Guidelines for Interpreting Vector-Based Risk Metrics in Portfolio Reports

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Description: A detailed guide on how to interpret vector-based risk metrics such as momentum, volatility, and earnings quality vectors, including baseline comparisons, vector shift ratios, and anomaly detection relevant to June 2025 market conditions.

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Introduction

This document provides comprehensive guidelines for analysts, portfolio managers, and risk officers at Northbridge Capital and its parent company, Fairfox Financial Holding. It focuses on the interpretation of vector-based risk metrics—specifically momentum, volatility, and earnings quality vectors—

within portfolio risk reporting for June 2025 market conditions. Accurate understanding of these vectors enables effective risk monitoring, anomaly detection, and strategic decision-making.

In the context of modern quantitative portfolio management, vectorial risk metrics serve as multidimensional indicators, revealing the directional and magnitude aspects of asset risk profiles. This guide elaborates on baseline comparisons, relative shifts, and anomaly signals essential for predictive insights and risk governance.

Governance Structure and Risk Policy Overview

All risk assessments and vector metric interpretations adhere to the governance policies established by Northbridge Capital's Risk Committee. The key document, POL-20250602-001, outlines policies for risk measurement, acceptable deviation thresholds, and escalation protocols.

Risk policies define responsibilities as follows:

- **Risk Officers:** Monitor vector metrics, validate anomaly signals, and document incidents.
- **Portfolio Managers:** Evaluate risk vector signals for portfolio adjustments, adhering to set policies.
- **Compliance Team:** Ensure reporting complies with internal and regulatory standards, including breach codes (e.g., BR-20250618-0001).

Risk policies emphasize:

1. Regular monitoring of risk vector shifts against historical baselines.
2. Prompt investigation of significant anomalies.
3. Documentation of incident notes and resolution steps, especially for breaches or significant deviations.

For example, incident report BR-20250618-0001 documented a sudden elevation in volatility vectors linked to the market turbulence on June 18, 2025.

Portfolio Sleeve Mappings & Data Landscape

The portfolio's structural mapping assigns assets to sleeves, with each sleeve aligned to specific risk factors or sectors. The current data landscape includes:

- **Risk Factor Definitions:** Momentum (MOM), Volatility (VOL), Earnings Quality (EQR)
- **Data Sources:** Market feeds, internal valuation models, earnings reports.
- **Data Path:** The primary data file is accessible at:

```
/Volumes/demo_generator/saswata_sengupta_agneticportfoliomanager/ra
```

Mapping ensures data integrity and facilitates precise risk metric analysis aligned with portfolio segmentation.

Introduction to Vector-Based Risk Metrics

Vector risk metrics represent multidimensional indicators capturing asset dynamics over multiple attributes. They facilitate a granular understanding of risk behaviors, aiding in quantitative analysis and visualizations.

Key vectors include:

- **Momentum Vector**: Denotes the directional strength of asset price movements.
- **Volatility Vector**: Indicates the degree of price fluctuation and risk persistence.
- **Earnings Quality Vector**: Reflects the stability and reliability of earnings signals.

Each vector is represented in a 3D space or an n-dimensional space, with magnitude and directional components, computed via specialized algorithms involving factor loadings, time series analysis, and vector normalization techniques.

Interpreting Momentum Vectors

Momentum vectors (MOM) capture the directionality and strength of recent price trends. They are essential for trend-following strategies and early warning signals.

Example:

Consider an asset with the following momentum vector components:

```
MOM_x = 0.85 (High positive trend)
MOM_y = -0.10 (Slight reverse in sector alignment)
MOM_z = 0.40 (Moderate trend acceleration)
```

These components suggest strong upward momentum in primary trend direction with minor reverse signals. The vector magnitude $|\text{MOM}|$ is calculated as:

```
|MOM| = √(0.85² + (-0.10)² + 0.40²) ≈ 0.94
```

Interpretation guidelines:

- **High magnitude (>0.8):** Strong underlying trend; consider trend continuation or initiation signals.
- **Low magnitude (<0.3):** Minimal directional bias; potentially consolidating or sideways movement.
- **Directionality:** Components indicate sector-specific or factor-driven momentum bias.

Market Scenario:

In June 2025, assets with increasing MOM vectors aligned with macroeconomic growth signals are flagged for potential upside exposure.

Interpreting Volatility Vectors

Volatility vectors (VOL) quantify the magnitude and direction of risk changes. They distinguish between increasing risk exposure and risk mitigation phases.

Example:

```
VOL_x = −0.65 (Decreasing overall risk)
VOL_y = 0.70 (Increasing sector-specific volatility)
VOL_z = 0.10 (Stable overall market volatility)
```

The overall volatility vector magnitude is:

```
|VOL| = √((−0.65)² + 0.70² + 0.10²) ≈ 1.01
```

Guidelines for interpretation:

- **Magnitude >1.0:** Elevated systemic risk; monitor for potential risk escalation.
- **Directional patterns:** Negative components suggest risk reduction; positive components indicate emerging risks.
- **Application:** During June 2025, abnormal volatility shifts detected via vectors prompted risk mitigation actions.

Example Scenario:

An unexpected spike in sector-specific volatility led to vector shift analysis, revealing increasing sector risk relative to broader market stability.

Interpreting Earnings Quality Vectors

Earnings quality vectors (EQR) assess stability, predictability, and sustainability of earnings signals. These help gauge fundamental risk and potential anomalies.

Example:

```
EQR_x = 0.45 (Moderate positive earnings signal)
EQR_y = -0.60 (Declining earnings quality in a key sector)
EQR_z = 0.20 (Minor fluctuations)
```

The magnitude:

```
|EQR| = √(0.45² + (-0.60)² + 0.20²) ≈ 0.78
```

Interpretation tips:

- **High EQR magnitude (>0.8):** Stable earnings; low fundamental risk.
- **Negative components:** Deterioration in earnings quality warrants deeper analysis.
- **Trend monitoring:** Persistent downward shifts in EQR vectors can signal upcoming fundamental risks.

Scenario in June 2025:

Analyzing earnings quality vectors uncovered decreased earnings reliability amid macroeconomic uncertainty, prompting review of fundamental portfolios.

Baseline and Reference Comparisons

Effective risk interpretation relies on comparing current vectors against established baselines derived from historical data, stress periods, or benchmark indices.

Methodology:

1. Calculate average vector components over a stable period (e.g., Q4 2024).
2. Compute deviations: Δ = Current - Baseline.
3. Assess the significance of deviations using z-scores or percentiles.

Example:

Risk Metric	Baseline	Current	Deviation	Interpretation
MOM_x	0.60	0.85	+0.25	Unusual bullish momentum
VOL_y	0.50	0.70	+0.20	Elevated sector risk
EQR_z	0.65	0.20	-0.45	Potential earnings deterioration

Such baseline comparisons enable quantification of risk shifts within the context of historical norms.

Understanding Vector Shift Ratios

Vector shift ratios quantify relative change between current and baseline vectors, facilitating rapid detection of abnormal movement patterns.

Calculation:

```
Shift Ratio = |Current Vector| / |Baseline Vector|
```

Example:

Baseline Momentum magnitude: 0.60

Current Momentum magnitude: 0.85

Shift Ratio:

```
= 0.85 / 0.60 ≈ 1.42
```

Interpretation:

- Ratios >1.2 indicate significant shifts—possible trend acceleration.
- Ratios <0.8 suggest trend weakening or reversal.

Application:

During June 2025.8, vector shift ratios identified sectors experiencing rapid momentum surges, prompting risk reassessment.

Anomaly Detection in Risk Vectors

Detection involves identifying deviations exceeding predefined thresholds and confirming through sequential analysis.

Procedures:

1. Set deviation thresholds based on historical standard deviations (e.g., 2σ).
2. Compute real-time vector deviations.
3. Flag significant deviations exceeding thresholds as anomalies.
4. Validate through auxiliary metrics and market news.

Flowchart:

Example:

In June 2025, volatility vector signals exceeded thresholds, correlating with macroeconomic news, confirming market stress signals.

Actions:

- Increase monitoring frequency
- Implement risk mitigation strategies
- Record incident details and trigger governance protocols

Application Examples and Case Studies

Case Study 1: Sector Rotation Signal

Momentum vectors indicated a surge in technology sector assets. The vector magnitude increased from 0.65 to 1.10, exceeding thresholds for momentum acceleration.

Simultaneously, earnings quality vectors declined, signaling potential fundamental risks. Portfolio adjustments were made accordingly, reducing exposure to overextended assets.

Case Study 2: Volatility Shock Response

On June 18, 2025, sector volatility vectors spiked, triggering breach codes BR-20250618-0001. Risk officers documented the incident, triggering escalation protocols and review meetings.

This analysis led to temporary risk hedging and enhanced monitoring, successfully mitigating undue losses.

Additional Examples:

- Identifying divergence between momentum and earnings vectors as a signal for upcoming correction.
- Using baseline deviations to calibrate risk budgets during market stress periods.

Risk Incident Notes (2025-06-18 Update)

On June 18, 2025, a significant market