the business user had estimated that a total of 5 man days was required to complete the repair. However, due to bad weather, the actual man days incurred was 6 days. The auditor obtained evidence of review and approval given by the business group manager and also sighted to signed time sheets by the contracted labor to verify the total man days incurred.

Based on the audit evidence, the auditor concluded that the exceptions are not misstatements and no further investigative work is required.

Table 2 Three-way match on amounts

Account	Three-way match on Amounts	Amount ($)	%
Maintenance & Repair Account	PO=GR=INV amounts	2,100,267	96.14%
	GR> PO amounts	30,785	1.41%
	INV>GR amounts	53,557	2.45%
Total expenses for Account		2,184,609	100.0%

Table 2 shows the results from the three-way match performed on amounts. For transactions where the receipt amount exceeded the order amount, the auditor noted that this was due to the circumstances as described in the section above.

The auditor noted that there were transactions where vendor invoice amount was higher than the corresponding receipt amount. The amount of exception is considered significant and warranted further investigation.

Using the audit software, the auditor drilled down and extracted the details of the exceptions which was then shared with the management to obtain their explanations. Based on understanding obtained from the management, these were procurement for horticulture products from a local vendor. The vendor had shipped these products from overseas and the actual shipping fees incurred by the vendor was

charged back to the company. The auditor sighted to the underlying vendor invoices and noted evidences of review by the payments personnel who had made a note on the additional shipping fees. Based on the audit evidence, the auditor concluded that the exceptions are not misstatements and no further investigative work is required.

The auditor concluded that the objectives of the data analytics as set out in Step 1 have been met.