Incorporating Risk Management Techniques Into the Investment Process

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IBM Risk Analytics

Lessons learned in a post GFC world

“Firms that experienced more significant problems tended to apply a mechanical risk management approach.”

“Firms that tended to avoid significant challenges assessed risk positions drawing on different underlying assumptions.”
“Firms that suffered significant losses tended to depend on a narrow range of risk measures and on measurement processes that were difficult to alter once it became apparent that the underlying assumptions were wrong.”

Information underlying the simple metrics

Means and co-variances

Expected Return

Variance

Return

Scenario

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Managers at better performing firms relied on a *wide range* of measures of risk.

Many were able to *integrate* their measures of market risk and counterparty risk across businesses.

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**A wider range of possible measures**

**Deviations in various directions**

- Downside
- Upside
- All
- Net

**Multiple measures calculated from the deviations**

- VaR
- Sum of absolute deviations
- Skewness
- Maximum
- Expected return
- Upside / Downside
- Expected sum of squares
- Tail expectation
While progress has occurred…

“Our observations in this report indicate that while most firms have made progress in developing risk appetite frameworks and begun multiyear projects to improve IT infrastructure, financial institutions have considerably more work to do in order to strengthen these practices.”

“The lack of integrated systems and platforms is a key challenge to ensuring the firm wide aggregation of risk data is accurate and comprehensive.”
Risk in the investment process

- Routine Enquiry
- Market Event
- Cash Inflow
- Economic View

Risk Assessment

- Triggers
- Analysis
- Tools
- Organization
- Execution

Strategy Workbench

Order Routing

Integrated enterprise framework

- Market Risk
- Credit Risk & Collateral
- ALM & Liquidity Risk
- Actuarial Risk
- Operational Risk
- IT Risk
- Policy & Compliance
- Financial Controls & Internal Audit

Front Office
Middle Office
Back Office
Trusted Information Infrastructure

Horizontal integration to eliminate “silos” and enable a comprehensive view of risks

Vertical integration to link risk management to business processes and business decisions
Risk assessment

Routine Enquiry  Market Event  Cash Inflow  Economic View

Risk Assessment

Triggers

Analysis

Value-at-risk report

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Testing a proposed strategy

Routine Enquiry  Market Event  Cash Inflow  Economic View

Risk Assessment

Triggers
Analysis
Tools

USD PV01 hedge

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Determine hedge ratio

Test actual hedge
"What-if" impact

Validating the proposed hedge

Routine Enquiry  Market Event  Cash Inflow  Economic View

Risk Assessment

What-if

Triggers

Analysis

Tools
Stress testing the hedge

"What-if" re-allocation across sectors
**Portfolio optimization techniques**

- Routine Enquiry
- Market Event
- Cash Inflow
- Economic View

**Risk Assessment**

- Triggers
- Analysis
- Tools

**Leveraging the risk infrastructure**

**Objective functions:**

<table>
<thead>
<tr>
<th>Measure</th>
<th>Downside</th>
<th>Upside</th>
<th>All</th>
<th>Net</th>
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<tbody>
<tr>
<td>Sum</td>
<td></td>
<td></td>
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<td>Expectation</td>
<td>Regret</td>
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<td>M.A.D.</td>
<td>Mean</td>
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<td>Maximum</td>
<td>Worst Case</td>
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<td>Sum of Squares</td>
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<tr>
<td>Exp Sum of Squares</td>
<td>Semi-variance</td>
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<td>Variance, TE^2</td>
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<tr>
<td>Tail Expectation</td>
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<td>CVaR</td>
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</tbody>
</table>

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Use cases

- Asset allocation, risk based allocation
- Index tracking
- Portfolio screening
- Liability replication → liability driven investments
- Distributional shaping, de-risking
- Risk budgeting, portable alpha management
- Efficient frontier construction
- Ranking of investment strategies

Tracking error against a benchmark
Portfolio replication example

Validating the proposed re-allocation

- Routine Enquiry
- Market Event
- Cash Inflow
- Economic View

- Risk Assessment
- What-if
- Optimization

Triggers
Analysis
Tools

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Stress testing multiple replicating portfolios

Sensitivity Across Stress Scenarios

-1 000 000 -800 000 -600 000 -400 000 -200 000 0 200 000 400 000 600 000 800 000 -1 000 000

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Incorporating risk in the investment process

Routine Enquiry Market Event Cash Inflow Economic View Triggers

Risk Assessment Analysis Tools

What-if Optimization Organization

Strategy Workbench Execution

Order Routing

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