



Brinson Risk Decomposition: Attributing Tracking Error to Allocation and Selection Decisions

May 13, 2010

Outline

- Sector-Based Performance Attribution
 - Allocation and selection effects
- Sector-Based Risk Attribution
 - Attributing risk and return to the same decision variables
 - Allocation and selection risk contributions
 - Sector active risk drilldowns to security-level
 - Fund active risk drilldowns to security-level
- Side-By-Side Performance and Risk



Brinson Sector-Based Performance Attribution

Brinson Sector-Based Framework

$$R^A = \overbrace{\sum_i \left(w_i^P - w_i^B \right) \left(R_i^B - R^B \right)}^{\text{Allocation Effect}} + \overbrace{\sum_i w_i^P \left(R_i^P - R_i^B \right)}^{\text{Selection Effect}}$$

R^A : Active Return

R^B : Benchmark Return

w_i^P : Portfolio Sector
Weight

R_i^P : Portfolio Sector
Return

w_i^B : Benchmark Sector
Weight

R_i^B : Benchmark Sector
Return

Brinson Sector-Based Framework

$$R^A = \underbrace{\sum_i \left(\underbrace{w_i^P - w_i^B}_{\text{Sector Active Weight}} \right) \left(R_i^B - R^B \right)}_{\text{Allocation Effect}} + \underbrace{\sum_i w_i^P \left(R_i^P - R_i^B \right)}_{\text{Selection Effect}}$$

R^A : Active Return

R^B : Benchmark Return

w_i^P : Portfolio Sector Weight

R_i^P : Portfolio Sector Return

w_i^B : Benchmark Sector Weight

R_i^B : Benchmark Sector Return

Brinson Sector-Based Framework

$$R^A = \sum_i \left(\overbrace{w_i^P - w_i^B}^{\text{Allocation Effect}} \right) \underbrace{\left(R_i^B - R^B \right)}_{\text{Sector Relative Return}} + \sum_i \overbrace{w_i^P \left(R_i^P - R_i^B \right)}^{\text{Selection Effect}}$$

R^A : Active Return

R^B : Benchmark Return

w_i^P : Portfolio Sector Weight

R_i^P : Portfolio Sector Return

w_i^B : Benchmark Sector Weight

R_i^B : Benchmark Sector Return

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Sector Portfolio Weight

R^A : Active Return

R^B : Benchmark Return

w_i^P : Portfolio Sector Weight

R_i^P : Portfolio Sector Return

w_i^B : Benchmark Sector Weight

R_i^B : Benchmark Sector Return

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$$R^A = \sum_i \left(\overbrace{w_i^P - w_i^B}^{\text{Allocation Effect}} \right) \left(R_i^B - R^B \right) + \sum_i w_i^P \underbrace{\left(R_i^P - R_i^B \right)}_{\text{Sector Active Return}}$$

R^A : Active Return

R^B : Benchmark Return

w_i^P : Portfolio Sector Weight

R_i^P : Portfolio Sector Return

w_i^B : Benchmark Sector Weight

R_i^B : Benchmark Sector Return

Example: February 2010 Growth versus Value

- Portfolio: MSCI USA Investable Market Index (IMI) Growth
- Benchmark: MSCI USA IMI Value
- Analysis Period: February 2010
- Portfolio Return: 3.87%
- Benchmark Return: 2.85%
- Active Return: 1.02%
- Barra Integrated Model (BIM) (Barra US Equity Model (USE3L))
Forecast Tracking Error: 8.77%

Global Industry Classification Standard (GICS®)

Sector-Based Performance Attribution

Sector	Portfolio Weight	Benchmark Weight	Active Weight	Portfolio Return	Benchmark Return	Relative Return	Active Return	Allocation Effect	Selection Effect	Total Effect
Cons Disc	12.72%	8.01%	4.71%	5.14%	7.32%	4.47%	-2.18%	0.21%	-0.28%	-0.07%
Cons Stpls	10.72%	9.55%	1.17%	3.47%	2.44%	-0.41%	1.03%	0.00%	0.11%	0.11%
Energy	7.62%	14.23%	-6.61%	3.70%	1.81%	-1.04%	1.88%	0.07%	0.14%	0.21%
Financials	6.27%	24.61%	-18.34%	3.07%	3.84%	0.99%	-0.77%	-0.18%	-0.05%	-0.23%
Health Care	14.81%	11.41%	3.40%	2.16%	-1.24%	-4.09%	3.40%	-0.14%	0.50%	0.36%
Industrials	9.03%	13.05%	-4.03%	5.34%	4.61%	1.76%	0.73%	-0.07%	0.07%	0.00%
IT	33.54%	4.08%	29.46%	4.09%	6.69%	3.84%	-2.59%	1.13%	-0.87%	0.26%
Materials	4.13%	3.39%	0.74%	4.41%	6.21%	3.36%	-1.80%	0.03%	-0.07%	-0.05%
Telecom	0.78%	4.62%	-3.83%	3.92%	-1.29%	-4.14%	5.21%	0.16%	0.04%	0.20%
Utilities	0.38%	7.04%	-6.67%	-3.65%	-0.76%	-3.61%	-2.88%	0.24%	-0.01%	0.23%
TOTAL	100.00%	100.00%	0.00%	3.87%	2.85%	0.00%	1.02%	1.44%	-0.41%	1.02%

- Total sector allocation (144 bps) was a major contributor to active return
- Total stock selection (-41 bps) detracted from active return

GICS® Sector-Based Performance Attribution

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- Top three sector contributors are Health Care (36 bps), IT (26 bps), and Utilities (23 bps)
- The main sector deduction coming from Financials (-23 bps)

GICS® Sector-Based Performance Attribution

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TOTAL	100.00%	100.00%	0.00%	3.87%	2.85%	0.00%	1.02%	1.44%	-0.41%	1.02%

- Aggressive overweight (29.46%) of outperforming Growth IT sector (3.84%) result most significant sector allocation effect (1.13%)



Risk Attribution

The X-Sigma-Rho Formula

General Performance Attribution

$$R = \sum_m x_m g_m$$

Performance Attribution

x_m = Source Exposure

g_m = Source Return

} Attribution model must reflect investment process

Specific Examples:

$$R^A = \sum_i (w_i^P - w_i^B)(R_i^B - R^B) + \sum_i w_i^P (R_i^P - R_i^B) \quad \text{Sector Approach}$$

$$R^A = \sum_n (w_n^P - w_n^B)(r_n - R^B) \quad \text{Security Approach}$$

General Risk Attribution

$$\sigma(R) = \sum_m x_m \sigma(g_m) \rho(g_m, R)$$

Risk Attribution $(x \sigma \rho)$

- Align risk and return attribution variables
- Risk contributions are additive and intuitive
- Identifies three drivers of portfolio risk:
 - Sizes of the exposures x_m
 - Stand-alone volatilities of the return sources $\sigma(g_m)$
 - Correlation of return sources with portfolio $\rho(g_m, R)$

Implied Returns

$$MCR_m = \sigma(g_m) \rho(g_m, R)$$

Marginal Contribution
to Risk of Source m

- For IR optimal portfolio:

$$E(g_m) = IR \times MCR_m$$

Implied Return of
Source m

- Reconciling views with implied returns:

Either $\left[\begin{array}{l} \text{Bullish when } MCR_m \text{ positive} \\ \text{Bearish when } MCR_m \text{ negative} \end{array} \right]$ or $\left[\begin{array}{l} \text{Can } \textit{increase} \\ \textit{forecast return} \\ \textit{and reduce risk} \end{array} \right]$

Sector-Based Risk Attribution

Fund
Active Risk

$$\sigma(R^A) = \sum_i (w_i^P - w_i^B) \sigma(R_i^B - R^B) \rho(R_i^B - R^B, R^A) + \sum_i w_i^P \sigma(R_i^P - R_i^B) \rho(R_i^P - R_i^B, R^A)$$

R^A : Active Return

R^B : Benchmark Return

w_i^P : Portfolio Sector Weight

R_i^P : Portfolio Sector Return

w_i^B : Benchmark Sector Weight

R_i^B : Benchmark Sector Return

Sector-Based Risk Attribution

$$\sigma(R^A) = \underbrace{\sum_i (w_i^P - w_i^B) \sigma(R_i^B - R^B) \rho(R_i^B - R^B, R^A)}_{\text{Allocation Risk Contribution}} + \sum_i w_i^P \sigma(R_i^P - R_i^B) \rho(R_i^P - R_i^B, R^A)$$

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Sector-Based Risk Attribution

$$\begin{aligned}\sigma(R^A) = & \sum_i (w_i^P - w_i^B) \sigma(R_i^B - R^B) \rho(R_i^B - R^B, R^A) \\ & + \underbrace{\sum_i w_i^P \sigma(R_i^P - R_i^B) \rho(R_i^P - R_i^B, R^A)}_{\text{Selection Risk Contribution}}\end{aligned}$$

R^A : Active Return

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Telecom	0.78%	4.62%	-3.83%	19.05%	0.26	-0.19%	24.32%	0.20	0.04%	-0.15%
Utilities	0.38%	7.04%	-6.67%	16.42%	0.26	-0.29%	16.29%	-0.06	0.00%	-0.29%
Total	100.00%	100.00%	0.00%			4.86%			3.90%	8.77%

Risk contributions are additive:

$$\begin{pmatrix} \text{Allocation} \\ \text{Risk} \\ \text{Contribution} \end{pmatrix} + \begin{pmatrix} \text{Selection} \\ \text{Risk} \\ \text{Contribution} \end{pmatrix} = \begin{pmatrix} \text{Total} \\ \text{Risk} \\ \text{Contribution} \end{pmatrix}$$

GICS® Sector-Based Risk Attribution

Sector	Portfolio Weight	Benchmark Weight	Active Weight	Allocation Relative Sector Volatility	Allocation Relative Sector Correlation	Allocation Risk Contribution	Selection Active Sector Volatility	Selection Active Sector Correlation	Selection Risk Contribution	Total Risk Contribution
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- Risk contributions identify main sector drivers of risk
- Active risk concentrated in Financials and IT

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Risk contributions are intuitive:

$$\begin{pmatrix} IT \\ Active \\ Weight \end{pmatrix} \times \begin{pmatrix} Relative \\ Sector \\ Volatility \end{pmatrix} \times \begin{pmatrix} Relative \\ Sector \\ Correlation \end{pmatrix} = \begin{pmatrix} IT \\ Allocation \\ Risk \end{pmatrix}$$

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- Utilities have positive implied relative return

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Either { Utilities underweighted for diversification benefit } or { More aggressive underweight warranted }

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Industrials	9.03%	13.05%	-4.03%	8.88%	0.01	0.00%	7.41%	0.38	0.26%	0.25%
IT	33.54%	4.08%	29.46%	16.39%	0.68	3.30%	11.09%	0.33	1.22%	4.52%
Materials	4.13%	3.39%	0.74%	12.93%	0.14	0.01%	10.19%	0.37	0.16%	0.17%
Telecom	0.78%	4.62%	-3.83%	19.05%	0.26	-0.19%	24.32%	0.20	0.04%	-0.15%
Utilities	0.38%	7.04%	-6.67%	16.42%	0.26	-0.29%	16.29%	-0.06	0.00%	-0.29%
Total	100.00%	100.00%	0.00%			4.86%			3.90%	8.77%

- Explicit distinction between stand-alone risk and impact on active risk
- Benchmark Telecom is a risky sector on a stand-alone basis (19.05% relative volatility), but reduces active risk by 19 bps due negative exposure and positive correlation

Full Drilldown Capability

Sector	Portfolio Weight	Benchmark Weight	Active Weight	Allocation Relative Sector Volatility	Allocation Relative Sector Correlation	Allocation Risk Contribution	Selection Active Sector Volatility	Selection Active Sector Correlation	Selection Risk Contribution	Total Risk Contribution
Cons Disc	12.72%	8.01%	4.71%	11.51%	0.05	0.03%	9.42%	0.59	0.71%	0.73%
Cons Stpls	10.72%	9.55%	1.17%	14.86%	0.37	0.06%	8.28%	0.31	0.27%	0.33%
Energy	7.62%	14.23%	-6.61%	21.13%	0.12	-0.17%	14.11%	0.28	0.30%	0.13%
Financials	6.27%	24.61%	-18.34%	17.90%	-0.59	1.93%	9.14%	0.62	0.35%	2.29%
Health Care	14.81%	11.41%	3.40%	15.21%	0.35	0.18%	9.07%	0.45	0.61%	0.78%
Industrials	9.03%	13.05%	-4.03%	8.88%	0.01	0.00%	7.41%	0.38	0.26%	0.25%
IT	33.54%	4.08%	29.46%	16.39%	0.68	3.30%	11.09%	0.33	1.22%	4.52%
Materials	4.13%	3.39%	0.74%	12.93%	0.14	0.01%	10.19%	0.37	0.16%	0.17%
Telecom	0.78%	4.62%	-3.83%	19.05%	0.26	-0.19%	24.32%	0.20	0.04%	-0.15%
Utilities	0.38%	7.04%	-6.67%	16.42%	0.26	-0.29%	16.29%	-0.06	0.00%	-0.29%
Total	100.00%	100.00%	0.00%			4.86%			3.90%	8.77%

- Telecom manager has a sector active risk of 24.32%
- Drilldown capability to the security level using Zooming in Positions Report

Sector Active Return Drilldown

$$\begin{array}{cc}
 \text{Sector } i & \text{Security } n \\
 \text{Active Return} & \text{Return Contribution} \\
 \hline
 R_i^P - R_i^B = \sum_{n \in i} \left(\tilde{w}_n^P - \tilde{w}_n^B \right) \left(r_n - R_i^B \right)
 \end{array}$$

$$\tilde{w}_n^P = \frac{w_n^P}{w_i^P} : \text{Security Portfolio Relative Weight}$$

r_n : Security Return

$$\tilde{w}_n^B = \frac{w_n^B}{w_i^B} : \text{Security Portfolio Relative Weight}$$

R_i^B : Benchmark Sector Return

Sector Active Risk Drilldown

Sector i
Active Risk

Security n Contribution to
Sector i Active Risk

$$\sigma(R_i^P - R_i^B) = \sum_{n \in i} (\tilde{w}_n^P - \tilde{w}_n^B) \sigma(r_n - R_i^B) \rho(r_n - R_i^B, R_i^P - R_i^B)$$

$\tilde{w}_n^P = \frac{w_n^P}{w_i^P}$: Security Portfolio
Relative Weight

$\tilde{w}_n^B = \frac{w_n^B}{w_i^B}$: Security Portfolio
Relative Weight

r_n : Security Return

R_i^B : Benchmark Sector Return

Telecom Active Risk Drilldown

Asset Name	Portfolio Relative Weight	Benchmark Relative Weight	Active Relative Weight	Telecom Active Total Risk	Telecom Active Correlation	MC to Total Tracking Error	Telecom Active Risk Contribution
	100.00%	100.00%	0.00%	24.32%	1.00	24.32%	24.32%
AMERICAN TOWER CORP	37.24%	0.00%	37.24%	27.83%	0.87	24.27%	9.04%
CROWN CASTLE INTL CORP	23.90%	0.00%	23.90%	34.55%	0.84	29.11%	6.96%
NII HLDGS INC	12.09%	0.00%	12.09%	36.05%	0.76	27.54%	3.33%
SBA COMMUNICATIONS CORP	7.72%	0.00%	7.72%	35.60%	0.73	26.15%	2.02%
AT&T INC	0.00%	54.10%	-54.10%	8.19%	-0.37	-2.99%	1.62%
...
LEAP WIRELESS INTL INC	0.00%	0.30%	-0.30%	56.54%	0.50	28.23%	-0.08%
SYNIVERSE HLDGS INC	0.00%	0.40%	-0.40%	34.88%	0.64	22.36%	-0.09%
QWEST COMMUNICATIONS INTL I	0.00%	2.36%	-2.36%	27.36%	0.19	5.09%	-0.12%
VERIZON COMMUNICATIONS INC	0.00%	30.22%	-30.22%	12.66%	0.04	0.49%	-0.15%
SPRINT NEXTEL CORP	0.00%	3.45%	-3.45%	52.02%	0.42	21.76%	-0.75%

Security risk contributions sum to Telecom active sector risk

Telecom Active Risk Drilldown

Asset Name	Portfolio Relative Weight	Benchmark Relative Weight	Active Relative Weight	Telecom Active Total Risk	Telecom Active Correlation	MC to Total Tracking Error	Telecom Active Risk Contribution
	100.00%	100.00%	0.00%	24.32%	1.00	24.32%	24.32%
AMERICAN TOWER CORP	37.24%	0.00%	37.24%	27.83%	0.87	24.27%	9.04%
CROWN CASTLE INTL CORP	23.90%	0.00%	23.90%	34.55%	0.84	29.11%	6.96%
NII HLDGS INC	12.09%	0.00%	12.09%	36.05%	0.76	27.54%	3.33%
SBA COMMUNICATIONS CORP	7.72%	0.00%	7.72%	35.60%	0.73	26.15%	2.02%
AT&T INC	0.00%	54.10%	-54.10%	8.19%	-0.37	-2.99%	1.62%
...
LEAP WIRELESS INTL INC	0.00%	0.30%	-0.30%	56.54%	0.50	28.23%	-0.08%
SYNIVERSE HLDGS INC	0.00%	0.40%	-0.40%	34.88%	0.64	22.36%	-0.09%
QWEST COMMUNICATIONS INTL I	0.00%	2.36%	-2.36%	27.36%	0.19	5.09%	-0.12%
VERIZON COMMUNICATIONS INC	0.00%	30.22%	-30.22%	12.66%	0.04	0.49%	-0.15%
SPRINT NEXTEL CORP	0.00%	3.45%	-3.45%	52.02%	0.42	21.76%	-0.75%

American Tower is an aggressive Telecom name and largest Telecom active risk contributor

Telecom Active Risk Drilldown

Asset Name	Portfolio Relative Weight	Benchmark Relative Weight	Active Relative Weight	Telecom Active Total Risk	Telecom Active Correlation	MC to Total Tracking Error	Telecom Active Risk Contribution
	100.00%	100.00%	0.00%	24.32%	1.00	24.32%	24.32%
AMERICAN TOWER CORP	37.24%	0.00%	37.24%	27.83%	0.87	24.27%	9.04%
CROWN CASTLE INTL CORP	23.90%	0.00%	23.90%	34.55%	0.84	29.11%	6.96%
NII HLDGS INC	12.09%	0.00%	12.09%	36.05%	0.76	27.54%	3.33%
SBA COMMUNICATIONS CORP	7.72%	0.00%	7.72%	35.60%	0.73	26.15%	2.02%
AT&T INC	0.00%	54.10%	-54.10%	8.19%	-0.37	-2.99%	1.62%
...
LEAP WIRELESS INTL INC	0.00%	0.30%	-0.30%	56.54%	0.50	28.23%	-0.08%
SYNIVERSE HLDGS INC	0.00%	0.40%	-0.40%	34.88%	0.64	22.36%	-0.09%
QWEST COMMUNICATIONS INTL I	0.00%	2.36%	-2.36%	27.36%	0.19	5.09%	-0.12%
VERIZON COMMUNICATIONS INC	0.00%	30.22%	-30.22%	12.66%	0.04	0.49%	-0.15%
SPRINT NEXTEL CORP	0.00%	3.45%	-3.45%	52.02%	0.42	21.76%	-0.75%

AT&T dominant name in the Telecom Benchmark and so has relatively low Active Risk

Telecom Active Risk Drilldown

Asset Name	Portfolio Relative Weight	Benchmark Relative Weight	Active Relative Weight	Telecom Active Total Risk	Telecom Active Correlation	MC to Total Tracking Error	Telecom Active Risk Contribution
	100.00%	100.00%	0.00%	24.32%	1.00	24.32%	24.32%
AMERICAN TOWER CORP	37.24%	0.00%	37.24%	27.83%	0.87	24.27%	9.04%
CROWN CASTLE INTL CORP	23.90%	0.00%	23.90%	34.55%	0.84	29.11%	6.96%
NII HLDGS INC	12.09%	0.00%	12.09%	36.05%	0.76	27.54%	3.33%
SBA COMMUNICATIONS CORP	7.72%	0.00%	7.72%	35.60%	0.73	26.15%	2.02%
AT&T INC	0.00%	54.10%	-54.10%	8.19%	-0.37	-2.99%	1.62%
...
LEAP WIRELESS INTL INC	0.00%	0.30%	-0.30%	56.54%	0.50	28.23%	-0.08%
SYNIVERSE HLDGS INC	0.00%	0.40%	-0.40%	34.88%	0.64	22.36%	-0.09%
QWEST COMMUNICATIONS INTL I	0.00%	2.36%	-2.36%	27.36%	0.19	5.09%	-0.12%
VERIZON COMMUNICATIONS INC	0.00%	30.22%	-30.22%	12.66%	0.04	0.49%	-0.15%
SPRINT NEXTEL CORP	0.00%	3.45%	-3.45%	52.02%	0.42	21.76%	-0.75%

Sprint most diversifying name for Telecom Active Risk

Full Drilldown Capability

Sector	Portfolio Weight	Benchmark Weight	Active Weight	Allocation Relative Sector Volatility	Allocation Relative Sector Correlation	Allocation Risk Contribution	Selection Active Sector Volatility	Selection Active Sector Correlation	Selection Risk Contribution	Total Risk Contribution
Cons Disc	12.72%	8.01%	4.71%	11.51%	0.05	0.03%	9.42%	0.59	0.71%	0.73%
Cons Stpls	10.72%	9.55%	1.17%	14.86%	0.37	0.06%	8.28%	0.31	0.27%	0.33%
Energy	7.62%	14.23%	-6.61%	21.13%	0.12	-0.17%	14.11%	0.28	0.30%	0.13%
Financials	6.27%	24.61%	-18.34%	17.90%	-0.59	1.93%	9.14%	0.62	0.35%	2.29%
Health Care	14.81%	11.41%	3.40%	15.21%	0.35	0.18%	9.07%	0.45	0.61%	0.78%
Industrials	9.03%	13.05%	-4.03%	8.88%	0.01	0.00%	7.41%	0.38	0.26%	0.25%
IT	33.54%	4.08%	29.46%	16.39%	0.68	3.30%	11.09%	0.33	1.22%	4.52%
Materials	4.13%	3.39%	0.74%	12.93%	0.14	0.01%	10.19%	0.37	0.16%	0.17%
Telecom	0.78%	4.62%	-3.83%	19.05%	0.26	-0.19%	24.32%	0.20	0.04%	-0.15%
Utilities	0.38%	7.04%	-6.67%	16.42%	0.26	-0.29%	16.29%	-0.06	0.00%	-0.29%
Active Total Risk	100.00%	100.00%	0.00%			4.86%			3.90%	8.77%

- Telecom manager has a Total Active Risk Contribution of -15 bps
- Drilldown capability to the security level using Positions Report

Fund Active Risk Drilldown

$$R^P - R^B = \sum_i \sum_{n \in i} (w_n^P - w_n^B)(r_n - R^B) \quad \text{Security Approach}$$



Fund
Active Risk

Security n Contribution to
Fund Active Risk

$$\sigma(R^P - R^B) = \sum_i \sum_{n \in i} (w_n^P - w_n^B) \sigma(r_n - R^B) \rho(r_n - R^B, R^P - R^B)$$

Fund Active Risk due to Telecom Names

Asset Name	Portfolio Weight	Benchmark Weight	Active Weight	Active Total Risk	Active Correlation	MC to Total Tracking Error	Active Risk Contribution
	0.78%	4.62%	-3.83%				-0.15%
AMERICAN TOWER CORP	0.29%	0.00%	0.29%	28.34%	0.40	11.25%	0.03%
CROWN CASTLE INTL CORP	0.19%	0.00%	0.19%	33.86%	0.36	12.34%	0.02%
SBA COMMUNICATIONS CORP	0.06%	0.00%	0.06%	34.19%	0.35	12.03%	0.01%
NII HLDGS INC	0.09%	0.00%	0.09%	33.89%	0.22	7.39%	0.01%
SPRINT NEXTEL CORP	0.00%	0.16%	-0.16%	49.38%	-0.09	-4.37%	0.01%
...
ABOVENET INC	0.00%	0.01%	-0.01%	39.16%	0.53	20.67%	0.00%
METROPCS COMMUNICATIONS INC	0.02%	0.00%	0.02%	51.26%	-0.27	-13.73%	0.00%
CENTURYTEL INC	0.00%	0.17%	-0.17%	23.66%	0.18	4.37%	-0.01%
VERIZON COMMUNICATIONS INC	0.00%	1.40%	-1.40%	23.04%	0.26	5.94%	-0.08%
AT&T INC	0.00%	2.50%	-2.50%	22.91%	0.23	5.30%	-0.13%

**Fund Active Risk
due to Telecoms**

Fund Active Risk due to Telecom Names

Asset Name	Portfolio Weight	Benchmark Weight	Active Weight	Active Total Risk	Active Correlation	MC to Total Tracking Error	Active Risk Contribution
	0.78%	4.62%	-3.83%				-0.15%
AMERICAN TOWER CORP	0.29%	0.00%	0.29%	28.34%	0.40	11.25%	0.03%
CROWN CASTLE INTL CORP	0.19%	0.00%	0.19%	33.86%	0.36	12.34%	0.02%
SBA COMMUNICATIONS CORP	0.06%	0.00%	0.06%	34.19%	0.35	12.03%	0.01%
NII HLDGS INC	0.09%	0.00%	0.09%	33.89%	0.22	7.39%	0.01%
SPRINT NEXTEL CORP	0.00%	0.16%	-0.16%	49.38%	-0.09	-4.37%	0.01%
...
ABOVENET INC	0.00%	0.01%	-0.01%	39.16%	0.53	20.67%	0.00%
METROPCS COMMUNICATIONS INC	0.02%	0.00%	0.02%	51.26%	-0.27	-13.73%	0.00%
CENTURYTEL INC	0.00%	0.17%	-0.17%	23.66%	0.18	4.37%	-0.01%
VERIZON COMMUNICATIONS INC	0.00%	1.40%	-1.40%	23.04%	0.26	5.94%	-0.08%
AT&T INC	0.00%	2.50%	-2.50%	22.91%	0.23	5.30%	-0.13%

American Tower is an aggressive Telecom name and largest Telecom fund active risk contributor

Fund Active Risk due to Telecom Names

Asset Name	Portfolio Weight	Benchmark Weight	Active Weight	Active Total Risk	Active Correlation	MC to Total Tracking Error	Active Risk Contribution
	0.78%	4.62%	-3.83%				-0.15%
AMERICAN TOWER CORP	0.29%	0.00%	0.29%	28.34%	0.40	11.25%	0.03%
CROWN CASTLE INTL CORP	0.19%	0.00%	0.19%	33.86%	0.36	12.34%	0.02%
SBA COMMUNICATIONS CORP	0.06%	0.00%	0.06%	34.19%	0.35	12.03%	0.01%
NII HLDGS INC	0.09%	0.00%	0.09%	33.89%	0.22	7.39%	0.01%
SPRINT NEXTEL CORP	0.00%	0.16%	-0.16%	49.38%	-0.09	-4.37%	0.01%
...
ABOVENET INC	0.00%	0.01%	-0.01%	39.16%	0.53	20.67%	0.00%
METROPCS COMMUNICATIONS INC	0.02%	0.00%	0.02%	51.26%	-0.27	-13.73%	0.00%
CENTURYTEL INC	0.00%	0.17%	-0.17%	23.66%	0.18	4.37%	-0.01%
VERIZON COMMUNICATIONS INC	0.00%	1.40%	-1.40%	23.04%	0.26	5.94%	-0.08%
AT&T INC	0.00%	2.50%	-2.50%	22.91%	0.23	5.30%	-0.13%

Sprint *increases* fund Active Risk

Fund Active Risk due to Telecom Names

Asset Name	Portfolio Weight	Benchmark Weight	Active Weight	Active Total Risk	Active Correlation	MC to Total Tracking Error	Active Risk Contribution
	0.78%	4.62%	-3.83%				-0.15%
AMERICAN TOWER CORP	0.29%	0.00%	0.29%	28.34%	0.40	11.25%	0.03%
CROWN CASTLE INTL CORP	0.19%	0.00%	0.19%	33.86%	0.36	12.34%	0.02%
SBA COMMUNICATIONS CORP	0.06%	0.00%	0.06%	34.19%	0.35	12.03%	0.01%
NII HLDGS INC	0.09%	0.00%	0.09%	33.89%	0.22	7.39%	0.01%
SPRINT NEXTEL CORP	0.00%	0.16%	-0.16%	49.38%	-0.09	-4.37%	0.01%
...
ABOVENET INC	0.00%	0.01%	-0.01%	39.16%	0.53	20.67%	0.00%
METROPCS COMMUNICATIONS INC	0.02%	0.00%	0.02%	51.26%	-0.27	-13.73%	0.00%
CENTURYTEL INC	0.00%	0.17%	-0.17%	23.66%	0.18	4.37%	-0.01%
VERIZON COMMUNICATIONS INC	0.00%	1.40%	-1.40%	23.04%	0.26	5.94%	-0.08%
AT&T INC	0.00%	2.50%	-2.50%	22.91%	0.23	5.30%	-0.13%

AT&T most diversifying Telecom name for fund Active Risk

Side-by-Side Performance and Risk

Sector	Portfolio Weight	Benchmark Weight	Active Weight	Allocation Effect	Allocation Risk Contribution	Selection Effect	Selection Risk Contribution	Total Effect	Total Risk Contribution
Cons Disc	12.72%	8.01%	4.71%	0.21%	0.03%	-0.28%	0.71%	-0.07%	-0.04%
Cons Stpls	10.72%	9.55%	1.17%	0.00%	0.06%	0.11%	0.27%	0.11%	0.17%
Energy	7.62%	14.23%	-6.61%	0.07%	-0.17%	0.14%	0.30%	0.21%	0.04%
Financials	6.27%	24.61%	-18.34%	-0.18%	1.93%	-0.05%	0.35%	-0.23%	1.70%
Health Care	14.81%	11.41%	3.40%	-0.14%	0.18%	0.50%	0.61%	0.36%	0.54%
Industrials	9.03%	13.05%	-4.03%	-0.07%	0.00%	0.07%	0.26%	0.00%	-0.01%
IT	33.54%	4.08%	29.46%	1.13%	3.30%	-0.87%	1.22%	0.26%	3.56%
Materials	4.13%	3.39%	0.74%	0.03%	0.01%	-0.07%	0.16%	-0.05%	-0.04%
Telecom	0.78%	4.62%	-3.83%	0.16%	-0.19%	0.04%	0.04%	0.20%	0.01%
Utilities	0.38%	7.04%	-6.67%	0.24%	-0.29%	-0.01%	0.00%	0.23%	-0.06%
TOTAL	100.00%	100.00%	0.00%	1.44%	4.86%	-0.41%	3.90%	1.02%	5.89%

- Health Care and IT made similar contributions to return
- Health Care much less risky than IT
- Health Care risk adjusted return contribution superior to IT

Side-by-Side Performance and Risk

Sector	Portfolio Weight	Benchmark Weight	Active Weight	Allocation Effect	Allocation Risk Contribution	Selection Effect	Selection Risk Contribution	Total Effect	Total Risk Contribution
Cons Disc	12.72%	8.01%	4.71%	0.21%	0.03%	-0.28%	0.71%	-0.07%	-0.04%
Cons Stpls	10.72%	9.55%	1.17%	0.00%	0.06%	0.11%	0.27%	0.11%	0.17%
Energy	7.62%	14.23%	-6.61%	0.07%	-0.17%	0.14%	0.30%	0.21%	0.04%
Financials	6.27%	24.61%	-18.34%	-0.18%	1.93%	-0.05%	0.35%	-0.23%	1.70%
Health Care	14.81%	11.41%	3.40%	-0.14%	0.18%	0.50%	0.61%	0.36%	0.54%
Industrials	9.03%	13.05%	-4.03%	-0.07%	0.00%	0.07%	0.26%	0.00%	-0.01%
IT	33.54%	4.08%	29.46%	1.13%	3.30%	-0.87%	1.22%	0.26%	3.56%
Materials	4.13%	3.39%	0.74%	0.03%	0.01%	-0.07%	0.16%	-0.05%	-0.04%
Telecom	0.78%	4.62%	-3.83%	0.16%	-0.19%	0.04%	0.04%	0.20%	0.01%
Utilities	0.38%	7.04%	-6.67%	0.24%	-0.29%	-0.01%	0.00%	0.23%	-0.06%
TOTAL	100.00%	100.00%	0.00%	1.44%	4.86%	-0.41%	3.90%	1.02%	5.89%

- Utilities strategy *increased return and reduced risk*
- Utilities selection slightly detracted from return and had no impact on risk
- If Utilities forecast return negative, more aggressive underweight of Utilities warranted

Benefits of X-Sigma-Rho Allocation-Selection Risk Attribution

- Provides intuitive and additive allocation and selection risk contributions identifying the drivers of active risk
- Security-level drilldown into risk at both the fund and sector levels
- Explicit distinction between diversification effects at the fund and sector level
- Side-by-side performance and risk provides a basis for evaluating the trade-off between risk and return

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Montreal	+1.514.847.7506
Monterrey	+ 52.81.1253.0880
New York	+1.212.804.3901
San Francisco	+1.415.836.8800
São Paulo	+55.11.3706.1360
Stamford	+1.203.325.5630
Toronto	+1.416.628.1007

Europe, Middle East & Africa

Amsterdam	+31.20.462.1382
Cape Town	+27.21.673.0100
Frankfurt	+49.69.133.859.00
Geneva	+41.22.817.9777
London	+44.20.7618.2222
Madrid	+34.91.700.7275
Milan	+39.02.5849.0415
Paris	0800.91.59.17 (toll free)
Zurich	+41.44.220.9300

Asia Pacific

China North	10800.852.1032 (toll free)
China South	10800.152.1032 (toll free)
Hong Kong	+852.2844.9333
Seoul	+822.2054.8538
Singapore	800.852.3749 (toll free)
Sydney	+61.2.9033.9333
Tokyo	+81.3.5226.8222

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