READING

5

Data Integrity

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LEARNING OUTCOMES

Mastery	*The candidate should be able to:*
☐	**a.** describe dimensions of data quality;
☐	**b.** describe elements of sound investment data governance;
☐	**c.** identify and describe common sources of data errors in the performance and risk measurement process;
☐	**d.** describe the errors that may arise in processing corporate actions and their effect on performance and risk measurement;
☐	**e.** explain return discrepancies in a portfolio or a composite that may arise from currency issues;
☐	**f.** determine whether a data revision necessitates a restatement of prior-period returns.

INTRODUCTION

1

Data that investment management firms use in performance measurement and reporting can take many different forms and can come from many different sources. The wide range of forms and sources can give rise to numerous data quality issues. These issues can be compounded by the data flowing between systems and departments. The calculation of performance relies on multiple "upstream" pieces of data—data sources. All such inputs affect the ultimate returns that are used by many stakeholders, including the firm's portfolio managers, existing and potential clients, and external consultants. Practitioners must always remember that returns are the product of multiple sets of data—with discrepancies—and be able to articulate the accuracy of those returns based on the known and potentially unknown issues. In this reading, we explain what is meant by data integrity, what the best data governance practices are, and what the common sources of data errors are. We also consider scenarios that require revision of prior-period returns.

2   DIMENSIONS OF DATA QUALITY

The scope of what data is can be varied and wide ranging. Dictionary definitions vary too. One such definition describes data as "facts and statistics collected together for reference or analysis" (this definition comes from Oxford University Press). Ultimately, data is all information in all forms. In the context of investment performance measurement, it is easier to consider data as being in one of two distinct forms. The first form is structured in the sense that data sits within a system or application, such as an accounting or a portfolio performance system. It is extractable and organized in a way that makes it useful and suitable for the application's use. But data can also be less structured and can be found in Microsoft Excel spreadsheets, Microsoft Word documents, or paper documents. We will describe the dimensions of data quality, and by "dimensions," we mean the different ways in which we can think about data quality, as follows:

Accuracy: Data are valid and correct.

Completeness: Data are complete given the intended purpose.

Conformity: Data conform to standards and rules.

Consistency: There is a consistent application of rules across different systems.

Timeliness: Data must be available in time for use and regularly updated.

Lineage: There is a record and knowledge of where the data come from.

Such descriptions and examples are shown in Exhibit 1. These are characteristics or aspects of data that need to be considered when thinking about data quality. We consider both structured and unstructured data in the discussion of the dimensions. An overarching principle is that data should be "fit for purpose."

Exhibit 1 Dimensions of Data Quality		
Dimension	**Description**	**Examples and Scenarios**
Accuracy	Data are valid and correct. There is an appropriate level of accuracy of the data for its intended purpose. This outcome can be achieved through validation to an authoritative source of data or by comparing multiple sources of the same data.	Example of arrangements where one could apply different accuracy rules: "Report any instances where the NAV has moved over 25 bps over a set period of time when being used for regulatory reports." "Report any instances where the NAV has moved over 40 bps over a set period of time when being used to prepare client reports."
Completeness	Achieved when the dataset is complete given the purpose for which it was intended. It is worth noting that some data are mandatory and some are optional; this will all be part of the expected data collection.	An operations analyst may have a list of all open positions in the Investment Book of Records (the internal firm register of open positions). The analyst expects this information to be held by various brokers and counterparties. As a result, he or she will compare the independent multiple broker and counterparty position records with the internal Investment Book of Records view.
Conformity	Ensuring that the data conforms to internally defined standards and rules. For example: • character length (maximum number of characters allowed) • character type (alphanumeric, integer, numeric, Boolean, float, string, array, etc.)	When transferring a file from System A into another system or application, a check is run to ensure that the character type of the attribute in the file being sent matches what is expected to be received from the data warehouse (the in-house data store). A breach is reported if a mismatch is found.

Exhibit 1   (Continued)

Dimension	Description	Examples and Scenarios
Consistency	Ensuring that data quality rules are applied consistently across one or many systems or applications for the same attribute or dataset.	Net asset value (NAV) information is held in systems A, B, and C. If there is a rule to "report any instance where the NAV has moved over 5 bps a day" in System A but in Systems B and C the number is set at 10 bps and 15 bps, respectively, then the data consumers will have differing levels of confidence within the NAV data attribute (within different systems).
Timeliness	With regard to data quality processes, timeliness would ensure that the data are being reviewed to ensure that they are not stale. The rule(s) will test whether the attribute has updated per the expected frequency. Actual frequency is compared with the expected frequency. Generally, timeliness refers to getting information at the right time and quickly enough to meet reporting and analytical requirements.	The NAV of a daily priced fund is expected to be updated on a daily basis. If the date of the NAV attribute value is not the expected most recent date, allowing for the time the attribute is expected to be updated and public holidays, then it is stale and not appropriate to use.
Lineage	Understanding where the data have come from (the origin), what happens to the data, and where the data move over time. It allows errors to be traced and helps ensure the data quality for all its intended purposes.	A particular data attribute is created and maintained in a particular system (say, ABC) and is distributed to a different system (DEF). For example, a performance system receives inputs from multiple source systems—where a particular source data item is missing or incorrect, it may be necessary to fix the problem at the source, and therefore, knowledge of the source of each data item is required.

Note: The above descriptions of different dimensions of data quality are broadly based on contributions by Brian Buzzelli (Acadian Asset Management).

EXAMPLE 1

Dimensions of Data Quality

The data governance officer, responsible for developing an environment that ensures transparency of all current data governance–related policies at a fund management firm, is meeting with an investment consultant to describe the firm's data governance arrangements. She describes how the firm ensures that when data move from one system to another, there are no issues or errors arising from a mismatch of data attributes.

What dimension of data quality is the data governance officer *most likely* describing?

A   Accuracy

B   Conformity

C   Consistency

> **Solution**
>
> B is correct. The character type and attribute in the file being sent must match what is expected to be received from the data warehouse (the in-house data store). A breach is reported if a mismatch is found. A is incorrect because accuracy requires data to be valid and correct. C is incorrect because consistency is ensuring that data quality rules are applied consistently across one or many systems or applications for the same attribute or dataset.

3　DATA GOVERNANCE

In this section, we will explain what is meant by data governance and why it is important to the firm and its existing and potential clients. We will also describe desirable characteristics of sound data governance frameworks.

3.1　What Is Data Governance?

Data governance is the ownership and oversight of the firm's data over its life cycle. The **data life cycle**, as we will describe, is the sequence of stages that data will go through within a firm. Data governance provides overall management and integrity over data and drives good data management practices. Data governance will put in place the framework and oversight within the firm's departments to ensure the transparency, accuracy, and ownership of data across the organization. This outcome is achieved by implementing standards, policies, and procedures to support and guide the framework.

3.2　Why Data Governance Is Important

Failure to implement a robust data governance framework creates a number of risks to the firm's strategic and customer outcomes. It could also negatively affect the quality and accuracy of disclosures to regulators and asset owners. Not managing data appropriately erodes and may ultimately destroy the credibility of and reliance on the accuracy and completeness of the firm's data.

Sound data governance adds value to the organization in many different ways. The most substantial ones are as follows:

■ It protects clients' interests and helps ensure accurate reporting to asset owners and regulators. Demonstrating strong data governance should also help win and retain business.

■ It helps staff and management make more informed decisions and identify business opportunities (for example, reduction in duplication of data across the firm can result in reduced operational processes, leading to time and cost efficiencies).

■ It provides senior management with a central view of how data are being managed across the organization. It also provides senior management with reassurance that data are being managed in a controlled, efficient, and consistent manner throughout the organization.

Exhibit 2 shows an example of an asset management firm's data governance framework. When such a framework exists, it typically features a committee that oversees the firm's data governance policy. In turn, it defines controls and processes that are implemented by **data owners**, individuals who are accountable for the data and its source. The exhibit also shows that data owners are responsible for defining

the accuracy and completeness of all data within the data domains (of which the firm will typically have several, such as top-level "Performance") and data entities (a few dozen, such as "performance attribution" or "relative performance"). Data owners oversee and appoint data stewards who are responsible for monitoring the quality of data attributes (potentially thousands of actual data items—for example, ISIN [International Securities Identification Number], SEDOL [Stock Exchange Daily Official List], fund name, fund identifier, and security name). The framework exists to the benefit of both internal and external stakeholders.

Exhibit 2   Data Governance Framework
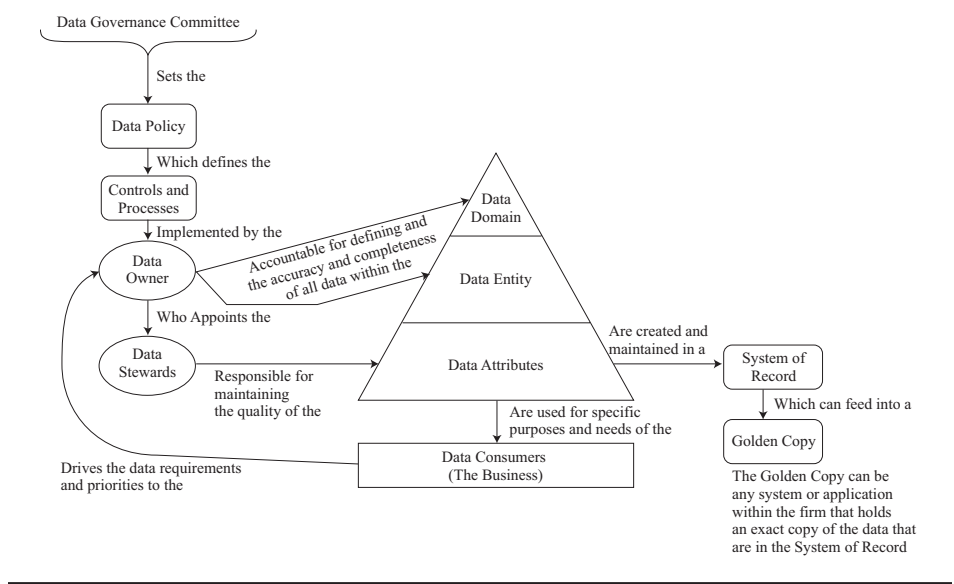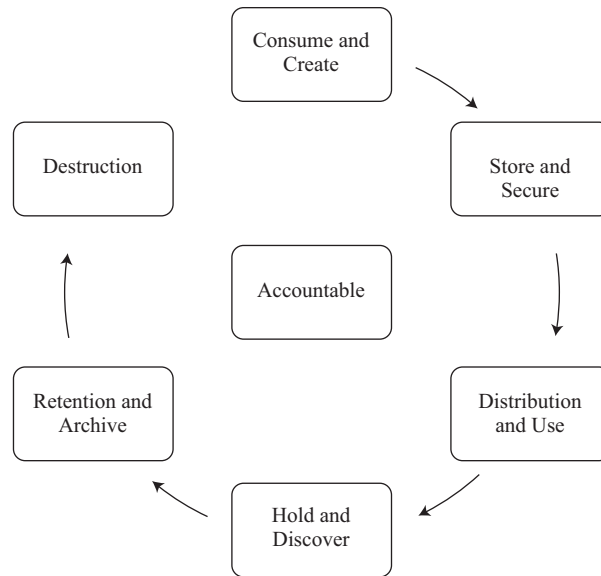

3.3 Features of Data Governance Framework

There are two main features of a data governance framework:

- The data life cycle and governance principles
- Key roles within the data governance framework

Next, we provide an overview of each.

3.3.1 *The Data Life Cycle and Governance Principles*

Exhibit 3 provides a high-level illustration of what a typical data life cycle would look like, reflecting the fact that data go through several stages. These span from creation, through secure storage, distribution, and use, all the way to retention and possible deletion, which we label as the "destruction" stage. The data owner is accountable for ensuring this life cycle is managed for the data that he or she is assigned ownership of. This life cycle should drive the principles that an organization adopts to ensure effective and good data governance principles, as shown in Exhibit 4.

Exhibit 3   Data Life Cycle

Exhibit 4   Data Governance Principles

Principle	Description
Accountable	Ensuring that the organization will implement a framework that will oversee and lead data governance and delegate roles and responsibilities to appropriate individuals. The organization will develop policies and controls to support individuals with their data governance–related roles and responsibilities.
Consume & Create	Ensuring that all data consumed or created by an organization have a purpose and reason and undergo review for quality to ensure accuracy and completeness is maintained in all circumstances.
Store & Secure	Ensuring that data are classified within the organization so that the appropriate level of security and encryption is applied at an attribute, file, and application level.
Distribution & Use	Ensuring the distribution and usage of the organization's data, both internally or externally, will be legal, with lineage documented. Business justification and purpose must be documented, making sure that the correct governance, assurance, and security arrangements are in place and sustained.
Hold & Discover	Ensuring that data will be held in a manner that allows for timely, efficient, and accurate discovery from any interested party, including regulatory bodies or clients that may legitimately request access to the data.

	Exhibit 4 (Continued)

Principle	Description
Retention & Archive	Ensuring that data will be held for the appropriate amount of time, considering all legal, regulatory, business, and historical requirements.
Destruction	Ensuring that once data have passed the retention period or if there is a specific request from an authorized party that does not conflict with any legal or regulatory requirements, secure destruction arrangements are in place.

EXAMPLE 2

Data Governance Principles

An investment management firm has policies and arrangements to classify and handle data to ensure that the appropriate level of security and encryption is used for the data it holds. These policies will also ensure that data are held in a manner that allows timely, efficient, and accurate discovery from any legitimate party that requests to view it. Finally, the firm has secure data destruction arrangements in place. Data are subject to a destruction principle that requires that data be held for seven years or as long as there is secure storage capacity on the firm's systems. Once storage limits are reached, data can be destroyed until enough storage again exists in the system.

Which data governance principle is the firm *most likely* violating?

A Store and secure

B Hold and discover
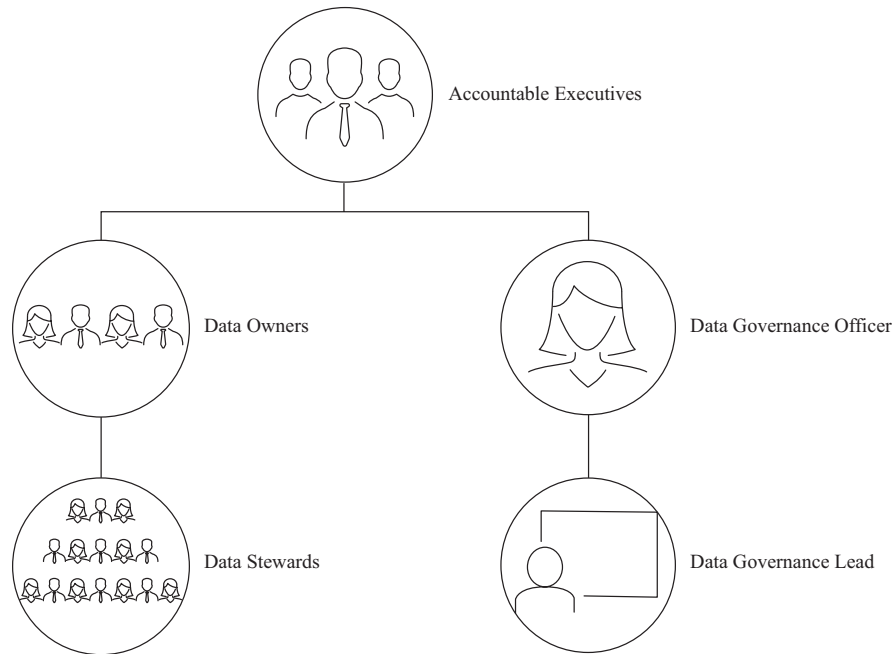
C Destruction

Solution

C is correct. Data can be destroyed only once it has passed its retention period or if there is a specific request from an authorized party that does not conflict with any legal or regulatory requirements. A is incorrect because the store and secure principle is satisfied since the firm is ensuring an appropriate level of security and encryption. B is incorrect because the hold and discover principle is satisfied. The description states that policies must ensure that data are held in a manner that allows timely, efficient, and accurate discovery from any legitimate party.

3.3.2 *Key Roles within the Data Governance Framework*

The data governance framework features key roles that need to be assigned within an organization to support it, enable its functioning, and implement its principles. Exhibit 5 outlines some of the key roles that should be considered within a firm and a brief description of what the role holder's responsibilities should be. At the top level, the firm's executive committee includes a member responsible for the effective deployment of data governance capabilities. It also features a data governance officer who develops an environment that ensures transparency of all current data governance–related policies and objectives across the organization. The data governance officer is supported by the data governance leads, who are responsible for the day-to-day oversight of the principles and activities and for reporting any issues or violations

to the data governance officer. Data owners and data stewards actually work with the data on day-to-day basis, as part of their performance measurement functions. It should be noted that each firm is different and that some roles may or may not exist. To maintain simplicity, we do not provide descriptions of some roles that exist in some firms (such as data protection officer or systems of record IT owner).


Exhibit 5   Key Roles in Data Governance Framework

Role Name	Role Description
Accountable Executive	The accountable executive is a member of the executive committee and is responsible for the effective deployment of data governance capabilities to improve data within the organization and its use in achieving the organization's strategic goals and objectives.
Data Governance Officer	The individual who is responsible for developing an environment that ensures transparency of all current data governance–related policies and objectives for the organization.
Data Governance Lead	The person in this role provides day-to-day support for the data governance officer and is responsible for ensuring that all data governance–related principles and activities are operating as expected through the implementation (or "operationalization") of the data governance structure. He or she monitors for non-compliance, escalates any such occurrences to the data governance officer, and builds awareness within the organization. Typically, a firm would have one such person in place for each major business line.
Data Owner	The individual who is accountable for making sure data stewards are in place for the data that he or she has been assigned. They also act as the deciding vote on any changes to any of the data definitions, rules, systems of record, or usage for their dataset.
Data Steward	The individual responsible for ensuring data maintenance is upheld within a specific system of record.

DATA ERRORS IN THE PERFORMANCE AND RISK MEASUREMENT PROCESS

4

We begin our discussion of data errors with a high-level view of the typical data flows involved in the performance calculation and reporting process. Exhibit 6 illustrates the flows of data between departments. Data generated by portfolio management activity flow into the portfolio accounting system, where they are combined with external data sources. Operations teams validate and maintain data within the portfolio accounting system. The performance system receives data feeds from portfolio accounting and external sources for index data. Returns are then calculated, verified, and distributed to a variety of stakeholders (including portfolio managers, the compliance department, and the client servicing department). Note that portfolio accounting may be outsourced to an external provider, but the activities undertaken with regard to maintaining data will be the same whether performed in house or outsourced.

Exhibit 6   High-Level Performance Measurement Data Flows
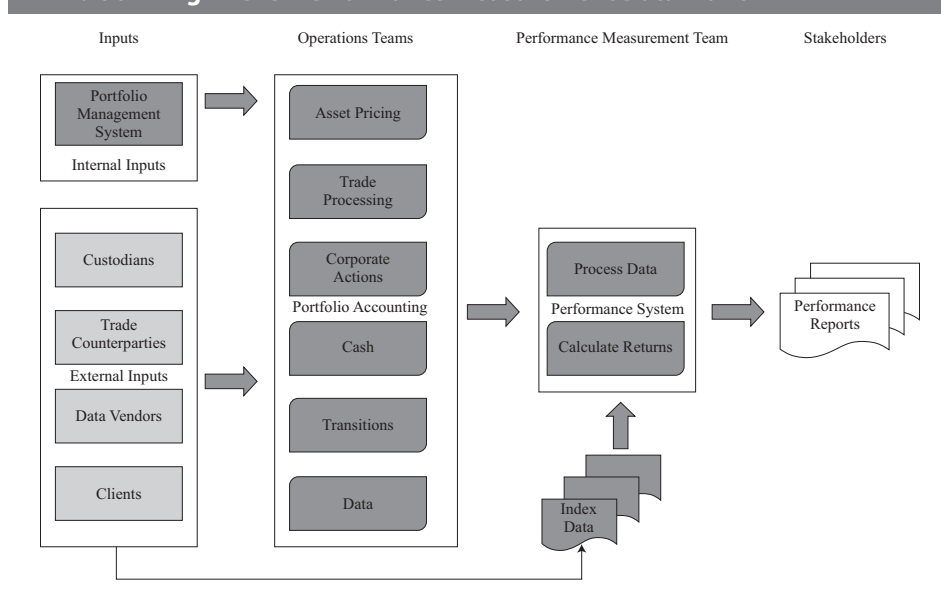
Any data errors feeding into the performance calculation may lead to inaccurate returns. As such, it is important for a performance analyst to understand all possible causes of error to enable efficient identification and resolution. It may be helpful to think of the impacts of data errors in terms of gain or loss on an individual asset or on the portfolio as a whole. We will often refer to such gains or losses as "false" gains or losses. Data errors will result in distortion of the return on the asset. In its most basic form,

$$\text{Return} = \frac{\text{Gain or loss}}{\text{Value invested}}.$$

Incorrect asset-level returns will "roll up" through any reporting hierarchy into the total portfolio level return. In turn, these will distort any *ex post* risk calculations.

There are numerous sources of potential data errors in performance measurement, and their impact can be characterized as one of two broad types:

- Incorrect or missing valuation of an asset or transaction
- Inconsistency between transactions and valuations, including associated cash impacts

Next, we will describe the main sources of data errors in performance. The concept of consistency can be understood by considering each investment transaction as affecting the four data elements shown in Exhibit 7. The timing of transaction bookings in the accounting system is a common cause of data inconsistency. Exhibit 7 shows how each asset purchase in a portfolio generates a change in asset position with an associated value increase. Each purchase also generates a payment obligation, which reduces the cash balance of the portfolio. One can view the top-left "Asset Purchase" as an investment decision where a transaction triggers a cash transaction obligation. Both elements then affect the value and balance.

Exhibit 7   Data Elements Created by an Asset Purchase

Investment Transaction
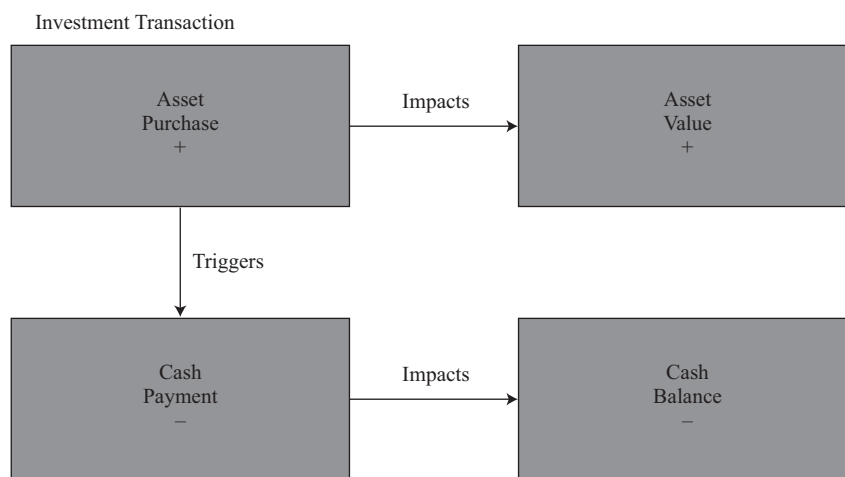
Inconsistency will also occur if backdated entries or corrections are made to accounting data that do not result in synchronized updating of each of these four data elements—asset purchase, asset value, cash payment, and cash balance. Where inconsistency occurs, false gains and losses will arise in individual time periods and on individual assets. Although these may net out over time at an aggregate level, they will be exposed where an error "crosses" a reporting period end. Their effects can crystalize in performance and risk attribution analysis, affecting the quality of output. Incorrectly calculated returns, if not spotted, may result in incorrect performance being reported to clients, causing reputational damage. Issues also may be caused by a firm's accounting policy leading to data being different from what is required for performance measurement. Accounting policies will not result in erroneous data per se, but their effects need to be understood to enable appropriate treatment in performance calculations. Doing so may require enrichment, as we will discuss, being applied to portfolio accounting data before they enter the performance system. Examples of areas where performance policies are required to determine calculation treatment include tax on income or security finance income, such as income from stock lending.

We will now look at common causes of data errors and policy-related issues in the performance measurement process.

4.1 Portfolio Accounting

The purpose of portfolio accounting systems is to maintain a book of records of investment activity. This book can be used for operational controls, such as reconciliations to third-party custody records, and for periodic client valuation reporting. The requirements that portfolio accounting fulfills may differ from the needs of performance measurement. For example, accounting data usually need to be accurate

only at points in time, such as month end, whereas performance calculation requires full historical accuracy. The policies that an accounting system uses, such as which asset pricing sources are used, may not suit the purpose of measuring performance. These policies can, therefore, lead to errors in performance return. As illustrated in Exhibit 6, there are many different functions performed by operations teams who maintain the portfolio accounting records. Each of these areas represents a potential source of data errors.

4.2 Extraction, Enrichment, and Processing of Data

Unless returns are calculated directly within an accounting system, there is a risk that the process of extracting data from the accounting system and loading these data into the performance system will create data errors. So, although the data in the accounting system may be correct, the records of the data that flow into the performance system may not be. These can be inconsistencies between transactions and holdings and between asset and cash data. Further problems may occur where accounting data are being enriched in order to suit performance calculations. An example of enrichment would be applying rules to create a market value amount for an adjustment that is entered at book cost in the accounting system. Enrichment could also take the form of aggregation of data or mapping, such as converting accounting system codes into categories recognized by the performance system.

4.2.1 *Asset Pricing Policy and Valuations*

A firm's asset pricing policy will determine which pricing source, time, and basis is used for each asset class. A source could be a stock exchange or specialist data supplier, and examples of bases include bid price and last traded price. Price time refers to time of day that the price is struck. An example of price timing is "global close." For equity markets, global close prices reflect each local market's closing time. The firm pricing policy may use a basis different from that used by a fund's benchmark. Where this occurs, the price variance can generate noise when monitoring performance relative to a benchmark. This situation can be particularly challenging if a portfolio invests globally with a wide range of local market operating hours. In this case, the same asset's prices and, therefore, returns will differ in the portfolio versus the benchmark. With regard to valuation process, portfolio accounting may be concerned only with an accurate month-end record. Daily calculated performance will also need intramonth prices to be correct in order to avoid generation of false gain or loss. In these situations, any false gain or loss may net out over time but individual days' returns will be incorrect. This false gain or loss may affect the quality of performance and risk reports, as well as other performance analytics.

The illustration in Exhibit 8 shows how an incorrect asset price during a reporting period will affect the profile of daily returns. In the example, an asset price is incorrect at the end of Day 2, with the value being too low. The return for Day 2 with the incorrect price shows a sharp loss, followed by a steep gain on Day 3, when the asset price is corrected. The cumulative performance return profiles based on the correct time series of prices and the time series containing the error diverge on Day 2 and Day 3 but then realign. If uncorrected, this error would increase the calculated volatility of returns for the portfolio, which would lead to an overstatement of tracking error and other *ex post* risk measures.

Exhibit 8   Impact of Non-Month-End Asset Pricing Error
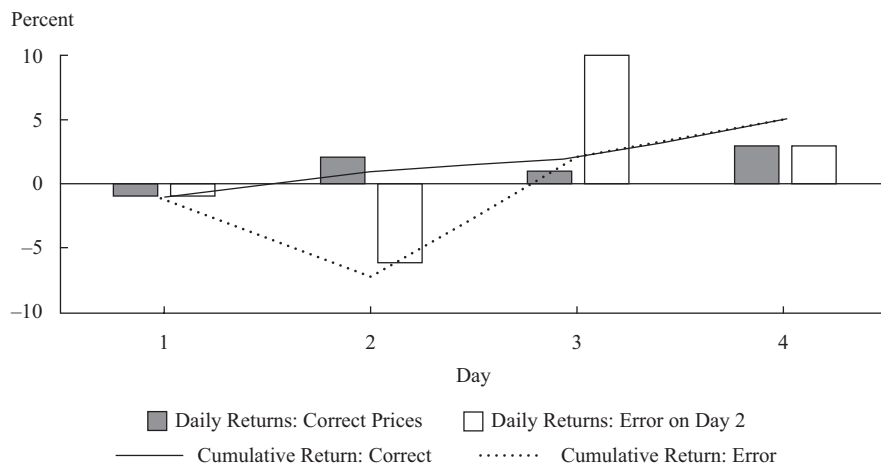
If a new asset is purchased—one not previously included on the portfolio accounting system—there may be a delay in the asset price flowing into the accounting system. This delay will have an impact similar to but potentially more extreme than an incorrect daily price. If there is no price, the asset may appear to be valued at zero, resulting in total loss.

Conventions regarding weekend pricing and accruals are also a potential area of inconsistency between portfolio and benchmark return calculation. In some cases, accruals will be updated on seven days each week, but in others, there are no weekend accrual increases. In some markets, static weekend accruals will result in Saturday and Sunday accrual increases all being captured in returns on the following Monday. In others, the markets are closed on Friday but are open on Sunday. Companies find it useful to have a policy on the treatment of weekends and holidays.

4.2.2 *Transaction Treatment*

For market trades involving a cash payment between counterparties, such as a purchase or sale of a bond, the accounting system transaction values will normally satisfy performance needs. However, for other transaction types, such as adjustments, transfers, and corporate actions, accounting may reflect book cost. In most instances, performance measurement needs to capture a market-valued transaction entry to ensure consistency with the valuation of assets, which is normally done on a mark-to-market basis. Exhibit 9 illustrates this transaction treatment for two portfolios between which the fund manager transfers an asset.

IMPACT OF TRANSACTIONS REFLECTED AT BOOK COST

In this example, an asset is transferred between two portfolios managed for the same client. This scenario could arise when a client wants the asset's cumulative gain or loss to be reflected on the receiving portfolio. Therefore, he or she asks for the transfer to be done at book cost. As a result, an asset valued at 150 is transferred between funds at a book cost of 120. This accounting treatment creates a false gain of 30 on the receiving fund, with a corresponding loss on the other fund. To be correct from a performance perspective, the transfer should be booked to reflect the prevailing market value of 150.

Exhibit 9	Impact of Transactions Reflected at Book Cost		
	20 June	21 June	22 June
Fund A Value	150	0	0
Fund A Transfer Out		−120	
Daily Gain/Loss		−30	0
Fund B Value	0	150	150
Fund B Transfer In		120	
Daily Gain/Loss		30	0

4.3 Transaction Booking Errors

Within the operations department, a team will be monitoring and validating market trades to ensure that they can settle successfully. Should the team detect errors, corrections should flow back into performance calculations. If both the transaction record and the relevant valuation impact are not updated, consistently false gains or losses will arise. Exhibit 10 provides an illustration.

CORRECTION OF TRANSACTION ENTRY ERROR

In this example, a purchase was entered at half the correct size (100 instead of 200). In the middle table, the purchase is corrected but the valuation does not get aligned until two days later. This situation results in incorrect daily gains and losses, although the cumulative amount is accurate. With the fully corrected accounting data in the final table, gains and losses are accurate each day.

Exhibit 10	Asset Data without Cash Impacts		
Original accounting entry	20 June	21 June	22 June
Asset purchase	100		
Asset value	100	101	102
Daily gain/loss	0	1	1
Only transaction corrected, not valuation	20 June	21 June	22 June
Asset purchase	200		
Asset value	100	101	204
Daily gain/loss	−100	1	103

(continued)

Exhibit 10   (Continued)

Fully corrected accounts	20 June	21 June	22 June
Asset purchase	200		
Asset value	200	202	204
Daily gain/loss	0	2	2

Building on the previous discussion and exhibit, cash effects must also be accounted for in synchronization with the asset side data. Exhibit 11 adds another layer of complexity with more data elements and with more potential for each data element to be inaccurate.

The first panel of Exhibit 11 shows the original entries. The adjustment in the middle table features updates to the asset side of the transaction and valuation and the cash impact of the transaction but not the cash balance. Daily gains and losses are incorrect in such a scenario, but the cumulative amount is accurate. With the fully corrected accounting data in the final table, gains and losses are accurate each day.

Exhibit 11   Correction of Transaction Entry Error: Asset and Cash Data Impacts

Original accounting entry	20 June	21 June	22 June
Asset purchase	100		
Cash payment	−100		
Asset value	100	101	102
Cash balance	−100	−100	−100
Daily gain/loss	0	1	1

Corrected except cash balance	20 June	21 June	22 June
Asset purchase	200		
Cash payment	−200		
Asset value	200	202	204
Cash balance	−100	−100	−200
Daily gain/loss	100	2	−98

Fully corrected accounts	20 June	21 June	22 June
Asset purchase	200		
Cash payment	−200		
Asset value	200	202	204
Cash balance	−200	−200	−200
Daily gain/loss	0	2	2

For non-market transactions, problems can also result from the incorrect or inconsistent use of transaction types. These problems may not be detected before they reach performance because the accounting impact could be correct. Once identified,

the problem should be corrected at the source, in the portfolio accounting system. Return impacts will also occur if cash transaction entries are misclassified between cash flows and income or expenses, because of their different treatment in the performance calculation, where income and expenses will affect gain or loss but cash flows will not. If transactions are booked late in the accounting system, it may cause false gains and losses over individual time periods if holdings are not updated in synchronization. As with the examples in Exhibit 8 and Exhibit 9, cumulative gains and losses may still be accurate despite values on individual days being incorrect.

EXAMPLE 3

Backdated Correction to Portfolio Accounting Transaction Record

A colleague in the operations department informs the performance team that fund transactions have been corrected in the portfolio accounting system. In this case, a trade was originally booked to the wrong security. The operations department has performed its own checks and is satisfied that the result is correct. What is the best course of action for the performance team to take?

A   Run periodic performance on the fund to ensure return and risk data are correct.

B   Check and review the monthly security-level returns that have been calculated for the fund for the two relevant securities.

C   Review the holdings and transactions relating to the securities in question in detail, for the purpose of consistency. Check that the cash impacts of the corrections are consistent with the security data changes.

Solution

C is correct. Inconsistencies between holdings and transactions will generate errors in the performance calculations at the security level. Inconsistencies between asset and cash data will also lead to inaccurate returns within the fund. A is incorrect because it does not include checking that the original booking to the wrong security has been fully cleaned up or that the overall cash impacts are corrected. Attribution may be incorrect at the security level. B is incorrect because although looking at the gain or loss on individual assets can be a good way to identify data errors, their impacts are often not visible when looking at longer time periods. Reviewing the daily returns would have been a better approach.

4.4 Security and Asset Setup

Certain errors within security setup in the accounting system will lead to incorrect transaction or valuation data being generated in the accounting data. An example of this problem is a security being set up with the wrong pricing currency, which would result in the security being incorrectly valued. This error would persist until the security record is corrected in the accounting system. If the security setup error is linked to an attribute that the accounting system uses to generate transaction records, this error will also persist until the security record is corrected. An example of this situation is the dividend payment date.

Security reference data, such as country and industry classifications or identifiers (for example, SEDOL or CUSIP), can cause issues if not processed correctly. There may also be inconsistencies between how the benchmark and how the portfolio classifies a security. For example, the benchmark provider may classify a security as

a UK company if its shares are traded in London, but the company's business may be based in Asia and subject to factors unrelated to the UK economy. The portfolio may, therefore, classify it as a frontier or emerging market company. Depending on how it has been reflected in the accounting system, a reclassification could result in the original position disappearing and a new one appearing without a transaction to explain the movement in values. This situation will create distortions in performance attribution. This would also be true with any inconsistencies between the portfolio's and the benchmark's classification of assets.

4.5 Instrument-Specific Issues

There are a number of instruments that require performance teams to either make assumptions or address problems with a lack of timely data. Many fields, particularly in the case of derivatives and fixed-income instruments, may be inputted incorrectly— for example, in situations where derivatives reference other securities. We now turn our attention to some types of securities that, owing to their nature, are particularly prone to errors. Those instruments are fixed-income securities and illiquid assets, including OTC derivatives.

4.5.1 *Fixed-Income Securities*

Fixed-income securities are often subject to setup errors because many of their characteristics directly relate to the generation of valuation or coupon payments. Common problems include the following:

■ Incorrect coupon rates or payment dates (a coupon is an income payment from a bond issuer to the holder; for conventional bonds, it would feature a fixed annual percentage value and specified dates on which payments are made).

■ Accrued interest day-count conventions (coupon on a bond is accrued daily such that the bondholders earn a fraction of the coupon for each day they hold the bond; there are different methods, or "day count conventions," that may be applied to perform accrued interest calculations).

In periods when liquidity in bond markets dries up, price availability reduces, which can increase price volatility. If a firm's asset valuation policy does not align with the approach used by a fund's benchmark, it can lead to an increase in noise when looking at the relative performance of that fund. In the event of a default by a fixed-income security, there may be delays in decisions being made on appropriate accounting treatment. The decisions may trigger backdated write-downs or write-offs of coupons and principal.

Another issue may arise when a portfolio holds sinkable bonds that allow issuers to repay borrowings in installments. When this occurs, a transaction will be processed to reflect the repayment proceeds and a sinking factor is applied to a bond's price and accruals to reflect the reduced balance due on maturity. If these two accounting entries are not processed with the same effective date, false gain and loss impacts will be seen in the security-level return.

Mortgage-backed securities (MBSs) can have similar prepayment factors if principal is repaid periodically. The details of such payments are determined a month in arrears so that there is a time lag before the relevant information is available. This situation leads to backdated updates to valuations, accruals, and transactions in the portfolio accounting system.

EXAMPLE 4

Fixed-Income Performance Query

A portfolio manager's assistant is questioning the monthly total fund-level return on a bond fund that invests in a wide range of fixed-income instruments. Which of the following is the *least likely* contributor to an error?

A The fund has a substantial mortgage-backed security holding.

B A setup error on a newly purchased bond has resulted in the coupon rate being off by a factor of 10.

C An adjustment transaction moving a security between different identifiers has been entered at book cost instead of market value.

Solution

C is correct. An adjustment transaction entered at book cost instead of market value will net out at the total fund level, which is what is being challenged. Therefore, it is unlikely to be a contributor to a total fund-level error.

A is incorrect. Mortgage-backed securities are a likely cause of data problems because of the time lag in availability of information.

B is incorrect. An error in the coupon rate setup for a bond will affect the amount of income it accrues within its valuation and will affect the total fund-level return.

4.5.2 *Illiquid Assets*

The idiosyncratic nature of illiquid investments can be challenging for the operations teams that maintain their records on the accounting system. As Exhibit 12 shows, there is an inverse correlation between the liquidity of an asset and the likelihood of data issues arising. This issue can be thought of in terms of data availability, where at one end of the spectrum, an exchange-traded equity will have real-time data available through multiple sources. On the opposite end of the spectrum, a physical asset or bilateral private transaction is unique and will not have data readily available through third-party vendors. Instead, firms will need to design their own valuation models.

Exhibit 12   Data Challenges Increase as the Liquidity of an Asset Class Decreases
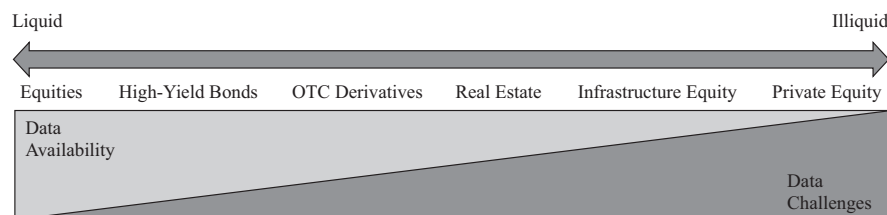
It is common for illiquid assets to be revalued only monthly or quarterly so that any price gain or loss will be posted on a single day. Prices may not be available until some time after the period end, which causes a valuation lag. Details of such transactions as drawdowns or distributions may not be available until after the pricing process has ended. This situation leads to backdating of entries, with the risk that valuation and transaction data reflect inconsistently. Exhibit 13 shows the possible treatment of a private equity investment.

VALUATION OF AN ILLIQUID ASSET

Exhibit 13 features a quarterly valued private equity investment of 100 units, worth 307, ahead of the March quarter end. For the first two days after quarter end, the valuation has not been updated and still shows the December values. On 3 April, the price applied to the investment is updated in the portfolio accounting system; on 7 April, details of a March distribution are available. This results in a return of capital of 20, which also reduces the holding from 100 to 95. The time lag of data availability leading to the need to backdate accounting entries heightens the probability that data are reflected inconsistently or incorrectly in the performance calculation.

Exhibit 13   Illustration of an Illiquid Asset Data Update Timeline

On 3 April, a quarter-end price becomes available and is updated in the accounting system.

Data originally reflected for 31 March, value date has not been updated.

On 7 April, a distribution for the month of March is confirmed and updated in the accounting system. The holding is also updated.

Accounting system entry dates:

	31 March	3 April	7 April
Holding	100	100	95
Price	3.07	3.20	3.20
Valuation	307	320	304
Cash Distribution	0	0	20
Total value 31 March	307	320	304
March transactions	0	0	20

Although OTC derivative pricing models have become more standardized, the wide range of potential customized terms and conditions they have leads to a higher likelihood of setup errors. These can affect ongoing cash flows and valuation of the position, resulting in incorrect data. Model-based pricing causes further challenges for pricing teams because variations can occur against counterparty or administrator valuations. These variations can lead to price challenges and corrections, as well as potential time lags in price availability. Understanding the way complex derivatives are booked on accounting systems is also important for enabling the right data to be processed in the performance calculation. A common challenge involves the treatment of multiple legs within a swap transaction. Given these inherent complexities of data processing for illiquid assets, performance practitioners should consider adding controls to detect data issues.

EXAMPLE 5

Illiquid Asset Performance Error

A portfolio manager informs the operations and performance measurement team that the reported return that they have seen for an illiquid asset, a bilateral private transaction, in their fund is wrong. They know what the investment is yielding, and there have been no adverse events, so they know what the return should be. Which of the following is the *least likely* cause of error?

A The end-of-period price for an asset has not been updated.

B A cash distribution was recorded in the accounting system after performance had been calculated.

C An incorrect price for the illiquid asset was received from a third-party vendor.

Answer

C is correct. Pricing of illiquid assets will not normally be provided by an external market data vendor due to the customized nature of the instruments. A is incorrect because late availability of pricing is a common feature of illiquid assets. B is incorrect because time lags in the availability of information for cash flows relating to illiquid assets can lead to late capture in accounting data.

4.6 Index and Benchmark Data

Index data mostly come directly from an index provider or from other external firms that offer data services. In either scenario, the provider will probably run extensive quality controls before distributing the data, which means that revisions are relatively infrequent. Blended benchmarks involve the combining of two or more indexes to a specified set of weighting rules. An example of a weighting rule is floating weights. With floating weights, the starting allocation between indexes is specified, and then the ongoing weights move as a result of the individual index returns over time. Another example is fixed weights, where the same allocation between indexes is applied to a daily calculation. Rebalancing or re-fixing features starting weights that float for a specified duration, at the end of which they are reset to the same starting weights. Blended benchmark maintenance and calculation can lead to errors in benchmark returns.

DATA ERRORS ARISING FROM CORPORATE ACTIONS

5

A corporate action is an event that brings about a change in securities issued by a company. There are many different types of corporate actions, and each may feature any combination of the following:

- A cash payment or receipt
- A switch between or an issuance of existing securities
- The creation of and a switch to new securities
- Multiple currencies
- The reclassification of one or more securities

Exhibit 14 illustrates common features of corporate actions. The features influence the way that the corporate action is entered in the portfolio accounting.

Exhibit 14	Features of Common Types of Corporate Actions				
Type	**Optional**	**Cash Movement**	**Security Transaction**	**New Security**	**Description**
New issue	Yes	Payment	Purchase	Yes	Capital raising via new security issuance
Rights issue	Yes	Payment	Multiple	Yes	Offer rights to existing shareholders to purchase new shares at discount. Rights are tradeable
Dividend	No	Receipt	Income	No	Distribution of profits in cash
Stock dividend	Yes	Receipt	Income/purchase	No	Dividend taken in the form of new shares instead of cash
Tender offer	Yes	Receipt	Sale	No	Company offers to buy back certain number of shares from shareholders
Bonus issue	No	No	Adjustment	No	New shares issued at no cost. Increases shares in issue and reduces price
Stock split	No	No	Adjustment	No	Increase in the number of shares in issue by a set ratio (e.g., 3:1). Will result in corresponding reduction in share price
Consolidation	No	No	Adjustment	No	Opposite of a stock split and will increase nominal price
Takeover/merger	No	Receipt	Yes	No	A company acquires another with payment in cash and/or shares
Spinoff	No	No	Adjustment	Yes	A company splits into two or more separately listed entities. Shareholders receive shares in new entities with decrease in value of existing holding

In order to check the data reflected for a corporate action, it is helpful to start with a clear understanding of what happened in the market:

- What assets does the portfolio hold that are affected by the corporate action—the starting position?
- What decisions were made (if the event is voluntary)?
- What transactions occurred as a result of the corporate action?
- What was the end result?

Similar to the case of non-market transactions, portfolio accounting records for corporate actions may be reflected in a way that does not suit the needs of performance calculation. Common problems with corporate actions data include the following:
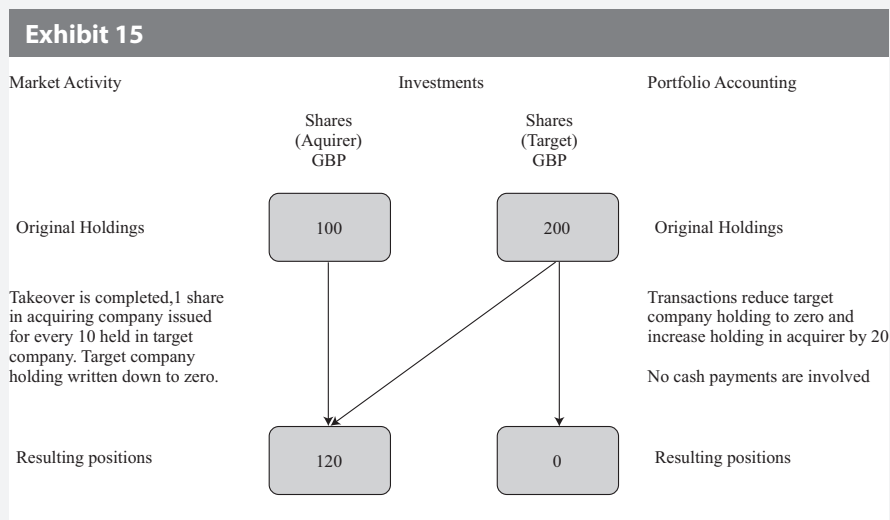
- Transactional entries reflect book cost (not market value) equivalent.
- Holdings and transactions fall out of synchronization.

A lack of timeliness of information flow for corporate actions often leads to late portfolio accounting updates for both transactions and prices. As with all performance data, it is useful to think of corporate actions in terms of gain or loss on each individual line as well as in aggregate across relevant assets. If any data entries do not support accurate gain or loss calculated at these levels, return, risk, and attribution analysis may be inaccurate. Also in line with other performance data issues, the aggregate performance return from a corporate action over its full duration may be correct even where data errors affect individual lines or time period returns. This outcome can be caused by equal and opposite error impacts between security lines or from one day to the next.

Exhibit 15, Exhibit 16, and Exhibit 17 show how corporate actions can be structured and reflected in portfolio accounting systems. They illustrate a range of issues that can arise and lead to incorrect investment returns. For example, transactions that do not reflect market values cause performance data distortions, as do missing steps when creating temporary securities.

ILLUSTRATION OF A TAKEOVER

A UK company completes a takeover of a domestic rival in which shareholders of the target company receive 1 share in the acquirer for every 10 shares they hold. No cash payments are involved. The scenario illustrated relates to a fund that holds shares in both the acquirer and the target company, in the amounts shown. The original holdings are 100 shares and 200 shares, respectively, and in line with the terms of the takeover, the holder receives 1 share in the acquiring company, leading to a resulting position of 120 shares in the acquiring company.

Exhibit 15

Market Activity	Investments		Portfolio Accounting
	Shares (Aquirer) GBP	Shares (Target) GBP	
Original Holdings	100	200	Original Holdings
Takeover is completed,1 share in acquiring company issued for every 10 held in target company. Target company holding written down to zero.			Transactions reduce target company holding to zero and increase holding in acquirer by 20 No cash payments are involved
Resulting positions	120	0	Resulting positions

The accounting system entries for this corporate action are relatively straightforward because there are only two securities and two transactions involved. There is only one currency involved, which prevents the possibility of currency errors. These features should limit the likelihood of errors occurring.

As long as holdings and transaction movements are aligned for each security and between the two securities, there should be no data synchronization issues. At a total portfolio level, as long as the two transactional entries are of equal and opposite value, there should be no overall (incorrect) impact on returns. If the entries are not equal and opposite, then it will affect both the individual security returns and the total portfolio return. Under such circumstances, the security-level returns are potentially at risk of data error. If the transactional entries are recorded at book cost rather than market value, it would lead to incorrect returns on both of the security lines.

A simple check of the calculated returns can be performed where there are no cash movements involved. The return should simply reflect total ending value of assets divided by total starting value.

AN ILLUSTRATION OF A RIGHTS ISSUE

A company proposes a rights issue of 7 new shares at $1.78 for 15 existing shares (a rights issue allows a company to raise funds from existing shareholders by issuing new shares). The illustration assumes an initial holding of 150 shares in the company and that the rights issue is taken up. This situation results in a new total position of 220 shares.
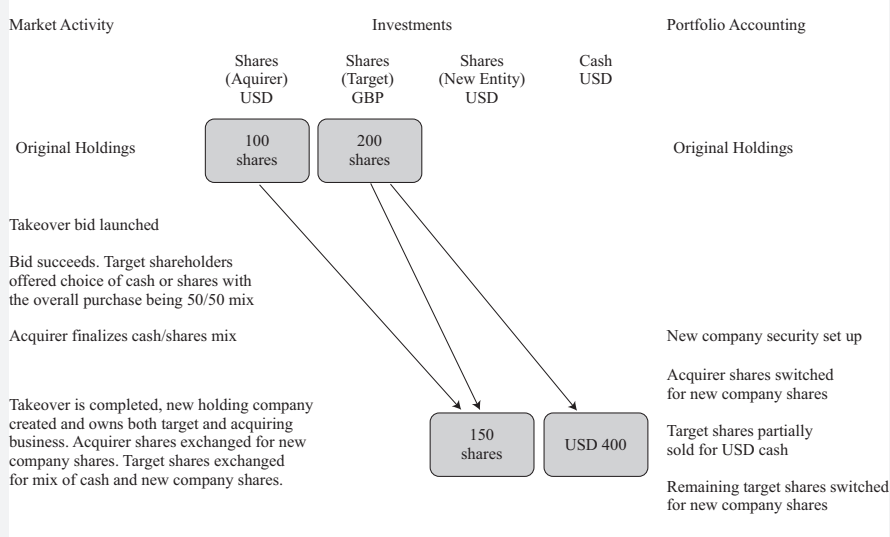
Exhibit 16

Market Activity	Individual Securities			Portfolio Accounting
	Ordinary Shares (Quantity)	Nil-Paid Rights (Quantity)	Fully Paid Rights (Quantity)	
Original Holding	150			Original Holding
Company issues nil-paid rights at record date	150	70		Nil-paid rights security created and priced. Transaction to increase nil-paid holding to 70
Rights taken up, payment made	150		70	Fully paid rights secuirty created and priced, purchase of 70 units. Transaction to remove nil-paid holding
Corporate action is completed	220			Transaction to exchange fully paid security for ordinary shares

From an accounting perspective, the rights issue features the creation of two new temporary securities, transfers between the different securities, and a cash payment. If any of the transactions used to move between the lines of security do not reflect the prevailing market value of the respective line, it will lead to incorrect returns. Inconsistencies between holding and transaction data are also a potential source of error. This applies to each individual security and in aggregate for the three securities. Problems can occur if the newly created securities are not set up with classifications, such as industry or sector, aligned to the ordinary shares. This situation could lead to their return impacts appearing in different parts of attribution analysis.

AN ACQUISITION AND A MERGER

A US company whose shares are priced in dollars acquires a UK company priced in sterling. The transaction involves the creation of a new holding company that will wholly own all of both the acquiring company and the target once the transaction is completed. Shareholders in the target company are offered the chance to choose between cash and shares, but the acquirer has the right to determine the final split on the basis of rules that it has specified. Under the final terms of the deal, shareholders in the acquirer receive shares in the new company at a ratio of 1:1. Shareholders in the target company receive new company shares at a ratio of 1:4 (one new share for every four shares of the target company held) plus a payment of USD2 per share.

Exhibit 17   Example of an Acquisition and a Merger

Market Activity	Investments				Portfolio Accounting
	Shares (Aquirer) USD	Shares (Target) GBP	Shares (New Entity) USD	Cash USD	
Original Holdings	100 shares	200 shares			Original Holdings
Takeover bid launched					
Bid succeeds. Target shareholders offered choice of cash or shares with the overall purchase being 50/50 mix					
Acquirer finalizes cash/shares mix					New company security set up
					Acquirer shares switched for new company shares
Takeover is completed, new holding company created and owns both target and acquiring business. Acquirer shares exchanged for new company shares. Target shares exchanged for mix of cash and new company shares.			150 shares	USD 400	Target shares partially sold for USD cash
					Remaining target shares switched for new company shares

Reflecting this corporate action in the portfolio accounting system requires the creation of two new securities, transfers between securities, and a partial sale. As with the rights issue example, if the transfers reflect a book value, then performance will not be correct. The fact that the takeover is a cross-border action adds complexity because of the inclusion of securities in different currencies. This complexity adds another potential source of incorrect data for the performance calculation. Unlike the rights issue, the acquisition and merger happen in a single step, which makes it less likely to lead to synchronization issues between holdings and transactions. However, the optional element (the choice between cash or shares) means that the final payment details would likely have been calculated on the eve of the deal completing. This could lead to delays in the final transactions being booked in the accounting system, which does give rise to data synchronization issues.

EXAMPLE 6

Corporate Action Data Challenges

The manager of the corporate actions team in the operations department contacts the manager of the performance team to say she has heard that corporate actions are causing problems for performance reporting. She wants to know how her team can work with the performance team to minimize any future problems. Which of the following statements is *most* accurate?

A   The calculation of performance needs adjustment transactions to be reflected at a market value because the use of book cost doesn't meet performance needs.

B   Corporate actions can cause problems at the individual security level, but they do not affect total fund-level returns.

C   New securities created as a result of cash dividends and tender offers need to be handled correctly; otherwise they may affect the accuracy of performance attribution.

Answer

A is correct. The statement is accurate because the use of book cost on transactions will affect calculated returns. B is incorrect because corporate actions can indeed cause problems at the individual security level, but they may also affect the overall fund-level return and risk. C is incorrect because cash dividends and tender offers do not result in new securities being created.

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6   CURRENCY EXPOSURE AND RETURN DISCREPANCIES

For any portfolio that invests in assets outside of its own base currency, there will be performance impacts from currency exposure. These include both real investment impacts and, potentially, issues caused by accounting policies and calculation methodology.

6.1 Accounting Policy

The choice of exchange rates used for end-of-day asset valuation will influence the return on a portfolio. If the exchange rates used are not aligned with those in the relevant portfolio benchmark, it will make the assessment of relative performance difficult. For example, if a well-constructed index-tracking global equity portfolio were to use valuation exchange rates that are different from its benchmark, its performance would diverge from the benchmark return.

Although there are a multitude of daily exchange rates available, the London 4:00 p.m. rates are commonly used by major global index providers for end-of-day currency conversion. Aligning accounting valuation exchange rates to these rates will eliminate one source of return discrepancy from currency exposure.

Accounting policy will also determine which exchange rates are applied to transactions for conversion to base or reporting currency. Accounting policies tend to be simplistic, such as using end-of-day rates. More sophisticated approaches exist, such as linking trades to specific spot foreign exchange (FX) transactions.

For simplistic approaches, such as applying start-of-day or end-of-day exchange rates, there will be a policy calculation effect present on each asset for which a transaction occurs. Because the transaction creates a cash impact with opposite signage (i.e., buy asset = sell cash), there is an offsetting effect within the cash return. Consequently, at a total level, the portfolio return will not show any impact from the policy.

The impact of accounting policy exchange rates on transactions works differently for purchases and sales, as shown in Exhibit 18. This exhibit introduces the subject of the impact of exchange rate accounting policy, and Exhibit 19 builds on it. Candidates may find it useful to consider these exhibits together.

IMPACT OF FX RATE ACCOUNTING POLICY ON RETURNS

A euro-based portfolio starts with USD100 worth of assets, and the EUR/USD exchange rate is 1.1 (USD1.1 per EUR1). The assets are sold for proceeds of USD102, and at the end of the period, the EUR/USD rate is 1.05. The first sale proceeds row shows gain or loss on the asset using a start-of-period exchange rate for the trade. The bottom row shows the same calculation using the end-of-period exchange rate. A different base currency gain is calculated for the two rates.

Exhibit 18   Impact of FX Rate Accounting Policy on Returns, Excluding Cash

	Values		FX Rate	Gain/Loss	
	USD	EUR	EUR/USD	USD	EUR
Start-of-period value	100.00	90.91	1.10	—	—
Sale proceeds: Start FX	−102.00	−92.73	1.10	2	1.82
Sale proceeds: End FX	−102.00	−97.14	1.05	2	6.23

Exhibit 19 builds on Exhibit 18 and shows the same example with cash impacts included. It also shows sale and purchase scenarios. The transaction value in the sale and purchase scenarios has been set to create a gain of 2 on US dollar assets in both scenarios. In both tables, the same total fund gain in euros is observed, but the amounts attributed between assets and cash are different because of the exchange rate effect. Performance practitioners should be aware of the potential impact of FX accounting policy and use this potential impact as a channel of investigation when base currency returns on an asset are being questioned.

Exhibit 19   Impact of FX Rate Accounting Policy on Returns, Including Cash

	Asset Sale						
		USD			EUR		FX Rate
	Assets	Cash	Total	Assets	Cash	Total	EUR/USD
Start-of-period value	100.00		100.00	90.91		90.91	1.10
Transactions	−102.00	102.00		−92.73	92.73		1.10

(continued)

Exhibit 19   (Continued)

Asset Sale

	Assets	USD Cash	Total	Assets	EUR Cash	Total	FX Rate EUR/USD
End-of-period value		102.00	102.00		97.14	97.14	1.05
Gain/loss	2.00		2.00	1.82	4.41	6.23	

Asset Purchase

	Assets	USD Cash	Total	Assets	EUR Cash	Total	FX Rate EUR/USD
Start-of-period value		100.00	100.00		90.91	90.91	1.10
Transactions	100.00	−100.00		90.91	−90.91		1.10
End-of-period value	102.00		102.00	97.14		97.14	1.05
Gain/loss	2.00		2.00	6.23		6.23	

One scenario where transaction exchange rate policy will not "wash out" is when a portfolio experiences a cash flow (inflow or outflow) that is not in its own base currency. If this situation occurs, the choice of exchange rate to be applied will directly affect the starting valuation on which subsequent gains or losses are calculated. Such instances are likely to be rare because mutual funds have such mechanisms as currency share classes to deal with them and separate accounts will have a designated base currency.

6.2 Currency Hedging

Forward FX contracts, where rates at which currencies will be exchanged in a month are locked into today, can be used to reduce the currency exposure in particular assets or on a portfolio as a whole. Implementation of hedging is imperfect because the value of the assets being hedged will move with the market. This movement leaves the portfolio either over- or underhedged as the sold amount on the forward FX remains unchanged. This will generate a real return impact on the portfolio that can be quantified, and that the amount is not significant will be of interest to portfolio managers. Where a portfolio is managed against a currency-hedged benchmark, there may be relative performance impacts caused by the benchmark hedging methodology. A common approach in benchmark hedging methodology is for the index provider to take the currency composition of the index at the beginning of the month and use prevailing market rates to apply notional one-month forward FX positions back to 100% base currency. The forward contracts are revalued each day until month end, when they are replaced by new one-month forward hedges using the same process. This approach has the same imperfections as portfolio hedging, noted previously. It also means that where the portfolio hedging approach is different from the benchmark, there will be real relative return impacts. For example, the portfolio managers may use three-month forward FX contracts, or they may adjust hedging positions when asset trading occurs in the portfolio.

6.3 Dual Currencies

In some cases, an investment may be valued in one currency but pay dividends or coupons in another. Such instruments can be difficult for accounting systems to handle automatically because of this unusual feature since they may be able to use only a single currency. If this is the case, dividends and coupons may be accrued and recorded in one currency but settled in another. Such situations may require intervention, and the implied exchange rate (received amount/expected amount) can cause a performance impact if it varies from prevailing rates.

Similar situations occur with trades in securities within a restricted market. In a restricted market, the local government places controls that include limiting who is allowed to buy and sell the local currency. Here, securities traded in local currency may be settled by the custodian in a fund's base currency. The effective exchange rate applied to the trade will create a real performance impact if it diverges from prevailing rates used in portfolio accounting.

Exhibit 20 illustrates how performance can be affected when coupon proceeds in a restricted market currency are converted into another currency by an external custodian and then paid to the portfolio. Because the conversion is a real trade, its impact on performance is not an error. In this example, the fund receives USD392 less than it was expecting in dollar terms, which will result in the portfolio's cash return and total level return being lower by the basis point equivalent of USD392. The return on the bond will be unaffected because the accounting policy conversion amount of USD56,192 will be used for calculating its return.

Exhibit 20 Dual-Currency Coupon Payment		
Coupon on Korean Won Bond		
Coupon proceeds	KRW	100,000,000
Accounting value of coupon converted	USD	56,192
Custodian executed FX sold	KRW	100,000,000
Custodian executed FX bought	USD	55,800
Performance impact from FX		−392

6.4 Global Investment Performance Standards (GIPS) Composites

Composites involve combining the performance track records of multiple funds using a weighted average approach. Combining portfolios with different base currencies is allowable if the investment strategies are similar and consistent with the composite definition, but the correct approach needs to be followed. If different currency track records are combined without first converting into a common currency, it will create meaningless results. This is due to both (1) combining different currency returns and (2) weighting using market values in different currencies.

In order to accurately construct composites containing funds with different base currencies, they must first be converted into a common currency. As long as the same exchange rates are applied to each portfolio and benchmark return, then the relative geometric return will remain consistent. Exhibit 21 illustrates the issue.

COMPOSITE CONSTITUENTS AND CURRENCIES

This example shows a composite made up of four constituent funds running similar investment strategies. The funds' base currencies are different. The total line in the first table shows the outcome if an incorrect approach is used—if local currency values are combined before converting to a common currency. The second table shows the correct results, where individual fund values and returns are first converted into the composite's base currency, the US dollar. The US dollar results are then combined to give the total composite return.

The individual funds' relative returns on a geometric basis are the same under both methodologies. The total composite relative return is distorted in the first table mainly by the overweighting due to Fund D being valued in Japanese yen. The individual funds' returns in the second table are also comparable because they are presented in a common currency, showing the correct calculation of the composite's relative return.

Exhibit 21	Converting Reporting Currencies for GIPS Composites				
Global Treasury Composite: All Local Currency					
Constituent	Base Currency	Value Base (m)	Fund Base CCY	Benchmark Base CCY	Relative Base CCY
Fund A	USD	350	6.6%	6.2%	0.4%
Fund B	EUR	1,000	8.3%	8.0%	0.3%
Fund C	EUR	275	8.4%	8.0%	0.4%
Fund D	JPY	50,000	3.6%	3.0%	0.6%
Total composite	Local	51,625	3.7%	3.1%	0.6%
Global Treasury Composite: Converted to USD					
Constituent	Base Currency	Value Base (USD)	Fund USD	Benchmark USD	Relative USD
Fund A	USD	350	6.6%	6.2%	0.4%
Fund B	EUR	909	6.1%	5.8%	0.3%
Fund C	EUR	250	6.2%	5.8%	0.4%
Fund D	JPY	500	5.7%	5.1%	0.6%
Total composite	USD	2,009	6.1%	5.7%	0.4%

Calculations are based on currency moves over the period against the dollar of +2% for the euro and −2% for the Japanese yen and on market value conversion rates of 1.10 for EUR/USD and 100 for USD/JPY.

EXAMPLE 7

Accounting Policy on Exchange Rates

The client reporting team has challenged the returns on a global equity index tracking fund that aims to be fully currency hedged back to the US dollar. The total fund performance is out of line with the hedged benchmark. The unhedged portfolio return including cash is in line with the unhedged benchmark. The portfolio experienced a large cash inflow during the reporting period, which has seen high level of market volatility. Which of the following is the *most likely* cause of this outcome?

A   It is due to the portfolio accounting policy choice of valuation FX rates being different from those used in the benchmark.

B   The investment of the large inflow may not have been well executed.

C   The hedging methodology is different for the fund and its benchmark.

Solution

C is correct. Hedging methodology may well be different for the portfolio and the benchmark. Any difference may be amplified because the portfolio has managed an inflow, which would likely result in an update to currency hedging positions. A is incorrect because it would result in a variance between fund and benchmark performance when looking at unhedged returns, excluding cash. B is incorrect because if it were the case, then it would affect the unhedged portfolio return.

DATA REVISIONS AND PRIOR-PERIOD RETURNS

7

Given the high volume of data that feeds into the performance calculation, it is almost inevitable that data errors that affect returns will occur. In some cases, errors may not be identified until after performance has been calculated and reports issued. If errors do occur, we have a range of considerations that need to be applied when deciding whether performance returns should be restated. Firms should develop and maintain a policy to ensure that the approach to restating returns is consistent and can be justified (firms that comply with GIPS must have an error correction policy in place). Next, we explain the main considerations for shaping a return restatement policy.

7.1 Status of Returns: Indicative, Preliminary, and Final Returns

Firms often produce a series of "indicative" returns. Portfolio management systems often calculate indicative performance using portfolio data that the firm holds or maintains. As the term "indicative" suggests, these are not formal or official returns and would not normally be subject to the need to restate. During the production of reports, a performance team will run validations on the returns and might issue a report to internal stakeholders to review and approve. Prior to receiving approvals, these numbers will be considered preliminary and would, therefore, not be subject to a restatement policy. The focus of our discussion of restatement policies is thus finalized returns. These can be thought of as those having passed validation checks and been issued to all stakeholders. Exhibit 22 provides and overview of the performance production process.

Exhibit 22 Performance: Returns Status
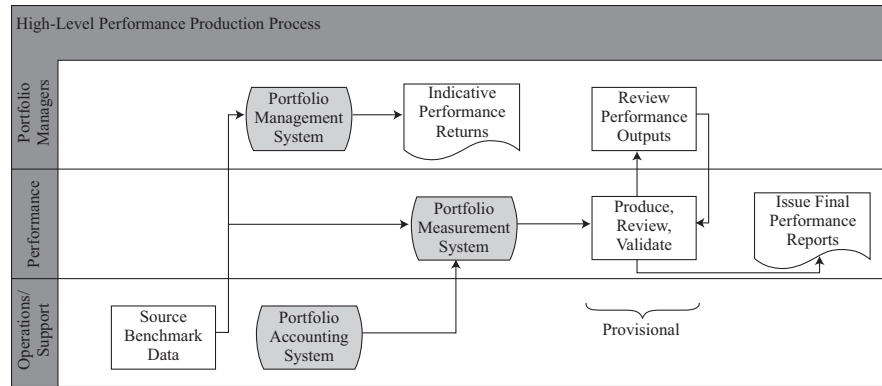
7.2 Stakeholders

The following are two key considerations in deciding whether to restate performance:

- Who are the stakeholders?
- What are the returns being used for?

Performance reports, and performance information in a wider sense, are made available to a wide range of stakeholder groups within the firm and to external parties. Each stakeholder will have his or her own interests in returns and may use them for different purposes. Understanding these purposes is important in order to determine whether a restatement of returns is necessary. Exhibit 23 shows the main stakeholder groups relevant for performance reporting.

Exhibit 23 Performance Measurement Stakeholders
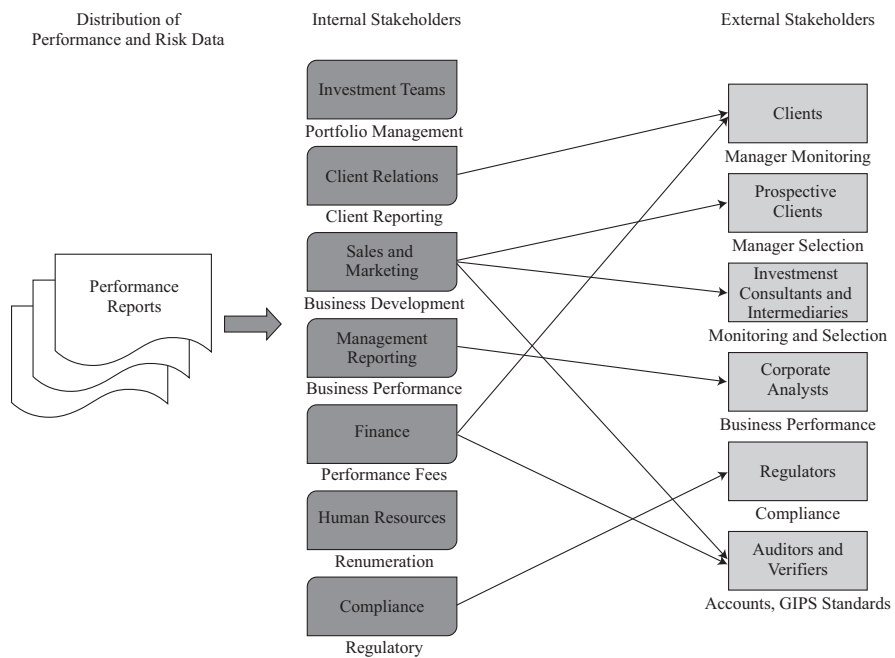
Stakeholders' use of fund returns can broadly be thought of as serving two purposes: information only or decision making. Many internal stakeholders receive performance reports for information purposes, meaning that decisions are not directly made on the basis of the performance numbers. In such cases, the impact of restatements is mainly one of reputational damage or of potentially undermining confidence in the performance team's outputs. Decision-making use includes stakeholders who use returns to calculate fees or payments. Examples include performance-related fees on a portfolio and portfolio manager bonus calculations. In both cases, there may be a financial impact as a result of restating performance. For performance-related fees, a restatement will also affect the client financially and will harm the investment manager's credibility. Whether to hire or retain an investment management firm is a key decision that will be based in part on investment performance. An extreme scenario is when a firm is hired on the basis of an overstated performance track record. In this situation, the firm may suffer reputational damage and could be exposed to mis-selling claims, in addition to being sanctioned by the regulator with potentially extreme consequences. Any form of decision-making use of fund returns is more likely to require a restatement in the event of a data error correction. This is why firms' controls need to be as good as possible to identify and resolve errors before publication, avoiding the need for restatements.

7.3 External Obligations

If an incorrect return has been issued to external stakeholders, specific rules apply. These rules include contractual stipulations in client agreements, local regulatory requirements, and Global Investment Performance Standards policies. Any obligations arising from these rules will need to be satisfied by the action taken in response to the data revision. Firms that are GIPS compliant will have a specific GIPS error correction policy, although this policy may focus on the impact at a composite level rather than the individual portfolio level (see the GIPS "Guidance Statement on Error Correction").

7.4 Materiality

Significance or materiality is an important factor to consider because the impact on returns of a data revision can range from zero to a large change. When determining materiality, an element of subjectivity may be required if there are no specified thresholds. Looking at the size of the return restatement in terms of proportions of risk budget or outperformance targets can provide a starting point, as Exhibit 24 illustrates.

Exhibit 24

Materiality of Performance Restatement

Consider two funds:

- A sovereign bond fund with an annual outperformance target of 0.5% over its benchmark
- An emerging market equity fund with an annual outperformance target of 2.5% over its benchmark.

Using 10% of the outperformance target as a restatement materiality rule would give materiality thresholds of 5 bps for the bond fund and 25 bps for the equity fund. In this case, a data revision that caused performance to change by 0.2% would require the bond fund's performance to be restated, but restatement would not be required for the equity fund's performance.

7.5 Implementing Revisions

Having determined the need to restate returns, there are options for executing the change:

■ Full restatement—recalculate and reissue the performance report.

■ Recalculate and include corrected history in the next reporting cycle accompanied by an explanation.

In each instance of restatement, a clear audit trail of any data or reporting changes should be kept, including reasons for any decisions that have been made. Clear communication to stakeholders is important to ensure full awareness and understanding of the impact, the cause of the error, and actions taken to prevent it from reoccurring.

EXAMPLE 8

Data Revisions

Staff in the pricing and valuation team in the operations department have alerted the performance team about a major pricing error on an illiquid asset in a fund that has been winning substantial amounts of new business. The error dates back over one year and has resulted in the asset being overvalued. The fund's fee structure includes a simple 0.5% per annum management fee. Which of the following stakeholders would be *most* affected from a decision-making perspective?

A Internal investment desk for monitoring and oversight of performance

B Recently won and prospective new clients because of inflated performance track record

C Fund managers responsible for the portfolio that holds the asset

Solution

B is correct. Existing and prospective clients may have made their decision to invest in the fund on the basis of incorrect performance. A and C are incorrect because this issue highlights failing controls, but the error discovery serves an information purpose for both the fund managers and the monitoring and oversight desk.

SUMMARY

■ The scope of data can be varied and wide ranging. Ultimately, data is all information in all forms. It can be structured, sitting within a system or application and extractable and organized in a useful and suitable way, or it can be less structured and be found in spreadsheets or other documents.

■ There are different ways in which dimensions of data quality can be described. They include accuracy (valid and correct), completeness (complete for its purpose), conformity (to standards and rules), consistency (of applications of rules across systems), timeliness (available in time for use), and lineage (knowledge of where it comes from).

- Data governance is the ownership and oversight of the firm's data over its life cycle. The data life cycle stages include creation, security and storage, distribution and use, holding and discovery, retention and archiving, and destruction.

- Governance provides overall management of the data over its life cycle and responsibility over the integrity of the data, leading to good data management practices.

- Data governance will put in place the framework and oversight within the firm's departments to ensure the transparency, accuracy, and ownership of data across the organization.

- Failure to implement a robust data governance framework creates a multitude of risks for the firm's strategic and customer outcomes.

- Data errors feeding into the performance calculation will lead to inaccurate returns. In turn, these will distort any *ex post* risk calculations.

- Data errors fall into two types: (1) incorrect valuation of an asset or transaction and (2) inconsistency between transactions and valuations, including associated cash impacts.

- Data errors include transaction booking errors, security and asset setup errors, and pricing and valuation issues.

- Fixed-income securities, with a wide variety of unique characteristics, are particularly prone to setup errors. Incorrect coupon rates or payment dates, accrued interest day-count conventions, or special features or structures, such as sinkable bonds or mortgage-backed securities, all pose challenges.

- Illiquid assets' unique characteristics and lack of data availability give rise to challenges in performance measurement. Time lags in data availability and customized terms and conditions of many derivatives are some of the issues that pose difficulties in valuations and return calculations.

- Corporate actions pose a range of data challenges. Common problems include transaction entries that reflect book cost equivalents rather than market values. Another common problem is synchronization issues between holdings and transactions.

- Return discrepancies may arise from currency exposures. Currency exposure itself does not cause return discrepancies, but treatment of currencies may. The key factors playing a role are the accounting policy chosen and the presence of currency hedging or dual currencies.

- Returns may require restatement if errors are identified after performance has been calculated and reports issued.

- Firms should develop and maintain policies to make sure the approach to restating returns is consistent and can be justified.

- Key considerations in restatements include stakeholders' roles and responsibilities and the ultimate purpose of the returns. Additional considerations include external obligations and materiality of errors.

PRACTICE PROBLEMS

1 A UK investment manager's new data warehouse uses the 12-character ISIN alphanumeric code to identify securities. In contrast, the firm's existing performance system (which receives feeds from the data warehouse) uses the seven-character SEDOL alphanumeric code for security identification. What dimension of data quality is of *most* concern in this situation?

   A Lineage

   B Conformity

   C Consistency

2 The data in an accounting or performance system is said to be in structured form in the sense that:

   A there are both a record and knowledge of where the data come from.

   B the data are complete given the purpose for which they were intended.

   C the data are extractable and organized in a manner suitable for the application's use.

3 In response to a verifier's question about data integrity measures, the firm's manager of performance reporting states that "her analysts review any instances where the NAV has moved more than 25 bps over a set period of time when being used for regulatory reports." The manager's response is an example of addressing which dimension of data quality?

   A Accuracy

   B Timeliness

   C Consistency

4 Which data governance principle requires ensuring that all data generated by an organization undergo a quality review to guarantee accuracy and completeness?

   A Hold & Discover

   B Consume & Create

   C Retention & Archive

5 The *second* stage of the investment data life cycle is referred to as:

   A Store & Secure.

   B Consume & Create.

   C Distribution & Use.

6 In a data governance framework, the deciding vote on any changes to any of the data definitions, rules, systems of record, or usage for a dataset is cast by the data:

   A owner.

   B governance lead.

   C governance officer.

7 In a data governance framework, ensuring that all governance-related principles are operating as expected and monitored for non-compliance is the responsibility of the data:

   A steward.

   B governance lead.

   C governance officer.

8 Which of the following data are *most likely* to be enriched prior to being extracted from the accounting system?

   A Returns that are calculated directly within an accounting system

   B Adjustments that are entered at book cost in the accounting system

   C Accounting system codes that are recognized by the performance system

9 Owing to their nature, which of the following asset classes is *most likely* to engender challenging data issues for operations teams that maintain their records on an accounting system?

   A Real estate

   B Private equity

   C Infrastructure equity

10 Which of the following transactions recorded in the accounting system is *most likely* to satisfy the downstream performance system's requirements?

   A An asset transfer between two portfolios at book cost

   B A market trade involving cash payment between the counterparties

   C The acquisition of a US company whose shares are priced in dollars by a Swiss company whose shares are priced in francs.

11 How many temporary securities must be created in the portfolio accounting system to reflect a rights issue that is taken up?

   A One

   B Two

   C Three

12 An investment manager's global equity composite has four constituent funds, each with a different base currency. The firm claims compliance with the GIPS standards. Which of the following statements regarding the global equity composite is *most* accurate?

   A The composite's benchmark-relative return is most meaningful when calculated in the constituent funds' base currencies.

   B The individual funds' benchmark-relative returns in their base currencies are the same, on a geometric basis, as those calculated in a common currency.

   C The individual funds' returns in their base currencies are comparable because each fund is managed according to similar investment strategies that are consistent with the composite definition.

13 Which of the following statements regarding a firm's exchange rate policy is *most* accurate?

   A The choice of exchange rates used for end-of-day asset valuation will not influence the return on a portfolio.

   B Applying start-of-day exchange rates to transactions will result in a policy calculation effect on each asset for which a transaction occurs.

   C Applying end-of-day exchange rates to transactions will result in a policy calculation effect at the total portfolio level.

14 A domestic mid-cap growth fund with an annual outperformance target of 2.0% over its benchmark has generated a three-year annualized return of 19.33% for the period ending 31 December 2019. In addition to the management fee, the fund also charges a performance-based fee that is shared with the portfolio manager. An error from January 2016 that caused the year's annual return to be understated by 17 bps was discovered in April 2020. Which of the following stakeholders is *most likely* to be interested in a restatement of the fund's performance?

A   An investment consultant

B   The firm's human resources department

C   A client whose account was opened on 31 March 2020

SOLUTIONS

1 B is correct. Conformity, as a data quality dimension, is described as ensuring that the data conform to internally defined standards and rules. For example, when transferring a file between two systems, a check is run to ensure that the character length of the attribute in the file being sent from the first system matches what is expected to be received by the second system. A is incorrect. Lineage, as a data quality dimension, can be defined as understanding where the data have come from (the origin), what happens to the data, and where the data move over time. It allows errors to be traced and helps ensure the data quality for all its intended purposes. C is incorrect. Consistency as a data quality dimension is described as the uniform application of data quality rules across one or more systems or applications for the same attribute or dataset. For example, if System A has a rule to "report any instance where the NAV has moved over 5 bps in a day," then other systems that hold NAV information also should apply this rule.

2 C is correct. In the context of investment performance measurement, it is helpful to consider data as being in one of two distinct forms. The first form is structured in the sense that data sitting within a system or application, such as an accounting system or portfolio performance system, are extractable and organized in a way that make them useful and suitable for the application's use. A is incorrect because the statement describes the "lineage" dimension of data quality, not the distinct form of data referred to as "structured." B is incorrect because the statement describes the "completeness" dimension of data quality, not the distinct form of data referred to as "structured."

3 A is correct. The accuracy dimension of data quality ensures that data are valid and correct. There is an appropriate level of accuracy of the data for its intended purpose. This outcome can be achieved through validation to an authoritative source of data or by comparing multiple sources of the same data. An example of an accuracy rule is, "Report any instances where the NAV has moved over 40 bps over a set period of time when being used for client reports." B is incorrect. The timeliness dimension of data quality ensures that the data are being reviewed in order to guarantee that they are not stale. The rules will test whether the attribute has been updated per the expected frequency. Actual frequency is compared with the expected frequency. Generally, timeliness refers to getting information at the right time and quickly enough to meet reporting and analytical requirements. C is incorrect. The consistency dimension of data quality ensures that data quality rules are applied consistently across one or more systems or applications for the same attribute or dataset.

4 B is correct. The Consume & Create data governance principle requires ensuring that all data consumed or created by an organization have a purpose and reason and undergo review for quality to guarantee that accuracy and completeness are maintained in all circumstances. A is incorrect. The Hold & Discover data governance principle requires ensuring that data will be held in a manner that allows for timely, efficient, and accurate discovery from any interested party, including regulatory bodies and clients that may legitimately request access to the data. C is incorrect. The Retention & Archive data governance principle requires ensuring that data will be held for the appropriate amount of time, considering all legal, regulatory, business, and historical requirements.

5 A is correct. Data go through several stages. These span from (1) Consume & Create, through (2) Store & Secure, (3) Distribution & Use, and (4) Hold & Discover, all the way to (5) Retention & Archive and possibly (6) Destruction.

B is incorrect. Consume & Create is the first stage of the investment data life cycle. C is incorrect. Distribution & Use is the third stage of the investment data life cycle.

6   A is correct. The data owner is accountable for making sure data stewards are in place for the data that he or she has been assigned. The data owner also acts as the deciding vote on any changes to any of the data definitions, rules, systems of record, or usage for his or her dataset. B is incorrect. The data governance lead provides day-to-day support for the data governance officer and is responsible for ensuring that all data governance–related principles and activities are operating as expected through the implementation (or "operationalization") of the data governance structure. He or she monitors for non-compliance, escalates any such occurrences to the data governance officer, and builds awareness within the organization. C is incorrect. The data governance officer is responsible for developing an environment that ensures transparency of all current data governance–related policies and objectives for the organization.

7   B is correct. The data governance lead provides day-to-day support for the data governance officer and is responsible for ensuring that all data governance–related principles and activities are operating as expected through the implementation (or "operationalization") of the data governance structure. He or she monitors for non-compliance, escalates any such occurrences to the data governance officer, and builds awareness within the organization. A is incorrect. The data steward is responsible for ensuring that data maintenance is upheld within a specific system of record. C is incorrect. The data governance officer is responsible for developing an environment that ensures transparency of all current data governance–related policies and objectives for the organization.

8   B is correct. Accounting data may need to be enriched in order to suit performance measurement calculations. An example of enrichment is the application of rules to create a market value amount for an adjustment that is entered into the accounting system at book cost. A is incorrect. There is a risk that the process of extracting data from the accounting system and loading these data into the performance system will create data errors, unless returns are calculated directly within an accounting system, mitigating the risk of incorrect performance numbers. C is incorrect. Enrichment can take the form of mapping, such as converting accounting system codes into categories recognized by the performance system. In this case, however, the accounting system codes do not require enrichment since they are already recognized by the performance system.

9   B is correct. There is an inverse correlation between the liquidity of an asset and the likelihood of data issues arising. Private equity is considered to be the least liquid investment class of the three choices. The issue can be thought of in terms of data availability, where at one end of the spectrum, an exchange-traded equity will have real-time data available through multiple sources. At the opposite end of the spectrum, a bilateral private transaction is unique and will not have data readily available through third-party vendors. Instead, firms will need to design their own valuation models. A is incorrect. Data challenges increase as the liquidity of asset classes decreases. Real estate as an investment class is considered more liquid than private equity and infrastructure equity. C is incorrect. As shown in Exhibit 12, although infrastructure equity as an asset class is less liquid than real estate, it is considered more liquid than private equity.

10 B is correct. For market trades involving a cash payment between counterparties, such as a purchase or sale of a bond, the accounting system transaction values will normally satisfy the performance system's needs. A is incorrect. The accounting treatment of an asset transfer between two portfolios at book cost

can create a false gain on the receiving portfolio with a corresponding loss on the sending portfolio when the transferred asset's value is greater than its book cost. C is incorrect. The accounting for corporate actions may reflect book cost. In most instances, performance measurement needs to capture a market-valued transaction entry to ensure consistency with the valuation of assets, which is normally done on a mark-to-market basis.

11 B is correct. From an accounting perspective, the rights issue features the creation of two new temporary securities that must be created in the portfolio accounting system. A is incorrect. The rights issue features the creation of two (not one) new temporary securities. C is incorrect. The rights issue features the creation of two (not three) new temporary securities.

12 B is correct. The individual funds' benchmark-relative returns on a geometric basis are the same, whether the funds' and benchmark's local currency returns are used or the funds' and benchmark's returns are first converted into the composite's common currency. As long as the same exchange rates are applied to each fund and benchmark return, the relative geometric returns will remain consistent. A is incorrect. Combining portfolios with different base currencies is allowable if the investment strategies are similar and consistent with the composite definition and the constituent funds' values and returns are first converted into the composite's common currency. If different currency track records are combined without first converting into a common currency, it will create meaningless results. C is incorrect. The individual funds' returns are comparable when presented in a common currency.

13 B is correct. Applying start-of-day or end-of-day exchange rates will result in a policy calculation effect for each asset for which a transaction occurs. A is incorrect. The choice of exchange rates used for end-of-day asset valuation will influence the return on a portfolio. If the exchange rates used are not aligned with those in the relevant benchmark, it will make the assessment of relative performance difficult. C is incorrect. Applying start-of-day or end-of-day exchange rates will result in a policy calculation effect for each asset for which a transaction occurs. Because the transaction creates a cash impact with opposite signage (i.e., buy asset = sell cash), there is an offsetting effect within the cash return. Consequently, at a total level, the portfolio return will not show any impact from the policy.

14 B is correct. Internal stakeholders that use returns to calculate payments include the firm's human resources department. Remuneration to the portfolio manager of the mid-cap growth fund includes a bonus if performance targets are met. Consequently, there may be a direct financial impact for the portfolio manager as a result of any restated performance. The human resources department will use a restatement to determine whether the portfolio manager received the correct amount of compensation. A is incorrect. An investment consultant would likely consider a 17 bp annual return understatement that occurred more than four years earlier as serving an informational role, given that the mid-cap growth fund generated a three-year annualized return of 19.33% for the period ending 31 December 2019. C is incorrect. When determining materiality, there is an element of subjectivity required if there are no pre-specified thresholds. Looking at the size of the return restatement in terms of proportions of risk budget or outperformance targets can provide a starting point. Using 10% of the outperformance target as a restatement materiality rule (i.e., 20 bps), the error from January 2016 would be considered immaterial. In addition, although the error may undermine confidence in the performance team, the error understated, rather than overstated, the fund's performance.

Glossary

Data governance The ownership and oversight of the firm's data over its life cycle.

Data life cycle The sequence of stages that data will go through within a firm.

Data owners Individuals who are accountable for the data and the data source.