

READING

4

Topics in Data Integrity

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LEARNING OUTCOMES

<i>Mastery</i>	<i>The candidate should be able to:</i>
<input type="checkbox"/>	a. explain common causes of performance discrepancies between the investment manager and the custodian;
<input type="checkbox"/>	b. explain common causes of performance discrepancies between NAV-based performance and end-of-day time-weighted performance;
<input type="checkbox"/>	c. describe best practices for maintaining composite data in order to ensure the composite provides a reliable representation of the investment strategy.

INTRODUCTION

1

Given their exposure to questions of performance and analytics, CIPM candidates understand that calculating returns involves approximation. “Upstream” data flows come in different varieties, and their nature affects how the performance of funds and fund managers are ultimately represented. True performance can be elusive for even the most diligent manager.

Professionalism calls for an understanding of the ambiguities of data, particularly within the financial data that drive performance measurement. The list of issues we cover here is not exhaustive; hundreds of decisions and approximations come into play. By building an awareness of these data dependencies and their impact, we may boost our analytical expertise. Sometimes the data pitfalls are evident, allowing us to be transparent with investors and other consumers of our investment performance metrics. Other times the challenges are not explicit, requiring us to approach performance results with increased caution.

We start by examining discrepancies between the performance calculated by the investment manager and the performance calculated by the custodian; often, the discrepancies are legitimate and inform how we communicate returns. We then turn to discrepancies between NAV-based performance and end-of-day time-weighted performance. Finally, we examine the data issues that arise in the management of and reporting on composites, and we describe best practices for maintaining composite data.

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PERFORMANCE DISCREPANCIES: INVESTMENT MANAGER VS. CUSTODIAN

Even for a given fund or portfolio, different stakeholders have their own hopes for the story that the numbers will tell. The official performance figures, however, are typically measured by a third party, frequently the investment custodian. Even if stakeholders' intentions are aligned, whenever two or more parties measure the performance of the same fund, discrepancies may arise.

Candidates should be familiar with those discrepancies and be able to elaborate on why differences in performance appear. Here we consider seven of the most common causes of discrepancies between the returns generated by investment managers and their custodians. Note that there are many other possible causes, including the choice of performance methodology and cash flow weighting, which are addressed elsewhere in the CIPM curriculum.

Exhibit 1 shows the performance numbers for a hypothetical portfolio generated by the investment manager and the custodian for the first two weeks of July. We will use this table of return discrepancies throughout our discussion as we examine possible data-driven explanations for those differences.

Exhibit 1 Performance for Portfolio ABC

Date	Investment Manager (%)	Custodian (%)	Difference (%)
1 Jul	2.40	2.46	-0.06
2 Jul	0.08	0.07	0.01
3 Jul	-0.25	-0.22	-0.03
4 Jul	-0.11	-0.12	0.01
5 Jul	-0.39	-0.37	-0.02
8 Jul	-0.90	-0.92	0.02
9 Jul	0.91	0.91	0.00
10 Jul	0.52	0.50	0.02
11 Jul	1.01	0.99	0.02
12 Jul	-2.10	-2.12	0.02

2.1 Pricing

We obtain market prices to measure the values of the individual components of a portfolio, and every security has multiple pricing sources. Even at a given point in time, different sources may offer different prices. The differences tend to be larger for less liquid securities, such as corporate bonds, structured products, and shares listed in some less developed markets.

As performance-measurement practitioners, our familiarity with the sources of our pricing information is important. We need to understand which sources are used to derive the market values of our portfolios. We also need to be sensitive to potential timing differences and to the impact of different securities' markets on those prices. A price, after all, is merely the amount that two or more parties agreed to buy or sell a particular security at a particular time. The investment manager has its own unique or non-standard pricing (choice of bid/ask/mid/end prices or broker price). In addition, pricing vendors provide prices for illiquid assets using model valuation rather than basing prices on actual trades.

In order to provide services to their various clients, investment custodians negotiate with pricing vendors for data and in turn use that data to calculate the value of their clients' holdings. These arrangements typically mean that custodians use only a few sources for pricing all of the securities in their book. Meanwhile, investment managers have their own pricing sources, which may differ from the custodian's chosen pricing vendors. Discrepancies between the performance results calculated by the investment manager and the custodian inevitably result.

Any third party the investment manager relies on for daily performance metrics will also source its own prices, of course. Let's compare the performance provided by a third-party performance provider to those of the investment manager's custodian in Exhibit 1.

If the headline portfolio performance numbers differ, a review of the pricing discrepancies in individual holdings may reveal the cause of the portfolio-level discrepancy. We know from Exhibit 1 that there is a difference of 6 basis points on 1 July between what the investment manager reported and what the custodian reported. Exhibit 2 shows us example pricing differences in three select holdings out of the more than one hundred holdings in Portfolio ABC. Differences in the reported prices of individual holdings may or may not introduce significant differences in the reported portfolio performance.

Exhibit 2 1 July Prices of Portfolio ABC Select Holdings (in \$)

Security	Performance Provider	Custodian	Difference
Microsoft	135.68	135.71	-0.03
Nestlé	102.14	101.99	0.15
Toyota	125.79	125.78	0.01

The practitioner could seek to reproduce the calculations of the two providers, but that would require both an understanding of their methodologies and the processing of additional data (e.g., number of holdings, previous day prices, transactions). Rather than attempting to reproduce the performance calculated by the two different providers, a practitioner would likely ask both parties to confirm that the prices agree with their pricing policy. If a pricing data policy exists, the performance provider may be asked to change pricing to match the policy (or possibly make an exception) and recalculate performance for that day. More frequently practitioners will need to 1) understand the reasons for the discrepancy (e.g., pricing differences between the vendors, different methodologies), 2) document the discrepancy, 3) implement controls to alert to those discrepancies, and 4) communicate those discrepancies, as needed, to all consumers of the performance reports.

In Exhibit 3, we see that the custodian calculates the portfolio's ending market value to be \$128,201,291, which is \$72,909 higher than the investment manager's calculation. Upon investigation, the performance measurement analyst found that the source of the ending market value (EMV) discrepancy was the difference of 3 cents in the reported price of Microsoft. While the pricing discrepancy was greater for the Nestlé holding at 15 cents, the investment manager's position in Nestlé was much smaller than its holding in Microsoft (position weights not shown); thus, the contribution of the Microsoft position to the overall discrepancy at the portfolio level was much greater.

Exhibit 3 Impact of Pricing Differences on Performance for 1 July

Portfolio ABC	Investment Manager	Custodian	Difference (manager – custodian)
Beginning market value	\$125,128,400	\$125,127,951	\$449
Ending market value	\$128,128,382	\$128,201,291	–\$72,909
Return	2.40%	2.46%	–0.06%

Note: We assume there are no inflows or outflows from the portfolio.

2.2 Missing trades

The measurement of performance is also impacted by trading. The omission of a trade in the calculation of a position can have a significant impact on reported performance, and missing trades occur frequently. For example, custodians typically insist on daily cutoff times by which they must receive all trade data from the manager in order to be included in that day's performance calculations. If certain trades come in too late, those trades will not be included in the performance calculations.

Consider the example where a fund manager hires a sub-adviser to manage part or all of the fund. The sub-adviser typically sends all of their trades to both the custodian and the investment manager. In this example, the sub-adviser prepares different trade feeds, one to match the custodian's required format and the other to meet the requirements of the fund managers. Two separate feeds—and processes to generate those feeds—introduce the possibility that trades (or other data) provided in one are missing from the other.

In both of these examples, missing trades affect the calculation of performance return. The impact may be non-material, but a discrepancy will be introduced nonetheless.

Referring to Exhibit 1, we know there's a return discrepancy of 1 basis point at the portfolio level on 4 July. Upon investigation, the performance analyst learns that a single trade was not reported to the custodian that day, as shown in Exhibit 4. The custodian missed a purchase of a security (one of many transactions that took place that day) in the amount of \$223,569, impacting both the amount of trades as well as the change in the cash balance. The asset in question increased in value after it was bought, so the value reflected in the custodian's book was lower at the EMV as the custodian was unaware the trade had taken place. As such, the EMV calculated by the custodian was lower than the EMV calculated by the investment manager by \$19,569. The impact to the portfolio return was 1 basis point lower: 0.12% for the custodian versus 0.11% for the investment manager.

In practice, the trade was likely processed by the custodian the following day and backdated so that performance could be recalculated and the discrepancy resolved.

Exhibit 4 Trade Not Reported

Portfolio ABC	Investment Manager	Custodian	Difference (manager – custodian)
Beginning market value	\$130,128,119	\$130,128,101	\$18
Trades	\$2,551,678	\$2,328,109	\$223,569
Cash	–\$2,551,678	–\$2,328,109	–\$223,569

Exhibit 4 (Continued)

Portfolio ABC	Investment Manager	Custodian	Difference (manager – custodian)
Ending market value	\$129,984,978	\$129,965,409	\$19,569
Return	-0.11%	-0.12%	0.01%

Notes: We assume there are no inflows or outflows from the portfolio. Numbers are rounded.

2.3 Missing and mistimed cash flows

Custodians record all movements of cash into and out of the fund. Tracking cash flow underpins the fund accounting services that custodians often provide and their role in holding the **Accounting Book of Record (ABOR)** for those funds. ABOR is an official accounting record, as explained later.

Because custodians typically manage the flows of cash with investors and other parties, it is not uncommon for an investment manager to miss a flow in or out of the fund; operational shortfalls, technological errors, and poor documentation may also come into play. Performance numbers are affected by missed cash flows in a manner proportional to the size of the missed flow.

Timing differences are frequently the source of discrepancies. The custodian and investment manager may record cash flows on different dates, for instance, whether intentionally or not. It may be the practice of a custodian to account for the cash flow on the settlement date—when the cash is actually moved—while the investment manager records the trade and a change in the cash account on the day the trade takes place (i.e., the trade date). Responsible practitioners are aware of these timing differences and are equipped to make the relevant adjustments.

2.4 Corporate actions

Most corporate actions—including stock splits, mergers, acquisitions, spinoffs, and the issuance of dividends and bonuses—impact the calculation of performance. Any failure to track them correctly, or neglecting timing differences between the custodian and investment manager, will result in performance discrepancies.

Because custodians work with so many financial institutions, they necessarily track corporate action information for most securities. Investment managers, on the other hand, may dedicate limited resources to the costly, data-intensive process of maintaining a complete awareness of corporate actions; the official book of record, after all, is usually maintained by the custodian. Any corporate actions missed by the investment manager could lead to a discrepancy, but even if all parties recognize the corporate action when it happens, it may be processed differently or incorrectly by either party.

Consider the scenario in Exhibit 5, where a dividend is not processed by the custodian. In this instance, the custodian has missed one or more dividend payments totaling \$29,882, resulting in an EMV that is lower than the investment manager's by that amount. The impact on the return is 2 basis points. Good practice calls for performance measurement staff to consider how material the impact is and to make any changes based on the investment manager firm's revision policies.

Exhibit 5 Dividend Not Processed

Portfolio ABC	Investment Manager	Custodian	Difference
Beginning market value	\$133,891,002	\$133,890,972	\$30
Trades	\$5,997,284	\$5,997,284	\$0
Cash	-\$5,465,383	-\$5,495,265	\$29,882
Dividends	\$531,901	\$502,019	\$29,882
Ending market value	\$131,081,225	\$131,051,343	\$29,882
Return	-2.10%	-2.12%	0.02%

Note: We assume there are no inflows or outflows from the portfolio.

2.5 Exchange rate data

When practitioners calculate market values or express performance metrics in different currencies, the exchange-rate differences create discrepancies. Because exchange rates change constantly, many analysts choose to use standard published rates, such as the WM/Reuters, for performance measurement and portfolio evaluation. But these standard rates, fixed at a specific time of day for a specific vendor, may introduce differences from the rates quoted by different exchanges or at different times of day.

2.6 Missing or incorrect terms and conditions

The presence of derivative securities and currency forwards in a portfolio introduces further scope for discrepancies. The terms and conditions associated with over-the-counter (OTC) derivatives are necessary for correctly valuing them and measuring exposures, but such information is often costly to obtain and not provided automatically to custodians, which limits their ability to measure the impact on performance. They must weigh the extra cost of the additional data against the extra precision they may obtain. In some circumstances, the extra precision may be required by the regulators. Currency forwards also introduce scope for discrepancies, as they are not priced by outside vendors. Instead, they are priced by internal systems that investment managers and custodians use.

2.7 Expenses and fees

Performance can be calculated net of taxes and management fees. Fees differ with each client. Here, too, we face the possibility of generating discrepancies; custodians and investment managers may specify or apply fees in divergent ways.

2.8 Summary

This section reviewed some of the possible discrepancies that may arise between the investment manager and their custodian in the calculation of performance. Practitioners, particularly fund managers, need to be aware of these discrepancies. Firms should implement controls and operational practices that alert data managers to discrepancies so that the most material differences can be addressed before asset owners review the performance figures. Written plans that address discrepancies within sensible tolerance values are an important part of best practice.

Most important, practitioners must always remember that returns are the product of multiple sets of data, any of which may give rise to discrepancies. As a result, they must be able to articulate the accuracy of the returns based on the known and potentially unknown issues.

EXAMPLE 1 PERFORMANCE DISCREPANCIES

Carnara Investment Management has recently hired Panos as a junior performance analyst. Panos is reviewing the past month of daily performance reports for a portfolio, with performance metrics calculated both by the custodian and Carnara. The portfolio has a buy-and-hold mandate and tends to hold some dividend paying, illiquid securities. Panos has a few questions for his manager, Roberta, who has managed the performance team at Carnara for the past eight years.

Panos notices that most of the daily returns calculated internally and by the custodian are within 1 basis point of each other, except for yesterday's performance. Yesterday, Carnara calculated a return of 1.29% for the fund in question, while the custodian calculated 1.47%. Panos asks Roberta about the potential causes of the discrepancy.

Question 1

Based on the holdings of the portfolio, to help Panos identify the source of the discrepancy, Roberta should suggest that the *least likely* sources of discrepancy are:

- A corporate actions.
- B pricing differences.
- C missing trades.

Question 2

Roberta also tells Panos she just heard from the portfolio manager for a different mandate that information about one of the day's trades (a sale) was not sent to the custodian in time to be included in yesterday's performance report. What should Panos's response be?

- A Conclude the search because the missing trade should explain the difference.
- B Find out the amount of the missing trade and calculate the likely impact of the missing trade on performance to see if that trade explains the difference.
- C Base the materiality of the missing trade on the security's transaction price from the end-of-day closing price.

Question 3

Along with yesterday's performance report, a summary of corporate actions from the same day comes across Panos's desk. The summary lists stock splits and dividends for 20 different securities across the entire universe of portfolios that the firm manages. Panos asks Roberta if any of those corporate actions could impact performance, and he seeks her advice about what to do next. What is most likely to be the best advice Roberta should offer Panos regarding the corporate actions summary report?

- A Disregard the summary report because it only includes stock splits and dividends and does not impact performance.

- B** Obtain a list of security holdings for the portfolio in question, and reference them against the list of 20 securities on the summary report.
- C** Go through each security on the summary report to determine its impact on performance.

Solution to 1

C is correct. Since the mandate is a buy and hold, it is unlikely that there would be any trading that wasn't directed by the client.

A is incorrect because corporate actions may be a source of discrepancy. These securities may pay dividends, which is a corporate action.

B is incorrect because pricing differences between the manager and the custodian may arise, particularly as there are illiquid securities in the portfolio.

Solution to 2

B is correct. Given the information from Roberta, Panos should investigate whether or not the missing trade explains the difference in the performance report. If it does not, or if it does not explain it completely, Panos should continue to investigate other possible causes.

A is incorrect because the missing trade may or may not explain the difference.

C is incorrect because materiality cannot be solely based on the security's price movement. The portfolio weight of the security is also needed to judge what the impact would be.

Solution to 3

B is correct. Panos should determine if any of the securities covered by the corporate actions summary are actually held in the portfolio. If not, there is no further action to take because yesterday's corporate actions would then be irrelevant to portfolio performance. If there were corporate actions involving holdings in the portfolio, Panos should determine their impact, if any.

A is incorrect because stock splits and dividends *can* impact performance.

C is incorrect because there is no need for Panos to research corporate actions relating to securities that may not be held in the portfolio.

3

PERFORMANCE DISCREPANCIES: NAV-BASED VS. END-OF-DAY TIME-WEIGHTED PERFORMANCE

The net asset value (NAV) of a fund represents the net value, or total assets minus total liabilities, at a given point in time. Fund NAVs are usually calculated by the custodian or administrator once per day and are then used to calculate daily performance. The NAV performance is often the performance measure that is entered into a fund's book of record. NAV-based returns frequently differ from another standard measure, end-of-day time-weighted performance, as we will show. First, we need to explain the two different sets of accounting data.

3.1 ABOR vs. IBOR

Most investment managers are provided with an official set of accounting records, typically calculated by a custodian or administrator, which cover the day's activity. This **Accounting Book of Record (ABOR)** collects all the pertinent daily investment data at a single point in time, the "cutoff" time, including pricing and exchange rates. The data contained in the ABOR are used to value portfolios and to generate NAVs

and NAV-based performance metrics. The calculation of risk, portfolio exposures, performance relative to benchmark, and price at which units of mutualized products are created or redeemed may also depend on the ABOR figures. ABOR figures are used for public consumption and are fed into peer group databases for comparative purposes.

Many investment managers, however, create a separate set of data for trading and portfolio-management purposes called the **Investment Book of Record (IBOR)**. The figures recorded there are typically timelier (from the perspective of the fund manager's working hours) than those found in the ABOR. If the ABOR's figures are calculated at the end of the previous day, for instance, the IBOR's figures may be updated overnight to include the latest trades, corporate actions, pricing updates, and exchange rates for a more accurate picture of the portfolio at the start of the next trading day. Alternatively, if the ABOR cutoff time is at midday, the fund managers may wish to see the end-of-day returns given by IBOR cutoff in the evening. IBOR may be calculated once or multiple times throughout the day to reflect ongoing activity and market movements. Thus, performance returns generated with ABOR data frequently differ from those generated with IBOR data. Practitioners need to be aware of these differences

3.2 NAV calculation

Consider Exhibit 6. The basic calculation of NAV involves summing the assets (securities + receivables + cash and cash equivalents + accrued income) and subtracting the sum of the liabilities (short-term + long-term + accrued expenses). The net value is then divided by the number of outstanding shares to calculate the NAV per share. Any balance-sheet item could be the source of differences between the time-weighted performance and the NAV performance figures.

Exhibit 6 Sample NAV

Portfolio ABC	29 July	30 July
Securities	\$130,000,000	\$124,000,000
Receivables	\$4,200,000	\$5,800,000
Cash and cash equivalents	\$6,000,000	\$7,200,000
Accrued income	\$175,000	\$176,000
Short-term liabilities	\$11,500,000	\$11,900,000
Long-term liabilities	\$2,830,000	\$2,900,000
Accrued expenses	\$15,000	\$18,000
NAV total	\$126,030,000	\$122,358,000
Shares outstanding	7,500,000	7,350,000
NAV per share/unit	\$16.80	\$16.65
NAV return		-0.89%

3.3 Timing differences

Among the most common sources for discrepancies in the reporting of ABOR-based NAV vs. the IBOR-based returns is timing. NAVs are calculated at the cutoff time—once a day—usually mandated by the regulations that apply to the fund in question (for example, at midday or 1 pm). Alternatively, in some regions the mandated cutoff time

may be after markets close in the late afternoon (for example, 5pm). The difference between the cutoff times for the NAV calculation differ from the IBOR time-weighted calculation because:

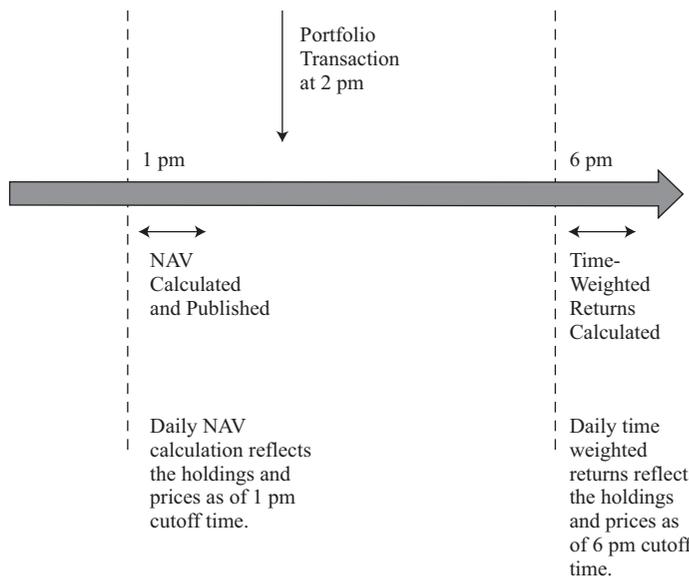
- the company manages a fund that is administered or domiciled on a different region or time zone,
- the company manages a fund that is partly or fully invested in a different region or time zone, or
- it is convenient to produce IBOR time-weighted returns whose cutoff differs from the NAV cutoff time.

In fact, a whole range of circumstances may arise. Here is one such example: a US-based fund management company manages a UK-domiciled mutual fund, with MSCI World Index exposure and administered out of Luxembourg, that uses a closing time of 5pm or 6pm GMT, which is prior to the US market closing and well before the time-weighted returns are calculated by the fund manager.

If the cutoff time for NAV calculation purposes is not the same as the cutoff for time-weighted performance calculation, differences in performance arise for a number of reasons, including the following:

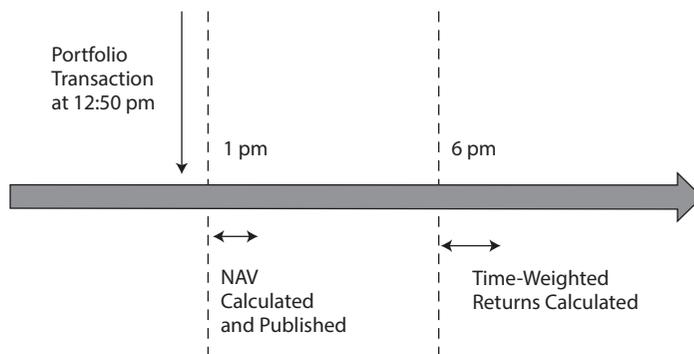
- Prices of portfolio holdings will change between the two points in time. For example, most prices used for a 1pm NAV calculation will be different compared to those used for a 6pm cutoff time-weighted calculation.
- Exchange rates will change between the two points in time. If exchange rates are required to calculate returns, the rates used will vary at different times of the day.
- Portfolio holdings may change. For example, if Fund ABC's mandated cutoff time is 1pm, the NAV calculations, as shown in Exhibit 7, include all portfolio trades received before that time. If time-weighted performance is computed at 6pm, it will also include trade data relating to transactions that occurred between 1pm and 6pm. That trade data was not available at the 1pm NAV cutoff time. So if the fund manager traded a particular security holding at around 2pm, the trade details could not be included in the NAV calculation for that day. The time-weighted return, calculated later in the day, *would* include the trade.

Exhibit 7 Transactions between Two Cutoffs



In addition to different prices and holdings used for return calculations at different times of the day, differences due to timing may also arise when transactions close to the cutoff times (e.g., 1pm in Exhibit 7) are not communicated to the custodian quickly enough to be captured in the NAV calculation. For example, the fund manager traded at 12:50pm, and NAV (reflecting prices and holdings at 1pm) is calculated soon after the time of the transaction; thus, the information about the trade may not reach the custodian in time to be reflected in the NAV calculation, as Exhibit 8 shows. This may happen for a variety of reasons, such as a time period of heavy trading activity.

Exhibit 8 Trade Reported Late



3.4 Fees, charges, and other data points

Many data points are used to calculate NAVs as well as time-weighted returns. Although we do not go into detail here, several items that may cause discrepancies are worth noting. NAV calculations include pending receipts from debtors; management fees and, if applicable, performance fees that the investment manager charges; legal costs; operating costs and distribution charges; and foreign liabilities, such as sale proceeds pending repatriation. The timing of fees may vary between the one applied by the

custodians or administrators who calculate the NAV and the fund manager calculating the time-weighted end-of-day returns. For example, the manager may not accrue management fees on a daily basis. Practitioners measuring performance will need to understand their client's particular situation and which fees and charges should be included or excluded from a particular return calculation.

EXAMPLE 2 PERFORMANCE DISCREPANCIES

Packwood Asset Management recently hired a middle-office outsourcing firm to provide IBOR time-weighted returns, calculated twice a day, to be used alongside Packwood's official NAV (based on ABOR), itself created by Packwood's custodian. All official returns for Packwood's funds are calculated from the ABOR NAVs, which are calculated at the close of business in the evening at 6pm. The middle-office outsourcing firm calculates time-weighted performance using the IBOR data at times that do not match the NAV cutoff times, one later in the day at 8pm (shown in Exhibit 9) and then another in the morning at 8am.

Pradeep, a performance analyst at Packwood, uses the following table (Exhibit 9) containing NAV-based and IBOR-based returns to explain the performance of portfolio ABC, which is invested in securities around the world, to Hannah, the portfolio manager.

Exhibit 9 Daily Returns for Portfolio ABC

Date	IBOR End-of-Day		Difference
	NAV (ABOR) Return	Return	
1 Aug 2019	1.08	1.02	0.06
2 Aug 2019	0.97	0.98	-0.01
5 Aug 2019	-1.01	-1.21	0.20
6 Aug 2019	-0.55	-0.60	0.05
7 Aug 2019	0.39	0.25	0.14
8 Aug 2019	-1.21	-1.01	-0.20
9 Aug 2019	0.72	0.78	-0.06
12 Aug 2019	0.29	0.37	-0.08

Pradeep makes the following statement:

“Possible explanations for the observed performance discrepancies are the differences in cutoff times leading to different prices and exchange rates being used, the possibility that trades were executed after the NAV cutoff times, as well as different treatment of fees and charges.”

Question 1

Is the statement correct?

- A Yes.
- B No, because trades that take place after the NAV is calculated do not make a difference to performance for that day.
- C No. Treatment of fees and charges is agreed in advance between the two parties.

Question 2

Although the NAV performance is the official performance measure for Portfolio ABC, why might Hannah prefer to use the IBOR-based returns?

- A** The IBOR-based returns are based on more up-to-date information from the fund manager's perspective.
- B** Packwood uses end-of-day, IBOR-based, time-weighted returns as the official-book-of-record returns.
- C** The IBOR-based returns can be more readily compared to other funds in its universe via a peer group database.

Solution to 1

A is correct. All of the reasons mentioned in the statement could explain the discrepancies in the table. B is incorrect because trades that take place after the NAV cutoff time will still impact that day's IBOR end-of-day return. C is incorrect because the parties are likely to apply fees and charges in different ways reflecting different circumstances.

Solution to 2

A is correct. IBOR returns will include trades that are recorded after the NAV cutoff time, whereas the NAV performance is limited to a strict cutoff time. B is incorrect because Packwood uses NAV-based returns for the official book of record, not the IBOR-based returns. C is incorrect because ABOR-based returns are available to the public and are provided to peer group databases for comparison.

MAINTENANCE OF COMPOSITE DATA

4

A **composite** is an aggregation of one or more portfolios that a firm manages according to a similar investment mandate, objective, or strategy. Its design and maintenance requirements raise data-integrity challenges and issues of best practice.

4.1 Data issues affecting composites

Managing composites calls for a large volume of data that the **composite system** (the set of processes, tools, and equipment that underpins it) must be able to handle. Performance data must be available in the correct format for potentially hundreds of portfolios over many time periods. In addition, the disclosures required for reporting purposes include items that may not be automatically covered by the composite management system. For example, information about **discretion**, the ability of a firm to implement its intended strategy, needs to be provided and documented. Clients may impose a number of restrictions on what the fund managers can do, which would make the fund non-discretionary. But it is a requirement that every portfolio that is discretionary be included in a composite.

In addition to these challenges, firms often use composites that are made up of different fund types. For example, they may include separately managed, segregated client portfolios (sometimes referred to as "segregated accounts"). The same composites may also include mutualized or pooled portfolios. Separate client accounts are often subject to performance-impacting items booked to the account. Yet those items are not the investment manager's responsibility. They might include fees paid to entities, such as custodians, or may include lending income. In addition, management fees may

be treated differently in different fund types. Adjustments for all such items on each of those client portfolios are required before the portfolio returns can be included in the composite return calculation.

Data challenges with composites may be viewed with reference to certain dimensions of data integrity—namely, accuracy, completeness, conformity, and timeliness. Exhibit 10 explores these dimensions.

Exhibit 10 Data Integrity and Composites

Data Integrity Dimensions	Issues with Composites
Accuracy: Are the data valid and correct?	<p>The system for managing composites must be able to generate all data that are required to calculate composite returns and provide disclosures.</p> <p>Examples:</p> <ul style="list-style-type: none"> ■ The system must avoid double counting total firm assets in case fund-of-funds products are invested in the firm’s own portfolios. ■ The system must accurately maintain information on discretionary and non-discretionary status of portfolios. ■ Changes made by the client to the strategy or mandate of a particular portfolio may require a change to the composite as the portfolio is moved from one composite to another. Accounting for the timing of the switch incorrectly could distort the returns reported for the two composites.
Completeness: Are the data sufficiently complete for the intended purpose?	<p>Completeness requirements apply to both performance data and additional disclosures.</p> <p>Examples:</p> <ul style="list-style-type: none"> ■ The performance data of all the portfolios that make up the composite should be available in the system. The standard deviation of composite returns over three years is commonly required. Missing returns on any one of the portfolios in a composite may make the disclosure of an accurate standard deviation calculation impossible. ■ Details on discretion and disclosures compose a form of information that is required but difficult to standardize. ■ A full and fair set of information must be available to explain why a portfolio is not assigned to a composite.
Conformity: Do the data conform to standards and rules?	<ul style="list-style-type: none"> ■ The composition of composites should be covered by an appropriate allocation rule or by definitions formulated by the GIPS committee (explained later). In some cases, the setup of composites or the existing composite management system will not fulfill all GIPS requirements. A manual solution may be required.
Timeliness: Are the data available in time for use, and are they updated regularly?	<ul style="list-style-type: none"> ■ Portfolios should be assigned to a composite in a timely manner. ■ Additional disclosures (such as those on discretion status) should be available in a timely manner.

4.2 Best practices in composite construction and maintenance

The composite construction process impacts several departments in an asset management firm, but it particularly affects the operational staff responsible for integrity and maintenance of the data that supports the composites. The needs of various stakeholders will directly inform GIPS composite construction policies, the required frequency of review, and the types and quality of data required to manage the composite membership and reporting. The GIPS standards provide a framework and rules for constructing composites. Assisted by the standards, practitioners can navigate potential conflicts of interest. The degree of flexibility and judgment allowed by the GIPS standards encourages composites designed in line with the investment strategies of the firm and the way that the firm presents itself to prospective clients. We outline the best practices next.

4.2.1 *GIPS committee*

Instead of seeking sign-off on composite construction from all stakeholders, best practice is to establish a GIPS committee that consists of different stakeholders. The committee should be responsible for setting out and maintaining firm policies and procedures regarding composites. Best practice includes defining a composite structure that reflects the investment strategy and the requirements of the stakeholders. Decisions around new portfolios, such as allocating them to existing composites or to setting up new ones, should be the responsibility of the GIPS committee. The committee should meet regularly to discuss composite maintenance.

The following departments would expect representation on the GIPS committee:

- portfolio accounting & administration
- performance measurement
- product management
- information technology
- risk management
- legal & compliance

The GIPS committee may include representatives from the sales & marketing team or the investment decision makers themselves, the portfolio managers. Neither the composite system nor its policies, however, should be driven by marketing needs, market conditions, or the wish to display investment performance in the best light for marketing purposes. Instead, the system is to be designed so that the composites accurately reflect the performance of the firm's investment strategies.

4.2.2 *Recommended best practices*

In general, practitioners will favor minimizing the amount of data required to maintain composites (all other factors being equal) and limiting how often portfolios are moved into and out of composites (unless documented changes to a portfolio's investment mandate, objective, or strategy, or the redefinition of the composite, makes switching appropriate). Best practice, in addition to having a GIPS committee in place, calls on the practitioner to:

Understand the needs of the entire organization and obtain their support. By creating composites, firms have an opportunity to create policies and procedures that clearly define how the firm generates the data that goes into the construction of composites. For example, a firm might include a policy to establish the minimum asset levels for portfolios to be included or excluded from the composites. The firm should then implement data controls to monitor those asset levels and create alerts when portfolio asset levels in composites are approaching the minimum levels. Ultimately, properly implemented controls improve the quality and timeliness of data for all stakeholders.

Avoid composite definitions that are too broad or too narrow. Composite maintenance can be onerous if definitions are not thoughtfully designed. A very narrow definition of composites (i.e., one that is necessarily very detailed because the investment process for the composite is complicated or highly customized) leads to the formation of many more composites and a lot of extra maintenance work, including moving portfolios in and out and managing all the associated data requirements. According to best practice, composites reflect actual measurable mandates that are reflective of the investment process. A definition of composites that is too broad, on the other hand, may lead to large magnitudes of return dispersion within the composite. A balance needs to be found whereby composites reflect true distinctions in the investment process without being so narrowly focused as to create additional data maintenance responsibilities and increased operational risk. Exhibit 11 illustrates such considerations in a fictitious firm.

EXHIBIT 11 ABC INVESTMENT MANAGEMENT

ABC Investment Management (ABC AM) is a global equity manager with a focus on security selection. ABC's product suite includes region-specific portfolios covering North America, EMEA, APAC, and other emerging and frontier markets. It offers products with different market capitalizations (small-cap, mid-cap, and large-cap) in each region. ABC AM has completed its initial GIPS composite definitions ahead of marketing its investment strategy to institutional clients. One composite has been labeled the Emerging Markets Composite and was defined to reflect any portfolio that holds more than 95% of its assets in emerging-market countries. Applying this definition, ABC AM calculates the following results:

Manager ABC's Emerging Markets Equities Composite

Year	Total Return (Gross of Fees)	Total Return (Net of Fees)	Composite Benchmark Return (%)	Number of Portfolios	Dispersion (%)	Total Composite Assets
2014	3.22	1.95	-2.55	347	0.89	\$709,128,901
2015	2.10	-0.05	-2.22	422	0.92	\$743,002,945
2016	-16.01	-17.99	-15.01	409	0.94	\$751,902,811
2017	14.29	12.16	11.31	413	0.86	\$702,902,694
2018	39.58	37.22	38.29	461	0.83	\$797,182,981
2019	-10.11	-12.37	-14.51	444	0.90	\$761,902,638

The initial composite definition results in a rather large dispersion (as shown in the "Dispersion" column and measured by the equal-weighted standard deviation of returns), indicating a large amount of variance across the portfolio returns within the composite.

In this instance, the manager finds that this broad composite definition, which focuses exclusively on what region the assets are in (emerging markets, in this case), ignores the different market-cap focus of the various portfolios, limiting the composite's usefulness. Within this composite some portfolios are weighted much more heavily to small-cap stocks, others to larger-cap stocks.

Instead, the manager tries a narrower definition, redefining the composite to differentiate for market cap. This change creates a Large-Cap Emerging Market Equities Composite. The definition stipulates that 95% of the assets are in emerging-market countries *and* 70% of its securities have a market cap greater than USD5 billion. The results for this new composite definition are

shown in Exhibit 12, where we see a much lower dispersion of returns within the composite. We can expect the other composites that include the remaining portfolios, the Small-Cap Emerging Market Equities Composite and the Mid-Cap Emerging Market Equities Composite (not shown here), to also show lower amounts of dispersion.

Exhibit 12 Manager ABC's Large-Cap Emerging Market Equities Composite

Year	Total Return (Gross of Fees)	Total Return (Net of Fees)	Composite Benchmark Return (%)	Number of Portfolios	Dispersion (%)	Total Composite Assets
2014	2.81	1.89	-2.05	243	0.43	\$567,303,121
2015	-1.85	-0.16	-1.82	309	0.72	\$594,402,356
2016	-15.59	-17.12	-14.95	302	0.52	\$601,522,249
2017	14.04	12.47	12.91	341	0.68	\$562,322,155
2018	38.99	36.82	38.93	352	0.63	\$637,746,385
2019	-11.08	-13.05	-14.45	376	0.59	\$609,522,110

The manager thus decides to include market cap as part of the new, narrower composite definition. Although more data are required to calculate and present the results, the narrower composite definition better fits with the manager's investment process and results in lower dispersion.

Define discretion with measurable criteria. Every discretionary portfolio must be included in a composite. Note that discretion is the ability of a firm to implement its intended strategy. Client-imposed restrictions, such as a ban on purchases of certain stocks or the requirement for pre-approval on trades, may interfere with the implementation of the intended strategy. In those cases, the portfolios are not representative of the strategy and are therefore considered non-discretionary. A sensible practice, and a requirement of the GIPS standards, is for the firm's GIPS policies and procedures to include its definition of discretion. Firms need to complete discretionary reviews on a regular basis for *all* fee-paying portfolios, not only for those already included in composites. It is difficult to automate information about the discretionary/non-discretionary nature of individual portfolios. Nevertheless, such information must be available, monitored, and refreshed—requiring manual processes.

No new portfolio can be classified without review, as stated in the GIPS standards, Guidance Statement on Composite Definition: "Few of these [client-imposed] restrictions are reason to automatically classify a portfolio as non-discretionary, as the firm must determine if the restriction will significantly hinder the implementation of the intended strategy." As such, enough time should be allowed both to thoroughly review and reconcile internal records to those from custodians, administrators, or other parties—to confirm the discretionary status and thus allocate the portfolio to the appropriate composite.

Consider the future evolution of the investment process. In general, the GIPS standards recommend that changes to the investment strategy of a particular portfolio will require either creating a new composite or switching the portfolio to an existing but different composite. Where possible, practitioners should anticipate the evolution of their investment process, creating enough space in the composite definitions to allow for some change. Practitioners should also include large grace periods in their policies and procedures, specifying a workable amount of time allowed before a new

portfolio must be added to a composite. Lastly, policies and processes put in place should anticipate issues that may arise in the future, and if such need arises, should allow for modifications to individual composite definitions.

EXAMPLE 3 COMPOSITE PORTFOLIOS

Helen, a performance analyst at Clayton Investment Management, is working with her manager, Norah, to define the composites for Clayton. Clayton manages only fixed-income portfolios, specializing in government bonds. They have 1,430 portfolios under management—900 invested in either developed or emerging markets and 530 blended with bonds from developed and emerging countries that are tailored for individual clients.

Question 1

Helen is concerned about the maintenance requirements of using too many composites. She proposes that Clayton use only two composites, one for emerging-market debt and one for developed-market bonds. Norah then tells Helen, “I will define the criteria so that all discretionary portfolios will be in one of the two composites. I may have to include portfolios with an investment process that differs from the overall composite, but I will ensure the dispersion of the performance returns is within tolerance set forth by the GIPS committee.”

Norah’s approach is most likely incorrect because of:

- A both of her comments regarding the investment process and dispersion.
- B her comment regarding differences of investment process only.
- C her comment regarding dispersion only.

Question 2

Upon review of the performance of the two composites, Helen finds that the dispersion (calculated as the equal-weighted standard deviation of returns) of the developed-market composite is 0.82% and the dispersion of the emerging markets composite is 0.94%. If she removes the 530 blended individual client portfolios from the two composites, leaving only the 900 developed or emerging ones, the dispersion drops to a more acceptable 0.43% and 0.47%, respectively. What should Helen propose to do next?

- A Maintain the separate developed and emerging composites and create a third composite for the blended portfolios.
- B Examine the investment process for the blended portfolios to determine if there are strategies that would warrant creation of several composites into which the blended portfolios could be allocated.
- C Create separate composites for each blended portfolio.

Helen and Norah then discuss the various investment strategies with the key stakeholders and organize the portfolios by strategy. They determine that the best approach for Clayton is to create one Developed Markets Debt Composite, one Emerging Markets Debt Composite, and three composites for the different blended strategies that they have identified. The Emerging Markets Debt Composite will require at least 90% portfolio allocation to emerging-market debt, while the Developed Markets Debt Composite will require at least 90% of the portfolio to be invested in developed markets debt. They have established policies on tolerances around the thresholds.

Question 3

What should Norah and Helen do to ensure that their approach continues to be appropriate?

- A** Having established the allocation of portfolios into the composites based on the investment strategies, they should focus on the regular measurement of dispersion.
- B** They should introduce in their procedures a tolerance check that specifies that if the number of portfolios in either composite exceeds 1,000, a new composite should be created.
- C** They should monitor the weighting of emerging-market debt held in the Emerging Markets Debt Composite portfolios and do the same with the Developed Markets Debt Composite, taking action and switching portfolios to a new or a different composite whenever the portfolios' emerging or developed holdings weights move below or above the 90% threshold.

Question 4

Several months later, Norah learns that two of the firm's clients with separate accounts that are currently part of the Developed Markets Debt Composite have imposed restrictions on fund holdings. The restrictions are determined to be of a material nature. As a result, the portfolios no longer meet the firm's definition of discretion. What course of action should Norah take ?

- A** Broaden the definition of the composite.
- B** Remove the portfolio from the composite as it has become non-discretionary.
- C** Create a new composite for the portfolio.

Solution to 1

B is correct. Norah should ensure that the investment approach for all included portfolios is closely aligned within the composite. The types of portfolios the firm manages are too distinct to fit into just two composites. The composite definitions don't provide for the blended portfolios.

A & C are incorrect because Norah's approach is wrong for reasons other than dispersion.

Solution to 2

B is correct. Before creating another composite, Helen should work with the portfolio managers to understand the investment process in more detail.

A is incorrect because the investment process used for the client portfolios may or may not be similar. C is incorrect because creating a separate composite for each blended portfolio would result in the creation of hundreds of composites, each with a very narrow definition.

Solution to 3

C is correct. They should institute a check that signals if the 90% threshold is crossed in either direction while also implementing a clear policy (control) that outlines how changes are made based on that check.

A is incorrect because they should continue to compare the composite definition to the investment process. B is incorrect because there is no limit to the number of portfolios in a composite.

Solution to 4

B is correct. Non-discretionary portfolios should be removed from the composite.

A is incorrect because definitions of composites should not be changed to accommodate portfolios that faces restrictions. C is incorrect because the portfolio has become non-discretionary and therefore can no longer be included in any composite.

SUMMARY

Discrepancies between the returns that the manager and custodian calculate are common and typically occur for legitimate reasons. The sources of these discrepancies should be researched, documented, and explained to performance-measurement stakeholders. The implementation of systems and controls that alert practitioners to both the sources and instances of performance discrepancies will improve the accuracy and reliability of performance returns.

- *Pricing*: Multiple pricing sources exist for every security, and prices may differ even for a given time of day. The differences tend to be larger for less liquid securities, such as corporate bonds, structured products, and foreign shares.
- *Missing trades*: This is a frequent occurrence that can have a significant impact on performance.
- *Missing and mistimed cash flows*: Discrepancies arise from missing fund inflows or outflows due to improper or overlooked operational procedures, technological flaws, or poor documentation. Discrepancies may also arise if the custodian and investment manager treat the timing of cash flows differently, with the former using the settlement date and the latter using the trade date.
- *Corporate actions*: The inconsistent treatment of or incomplete information on corporate actions may cause discrepancies between the returns reported by the custodian and investment manager.
- Other causes of discrepancies include differing exchange rates, insufficient information in the terms and conditions associated with derivatives and forwards, and the handling of fund expenses and fees in different ways.
- The most common discrepancies between NAV-based and time-weighted returns are timing differences and different approaches to fees and charges.
- NAV and time-weighted returns may be calculated at different points of the day. Because of differing cutoff points, a given trade could be accounted for by time-weighted return calculations but excluded from the NAV calculations.
- Fees and charges are paid to and received from different entities and may be treated differently by those who prepare NAV and end-of-day time-weighted performance, respectively, resulting in discrepancies.
- Furthermore, practitioners should be aware of the differences between performance based on ABOR (Accounting Book of Record) and IBOR (Investment Book of Record) and should understand the data requirements of each.
- ABOR is the official set of accounting records, typically calculated by a custodian or administrator. It is based on daily investment data at a single point in time, the “cutoff” time, including pricing and exchange rates. ABOR is used to value portfolios and generate NAVs and NAV-based performance metrics. ABOR figures are used for public consumption and are fed into peer group databases for comparative purposes.

- IBOR is a separate set of portfolio data for trading and portfolio-management purposes. The figures recorded there are typically timelier from the perspective of the fund manager's working hours than those found in the ABOR. IBOR may be calculated once or multiple times throughout the day to reflect ongoing activity and market movements.
- The use of composites poses a range of data-integrity challenges. Performance data must be available in the correct format for potentially hundreds of portfolios over many time periods. Various disclosures, including information about discretion, are required for reporting purposes. Pertinent dimensions of data integrity, which inform our handling of composites, include the following: accuracy, completeness, conformity, and timeliness.
- Composite construction is complex and must account for various stakeholders, many of whom will be represented on the GIPS committee, and include the following: portfolio accounting & administration, performance measurement, product management, IT, risk management, and legal & compliance. The GIPS committee is responsible for defining firm's policies and procedures relating to composites.
- Practitioners should avoid defining GIPS composites too narrowly or too broadly. Discretion should be carefully defined using measurable criteria. Decisions around the classifications of portfolios as discretionary or non-discretionary should be documented. GIPS composites and policies and procedures should anticipate future changes in the investment process.

PRACTICE PROBLEMS

- 1 The *best* explanation for why equities in developed markets tend to have smaller pricing differences among market-data vendors than stocks in less developed markets is:
 - A because shares in less developed markets are often less liquid than those in developed markets.
 - B because of the impact different securities markets have on prices.
 - C because stocks in developed markets have multiple pricing sources while stocks in less developed markets do not.
- 2 When there are pricing differences between the custodian and the investment manager's pricing vendor for individual holdings of a portfolio, the practitioner's *most likely* first step is to:
 - A seek to reproduce the calculations of the two providers.
 - B ask both parties to confirm that the prices agree with their pricing policy.
 - C focus on the largest pricing discrepancy since it will have the greatest contribution to the overall discrepancy at the portfolio level.
- 3 A performance analyst notices that a trade made by a sub-adviser two days prior appears to have been missed by the custodian. The differences between the investment manager and the custodian's trade and cash balances exactly offset each other on the day the trade in question occurred. No capital additions to or withdrawals from the portfolio occurred on that day. The *most likely* cause of this discrepancy is that the trade data:
 - A were never received by the custodian.
 - B were never received by the fund manager.
 - C arrived after the custodian's daily cutoff time.
- 4 Which of the following statements is *most* accurate?
 - A Calculating returns involves approximation.
 - B Vendors provide prices for both liquid and illiquid assets based on actual trades.
 - C Differences in the reported prices of individual holdings introduce significant differences in the reported portfolio performance.
- 5 An official transcript of all movements of cash into and out of an investment fund is maintained in the:
 - A GIPS composite database.
 - B accounting book of record.
 - C investment book of record.
- 6 Which of the following is the *least likely* cause of missing and mistimed cash flows into and out of a fund?
 - A Such factors as operational shortfalls, technological errors, and poor documentation may come into play for investment managers.
 - B Because investment firms typically manage the flows of cash with investors and other parties, it is not uncommon for a custodian to miss a flow in or out of a fund.

- C The custodian accounts for the cash flow on the settlement date, while the investment manager records the trade and the change in the cash account on the trade date.
- 7 The presence of derivatives in a portfolio introduces further scope for discrepancies between the investment manager and the custodian because:
- A custodians must weigh the extra cost of the additional data against the extra precision they may obtain.
 - B the terms and conditions of OTC derivatives are often costly to obtain and are not provided automatically to custodians.
 - C Derivatives, such as currency forwards, are priced by outside vendors rather than by the investment manager's own internal systems.
- 8 Which of the following items is *more likely* to be missed by the custodian than by the investment manager in the calculation of performance?
- A Cash flows
 - B Securities trades
 - C Corporate actions
- 9 Which of the following funds is *least likely* to experience a discrepancy between NAV-based performance and end-of-day time-weighted performance?
- A A New York-based and administered domestic small-cap equity fund.
 - B A London-based UK mid-cap equity fund administered in Hong Kong.
 - C An Osaka, Japan-domiciled large-cap equity fund with holdings in German shares.
- 10 Assume a cutoff time of 5:00 p.m. for both the custodian's NAV calculations and the firm's IBOR time-weighted performance calculations and that both the firm and the custodian use the same pricing and exchange rate feeds. While the afternoon was a period of heavy trading activity by the portfolio manager, all trades were completed before 5:00 p.m. Later, a performance analyst notices that the NAV calculation and the IBOR time-weighted calculation differ. The *most likely* cause of the calculation discrepancy was the use of different:
- A prices.
 - B holdings.
 - C exchange rates.
- 11 Given the wide variety of investment strategies, objectives, and mandates that exist, standardizing required composite disclosures across a multi-product firm can be difficult. The data integrity dimension that *most* directly addresses this data challenge is:
- A accuracy.
 - B conformity.
 - C completeness.
- 12 Designing composite definitions that are comprehensive in scope may lead to:
- A large magnitudes of return dispersion within composites.
 - B increased movement of portfolios into and out of composites.
 - C extra maintenance work, including managing all the associated data requirements.
- 13 Which of the following statements does not reflect a best practice under the GIPS standards?
- A Firms need to complete, on a regular basis, discretionary status reviews of fee-paying portfolios that are included in composites.

- B** Where possible, practitioners should anticipate the evolution of their investment process, creating enough space in composite definitions to allow for some change.
 - C** To understand the needs of the entire organization and obtain their support, a GIPS committee should be established with representatives from portfolio accounting, performance measurement, product management, information technology, risk management, and legal & compliance.
- 14** Decisions around new portfolios, such as allocating them to existing composites or setting up new composites, should be the responsibility of the:
- A** GIPS committee.
 - B** portfolio management team.
 - C** performance measurement team.
- 15** HMT Asset Management is marketing a new, actively-managed Eurozone large-cap equity product. Prospective client Abel is interested in European Union large-cap stocks and is impressed by HMT's success with other strategies, but he requires that all trades be pre-approved. Prospective client Baker is interested in Eurozone stocks, but her IPS prohibits investment in tobacco companies and weapons manufacturers. The prohibited companies typically make up less than 3% of the new strategy's benchmark. Charlie, an existing client in HMT's US large-cap strategy, would like to move his portfolio to the new Eurozone large-cap equity strategy. Assuming all three prospects invest in the new product, how should HMT comply with the requirements of the GIPS standards?
- A** Create a single composite for Baker's and Charlie's accounts and classify Abel's account as non-discretionary.
 - B** Create a single composite for Charlie's account and classify Abel's and Baker's accounts as non-discretionary.
 - C** Create three individual composites, one for Abel's account, one for Baker's account, and one for Charlie's account.

SOLUTIONS

- 1 A is correct. Even at a given point in time, different pricing sources may offer different prices; moreover, the differences tend to be larger for less liquid securities, such as corporate bonds, structured products, and foreign shares.

B is incorrect. As performance-measurement practitioners, we need to understand which sources are used to derive the market values of our portfolios. We also need to be sensitive to potential timing differences and to the impact of different securities markets on those prices.

C is incorrect because there are multiple pricing sources for every security.
- 2 B is correct. Rather than seeking to reproduce the performance calculated by two different providers, a practitioner would likely ask both parties to confirm that the prices agree with their pricing policy. If a pricing data policy exists, the performance provider may be asked to change pricing to match the policy and recalculate performance for that day.

A is incorrect. Seeking to reproduce the calculations of the two providers would require both an understanding of their methodologies and the processing of a lot of additional data (e.g., number of holdings, previous day prices, transactions).

C is incorrect. The pricing discrepancy alone does not determine the holding's contribution to the overall discrepancy at the portfolio level. The position weight of the holding must also be taken into consideration.
- 3 A is correct. Since the trade discrepancy was still unresolved two days after the date of the sub-adviser's trade, it is most likely that the trade data were never received by the custodian.

B is incorrect. A sub-adviser typically sends all of their trades to both the custodian and the fund manager. The sub-adviser prepares different trade feeds—one to match the custodian's required format, and the other to meet the requirements of the fund manager. Two separate feeds, and processes to generate those feeds, introduce the possibility that trades (or other data) provided in one are missing from the other. Since the fund manager's analyst was aware of the trade by the sub-adviser, we can assume that the investment firm did receive the trade data.

C is incorrect. If the trade feed was received after the custodian's daily cutoff time, the trade would likely have been processed by the custodian the following day and backdated so that performance could be recalculated and the discrepancy resolved. If this had occurred, the discrepancy would not have existed when the sub-adviser's trading was reviewed by the analyst two days after the trade.
- 4 A is correct. CIPM candidates, given their exposure to questions of performance and analytics, understand that calculating returns involves approximation. "Upstream" data flows come in different varieties, and their nature affects how the performance of funds and fund managers are ultimately represented.

B is incorrect. Pricing vendors provide prices for illiquid assets using model valuation rather than basing prices on actual trades.

C is incorrect. Differences in the reported prices of individual holdings may or may not introduce significant differences in the reported portfolio performance.
- 5 B is correct. The official record of all movements of cash into and out of a fund is maintained by the custodian in the accounting book of record.

A is incorrect. The GIPS composite system (including the database) is the set of processes, tools, and equipment used to maintain and manage GIPS composites. The system is not the official fund accounting record, however.

C is incorrect. The investment book of record is a separate set of data for trading and portfolio management purposes created by the investment manager.

- 6 B is correct. Because custodians (not investment managers) typically manage the flows of cash with investors and other parties, it is not uncommon for an investment manager to miss a flow in or out of a fund.

A is incorrect. It is not uncommon for an investment manager to miss a flow in or out of a fund; operational shortfalls, technological errors, and poor documentation may also come into play.

C is incorrect. The custodian and the investment manager may record cash flows on different dates, whether intentionally or not. For example, the custodian may account for the cash flow on the settlement date—when the cash is actually moved—while the investment manager records the trade and a change in the cash account on the day the trade takes place (i.e., the trade date).

- 7 B is correct. The terms and conditions associated with over-the-counter (OTC) derivatives are necessary for correctly valuing them and measuring exposures, but such information is often costly to obtain and not provided automatically to custodians, which limits their ability to measure the impact on performance.

A is incorrect. Custodians must weigh the extra cost of the additional data (for valuing derivatives) against the extra precision they may obtain. In some circumstances, the extra precision may be required by the regulators. The choice, however, is not a cause of discrepancies, *per se*.

C is incorrect. Currency forwards are not priced by outside vendors. Instead, they are priced by internal systems that investment managers and custodians use.

- 8 B is correct. The omission of a trade in the calculation of a position can have a significant impact on reported performance, and missing trades occur frequently. For example, custodians typically insist on daily cutoff times by which all trade data must be received from the manager in order to be included in that day's performance calculations. If certain trades come in too late, they will not be included in performance calculations.

A is incorrect. Custodians record all movements of cash into and out of a fund. Because custodians typically manage the flows of cash with investors and other parties, it is not uncommon for an investment manager to miss a flow in or out of a fund.

C is incorrect. Because custodians work with so many financial institutions, they necessarily track corporate action information for most securities.

Investment managers, on the other hand, may dedicate limited resources to the costly, data-intensive process of maintaining a complete awareness of corporate actions.

- 9 A is correct. The New York-based fund, in contrast to the London and Osaka funds, is not administered or domiciled on a different continent nor is it partly or fully invested in a different geographic region. For these reasons, the New York-based fund is least likely to experience a discrepancy between NAV-based performance and end-of-day time-weighted performance relative to the other funds.

B is incorrect. The cutoff times for NAV calculation and the IBOR time-weighted calculation may differ because the company manages a fund that is administered or domiciled on a different continent.

C is incorrect. The cutoff times for NAV calculation and the IBOR time-weighted calculation may differ because the company manages a fund that is partly or fully invested in a different geographic region.

- 10 B is correct. The most likely cause of the difference is a transaction occurring just prior to the cutoff time that was not communicated to the custodian quickly enough to be captured in the NAV calculation. This may happen when there is heavy trading activity near the cutoff time.

A is incorrect. The cutoff time was the same for both calculations. Since the custodian and the investment manager use the same pricing vendor, their prices should be identical.

C is incorrect. The cutoff time was the same for both calculations. Since the custodian and the investment manager use the same exchange-rate vendor, their FX rates should be identical.

- 11 C is correct. With respect to the GIPS standards, the data integrity dimension of completeness applies to both performance data and additional disclosures. The dimension addresses the question: Are the data sufficiently complete for the intended purpose? An example of this data dimension is: Details on discretion and disclosures compose a form of information that is required but difficult to standardize.

A is incorrect. The accuracy data integrity dimension addresses the question: Are the data valid and correct? The system for managing composites must be able to generate all data that are required to calculate composite returns and provide disclosures. An example of this data dimension is: The system must accurately maintain information on discretionary and non-discretionary status of portfolios.

B is incorrect. The conformity data integrity dimension addresses the question: Do the data conform to standards and rules? An example of this data dimension is: The composition of composites should be covered by an appropriate allocation rule or by definitions formulated by the GIPS committee.

- 12 A is correct. A definition of composites that is too broad may lead to large magnitudes of return dispersion within composites. Recommended best practice is to avoid composite definitions that are too broad or too narrow.

B is incorrect. A very narrow definition of composites may lead to increased movement of portfolios into and out of composites.

C is incorrect. A very narrow definition of composites may lead to a lot of extra maintenance work, including managing all the associated data requirements.

- 13 A is correct. A sensible practice, and a requirement of the GIPS standards, is for a firm's GIPS policies and procedures to include its definition of discretion. Firms need to complete discretionary reviews on a regular basis for *all* fee-paying portfolios, not just for those already included in composites.

B is incorrect. In general, the GIPS standards recommend that changes to the investment strategy of a particular portfolio will require either the creation of a new composite or switching the portfolio to an existing but different composite. Where possible, practitioners should anticipate the evolution of their investment process, creating enough space in the definitions to allow for some change, as a best practice.

C is incorrect. Best practice calls on the practitioner to understand the needs of the entire organization and obtain their support. A GIPS committee should be established with representatives from portfolio accounting & administration, performance measurement, product management, information technology, risk management, and legal & compliance (and possibly sales & marketing and portfolio management).

- 14 A is correct. Decisions around new portfolios, such as allocating them to existing composites or setting up new composites, should be the responsibility of the GIPS committee.

B is incorrect. While portfolio managers may be included on the GIPS committee, decisions around new portfolios, such as allocating them to existing composites or setting up new composites, should be the responsibility of the full GIPS committee.

C is incorrect. While representatives from the performance measurement team should be included on the GIPS committee, decisions around new portfolios, such as allocating them to existing composites or setting up new composites, should be the responsibility of the full GIPS committee.

- 15 A is correct. There are no restrictions on the management of Charlie's account. The restriction against investment in tobacco companies and weapons manufacturers listed in Baker's IPS is relatively minor—given that the prohibited companies typically make up less than 3% of the new strategy's benchmark—and thus unlikely to materially impact the firm's ability to implement its intended strategy.

B is incorrect. Abel's account is clearly non-discretionary due to the requirement that all trades be pre-approved. This restriction will materially impact the firm's ability to implement its intended strategy. Additionally, Abel's interest is in the European Union, which consists of significantly more countries than are included in the Eurozone. In contrast, the restriction in Baker's IPS is relatively minor and thus unlikely to materially impact the firm's ability to implement its intended strategy.

C is incorrect. Creating a separate composite for the Baker account because of the minor restriction described would go against best practice, resulting in a narrowly defined composite and extra maintenance work for the performance team. Moreover, Abel's account is clearly non-discretionary and therefore should not be included in any composite.

Glossary

Accounting Book of Record (ABOR) It is the official fund accounting record, produced by custodians or administrators. The data contained in the ABOR are used to value portfolios and to generate NAVs and NAV-based performance metrics.

Investment Book of Record (IBOR) It is a set of fund data for trading and portfolio-management purposes.

Composite Aggregation of one or more portfolios that a firm manages according to a similar investment mandate, objective, or strategy.

Composite System The set of processes, tools, and equipment used to maintain and manage the composites.

Discretion The ability of a firm to implement its intended strategy.