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A New Class of Equity Style Indices

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Allianz IDS GmbH



Overview

- I. The Project
- II. The Data Universe
- III. The Style Indices
- IV. Performance
- V. Summary and Outlook
- VI. References



I. The Project

- Project Goal
 - Innovative class of equity style indices for the European capital market
- Most index providers: Size, value and growth
- Our aim
 - Implementation of known and novel styles in index construction
- Innovation
 - Novel indices: Idiosyncratic risk and illiquidity
- Project steps
 - Construction of portfolios in Wilshire Atlas and backtesting



II. The Data Universe

Dow Jones Stoxx 600 index*

- European universe
→ 600 largest companies
- Broad, representative and investable
- Data availability
- Realistic Replication
→ Free-float adjusted market capitalization weighted indices
→ Equal weighted indices

*) as well as CDAX



III. The Style Indices

The family of style indices contains:

- Beta
 - Size
 - Valuation
 - Momentum and Alpha
 - Idiosyncratic risk
 - Illiquidity
- Monthly, quarterly and semi-annual reweighting*
- Time-period is currently: September 2002 to May 2008
- Styles in the spirit of Sharpe (1992)

*) All following indices: Quarterly reweighted



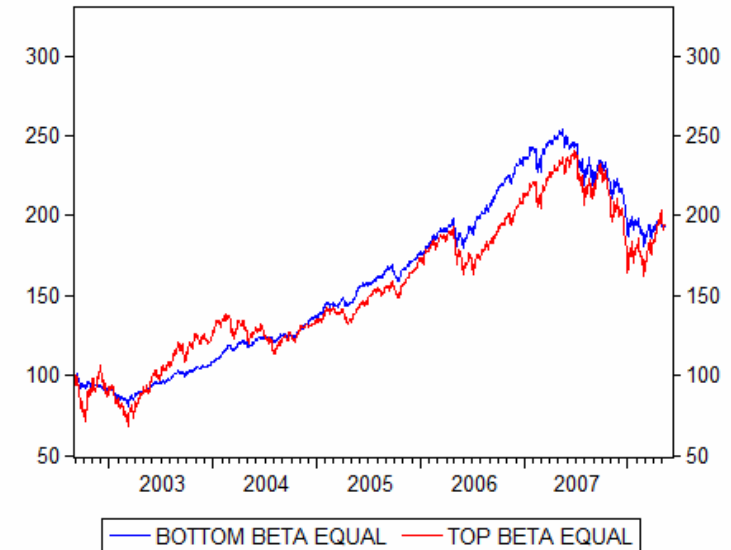
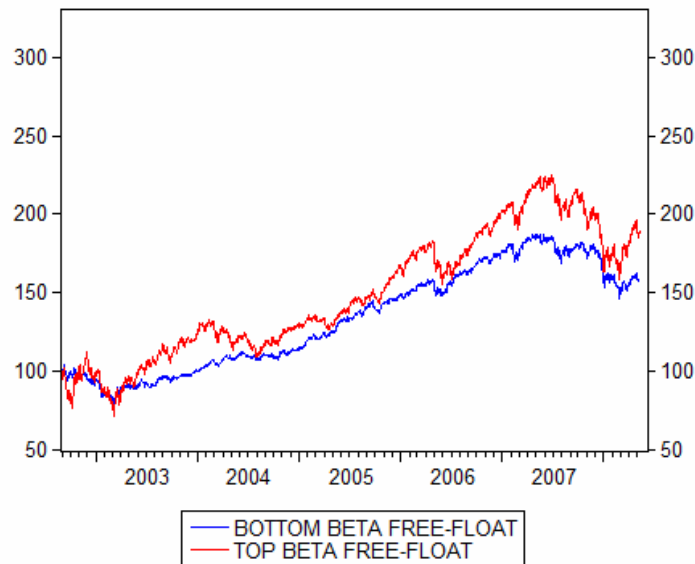
III.1. Beta

Criterion of systematic risk

$$\text{One factor model: } \tilde{R}_i - R_f = \alpha_i + \beta_i (\tilde{R}_M - R_f) + \tilde{\varepsilon}_i$$

Bottom Beta index: 5-25%-percentile

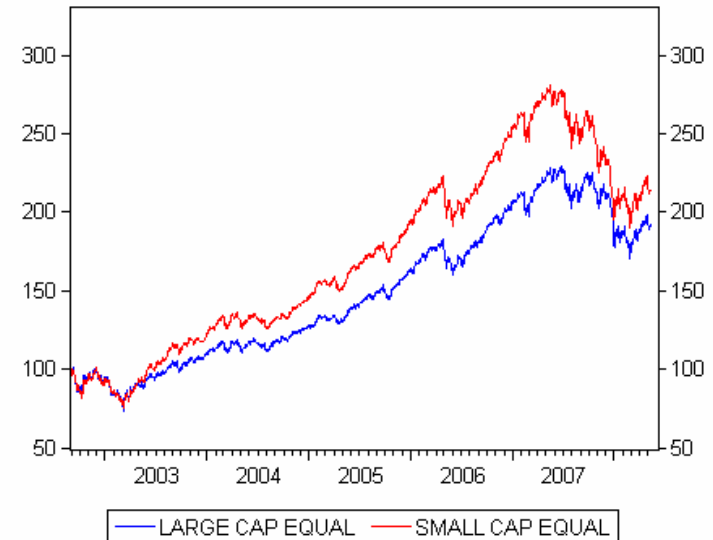
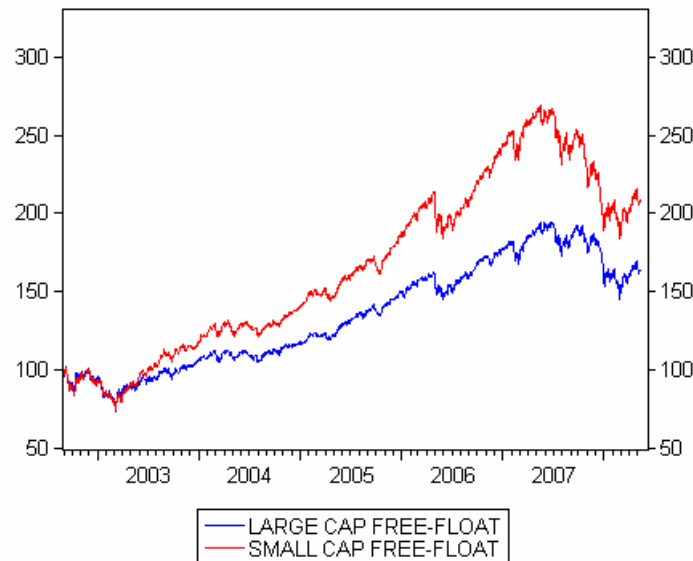
Top Beta index: 75-95%-percentile





III.2. Size

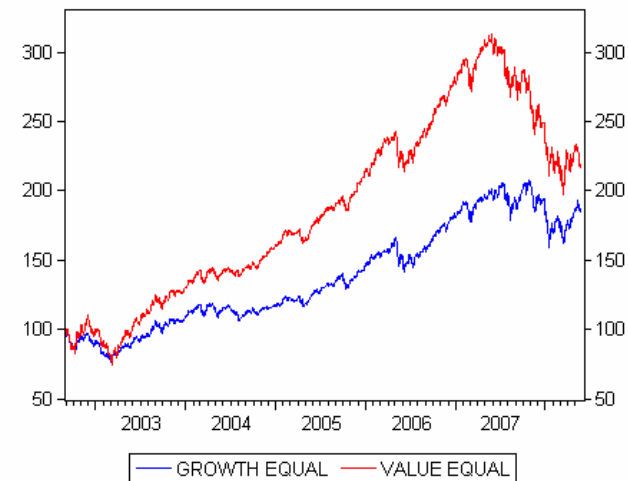
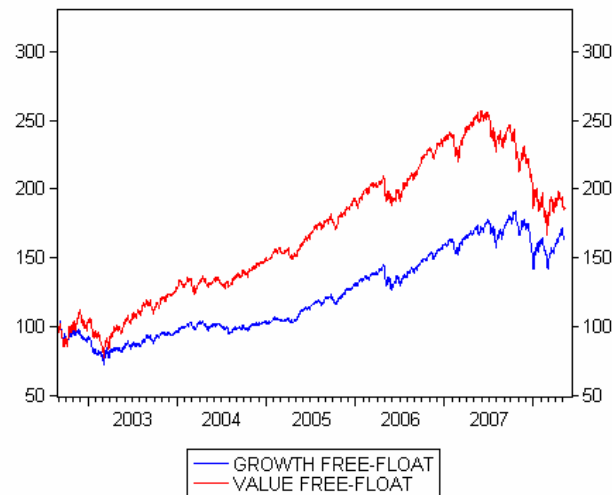
- Criterion of market capitalization
- Small Cap index: Bottom 20% (0-20%-percentile)
- Large Cap index: Remaining companies





III.3. Valuation

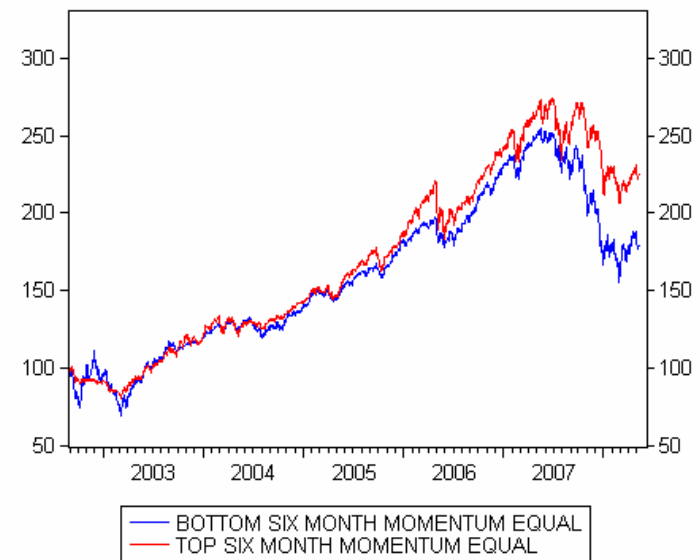
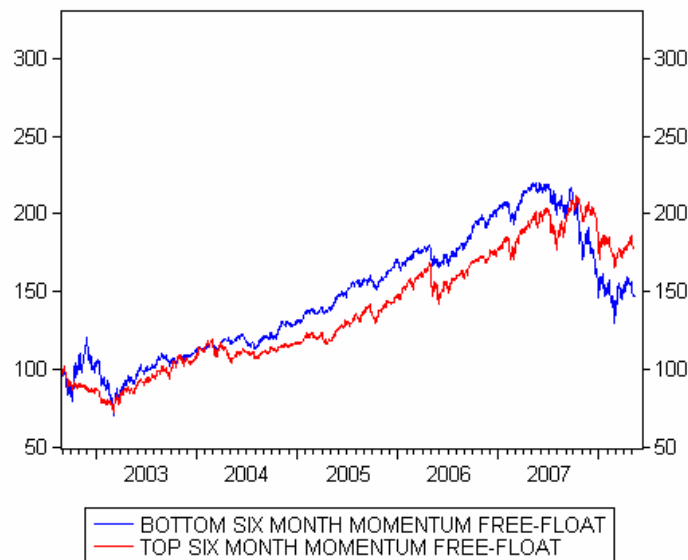
- Following Fama and French (1992, 1993)
- 2 out of 3 criteria: Price-to-book, price-to-earnings & dividend yield
- Value index: Low P/B and P/E ratios, high dividend yield (5-25%-and 75-95%-percentiles, respectively)
- Growth index: High P/B and P/E ratios, low dividend yield (75-95%- and 0-20%-percentiles, respectively)





III.4. Momentum

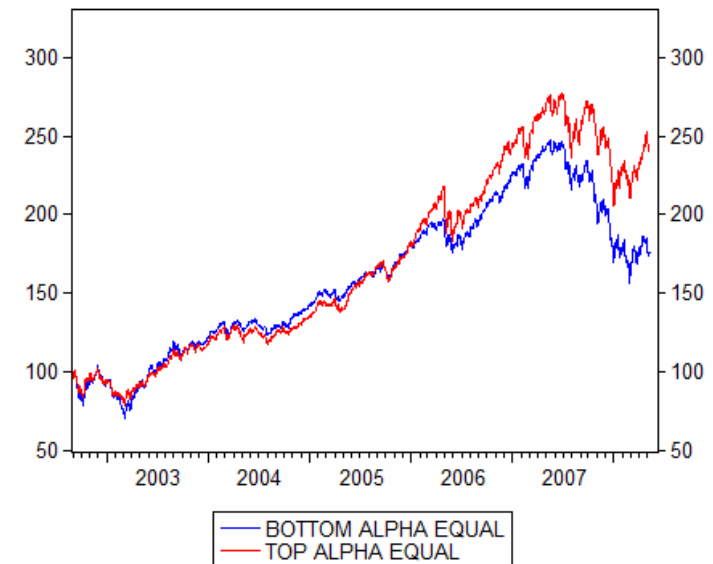
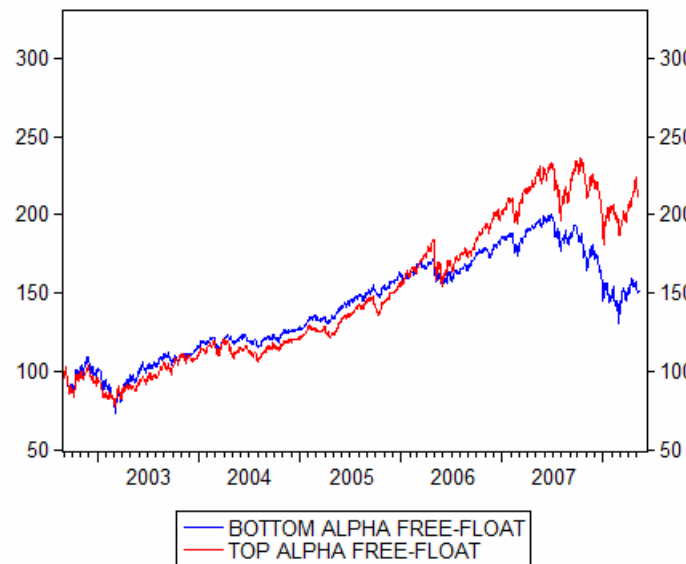
- Following Carhart (1997)
- Criterion: Past three or six month total return
- Depends on reweighting frequency and time period studied
- Bottom Momentum index: 5-25%-percentile
- Top Momentum index: 75-95%-percentile





III.5. Alpha

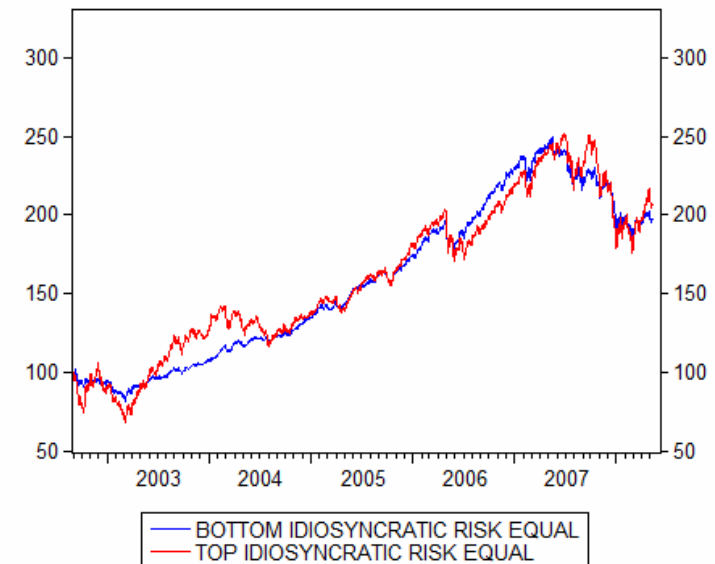
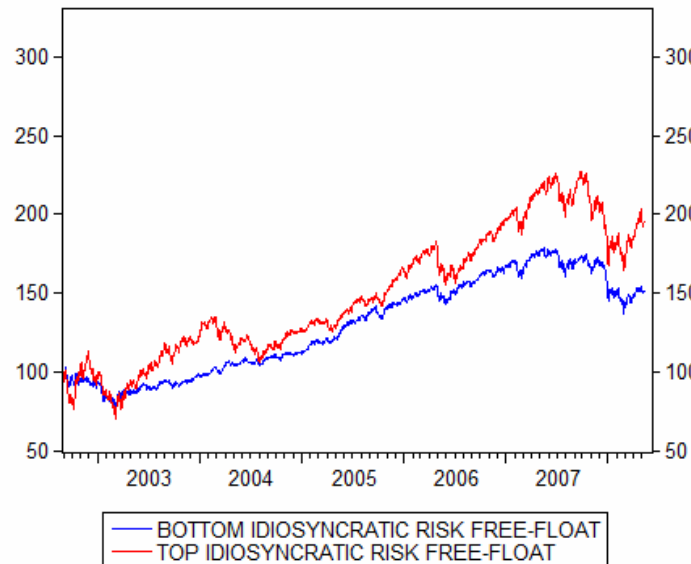
- Risk-adjusted momentum
- One-factor model: $\tilde{R}_i - R_f = \alpha_i + \beta_i (\tilde{R}_M - R_f) + \tilde{\epsilon}_i$
- Bottom Alpha index: 5-25%-percentile
- Top Alpha index: 75-95%-percentile





III.6. Idiosyncratic Risk

- Goyal and Santa-Clara (2003)
- Novelty in equity styles and index construction
- Criterion: Standard deviation of residuals in one-factor model
- Bottom Idiosyncratic Risk index: 5-25%-percentile
- Top Idiosyncratic Risk index: 75-95%-percentile





III.7. Illiquidity (I/II)

- Novelty in equity styles and index construction
- Systematic market illiquidity as a pricing factor
- Amihud (2002) price impact measure of illiquidity:

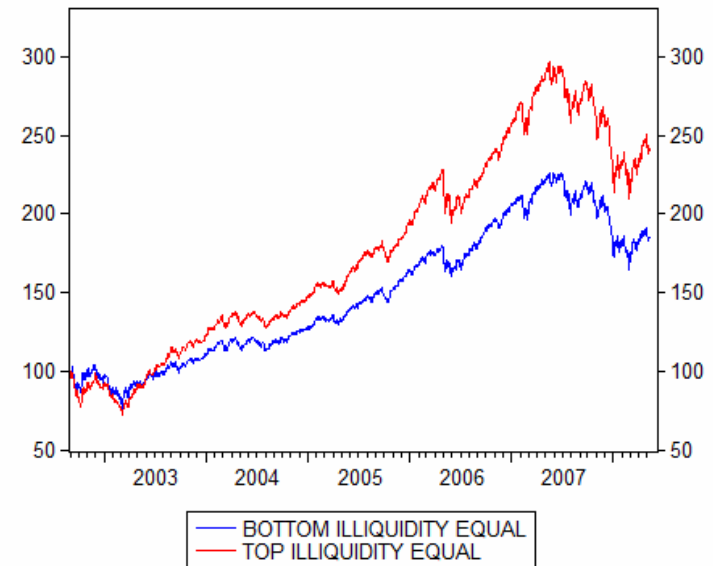
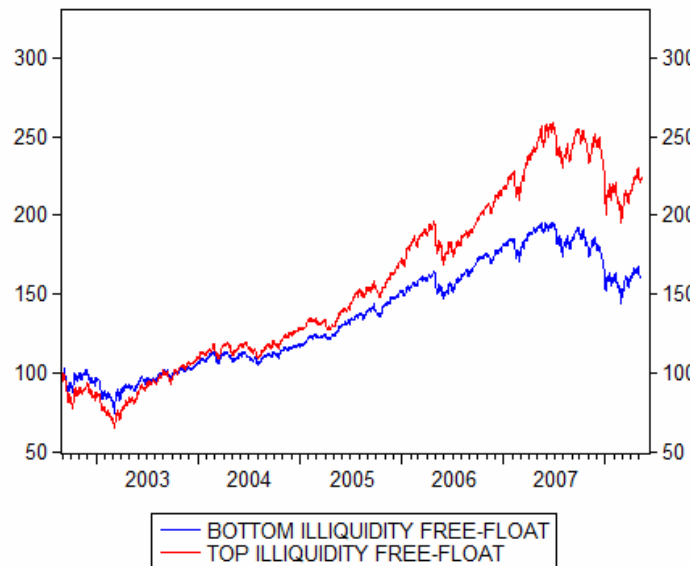
$$ILLIQ_{idt} = \frac{|R_{idt}|}{VOLE_{idt}}$$

- Data availability, but sensitivity to information arrival
- Calculated for each security under consideration of all past additions and deletions to and from the index: 936 companies
- Monthly and quarterly averages
- Additionally: Detrended Amihud measure



III.7. Illiquidity (II/II)

- Criterion: Amihud (2002) measure
- Bottom Illiquidity index: 5-25%-percentile
- Top Illiquidity index: 75-95%-percentile
- Here: Quarterly averages of Amihud measure





VI.1. Performance: Free-float weighted Indices*

| Free-float weighted 1485 obs. | TOP BETA | SMALL CAP | VALUE | TOP SIX MONTH MOM. | TOP ALPHA | TOP IDIOS. RISK | TOP ILLIQU. |
|----------------------------------|----------|--------------|--------|-----------------------|-----------|--------------------|----------------|
| Mean p.a. | 10.35% | 12.28% | 10.25% | 9.70% | 12.55% | 10.93% | 13.30% |
| p-value (t-stat.) | 0.261 | 0.060 | 0.212 | 0.159 | 0.103 | 0.240 | 0.073 |
| Median p.a. | 20.00% | 29.98% | 20.00% | 22.50% | 32.48% | 22.50% | 27.48% |
| Std. Dev. p.a. | 22.44% | 15.91% | 20.03% | 16.78% | 18.73% | 22.65% | 18.08% |
| Beta | 1.282 | 0.896 | 1.145 | 0.925 | 1.053 | 1.281 | 1.009 |

| Free-float weighted 1485 obs. | BOT. BETA | LARGE CAP | GROWTH | BOT. SIX MONTH MOM. | BOT. ALPHA | BOT. IDIOS. RISK | BOTTOM ILLIQU. |
|----------------------------------|-----------|-----------|--------|------------------------|------------|---------------------|-------------------|
| Mean p.a. | 7.63% | 8.03% | 8.10% | 6.15% | 6.58% | 6.75% | 7.85% |
| p-value (t-stat.) | 0.157 | 0.258 | 0.116 | 0.502 | 0.394 | 0.253 | 0.271 |
| Median p.a. | 20.00% | 17.50% | 25.00% | 17.50% | 15.00% | 15.00% | 15.00% |
| Std. Dev. p.a. | 13.10% | 17.30% | 16.82% | 22.34% | 18.82% | 14.40% | 17.35% |
| Beta | 0.722 | 1.024 | 0.944 | 1.232 | 1.083 | 0.815 | 1.023 |

*) In the following, t-statistics test null hypothesis of a zero daily logarithmic return. Statistically significant results are bold.
Performance of Dow Jones Stoxx 600 (free-float weighted): Mean (p.a.) = 8.80%, std. dev. (p.a.) = 16.85%.



VI.2. Performance: Equal weighted Indices*

| Equal weighted 1485 obs. | TOP BETA | SMALL CAP | VALUE | TOP SIX MONTH MOM. | TOP ALPHA | TOP IDIOS. RISK | TOP ILLIQU. |
|-----------------------------|----------|--------------|--------------|-----------------------|--------------|--------------------|----------------|
| Mean p.a. | 10.98% | 12.75% | 13.00% | 13.60% | 14.90% | 12.00% | 14.68% |
| p-value (t-stat.) | 0.208 | 0.048 | 0.080 | 0.028 | 0.029 | 0.148 | 0.021 |
| Median p.a. | 27.48% | 29.98% | 27.48% | 32.48% | 34.98% | 32.48% | 32.48% |
| Std. Dev. p.a. | 21.21% | 15.69% | 18.12% | 15.02% | 16.59% | 20.21% | 15.49% |
| Beta | 1.304 | 0.986 | 1.120 | 0.889 | 1.024 | 1.248 | 0.957 |

| Equal weighted 1485 obs. | BOT. BETA | LARGE CAP | GROWTH | BOT. SIX MONTH MOM. | BOT. ALPHA | BOT. IDIOS. RISK | BOTTOM ILLIQU. |
|-----------------------------|--------------|-----------|--------|------------------------|------------|---------------------|-------------------|
| Mean p.a. | 11.10% | 10.73% | 10.43% | 9.53% | 9.30% | 11.43% | 10.15% |
| p-value (t-stat.) | 0.020 | 0.121 | 0.114 | 0.238 | 0.201 | 0.018 | 0.141 |
| Median p.a. | 22.50% | 22.50% | 29.98% | 22.50% | 27.48% | 25.00% | 20.00% |
| Std. Dev. p.a. | 11.58% | 16.85% | 16.04% | 19.66% | 17.75% | 11.77% | 16.79% |
| Beta | 0.686 | 1.037 | 0.982 | 1.188 | 1.095 | 0.711 | 1.029 |

*) Performance of Dow Jones Stoxx 600 (equal-weighted): Mean (p.a.) = 12.13%, std. dev. (p.a.) = 15.79%.



VI.3. Performance: Factor Portfolios

| Free-float weighted 1485 obs. | BETA | SIZE | VALUATION | SIX MONTH MOM. | ALPHA | IDIOS. RISK | ILLIQUIDITY |
|----------------------------------|--------|-------|-----------|----------------|-------|-------------|--------------|
| Mean p.a. | 2.75% | 4.23% | 2.17% | 3.55% | 5.98% | 4.15% | 5.45% |
| T-stat. | 0.485 | 1.581 | 0.546 | 0.604 | 1.557 | 0.782 | 1.818 |
| P-value (t-stat.) | 0.628 | 0.114 | 0.585 | 0.546 | 0.120 | 0.434 | 0.069 |
| Median p.a. | 4.98% | 4.98% | 5.00% | 4.98% | 7.50% | 7.50% | 7.55% |
| Std. dev. p.a. | 13.77% | 6.53% | 9.71% | 14.37% | 9.35% | 12.95% | 7.32% |

| Equal weighted 1485 obs. | BETA | SIZE | VALUATION | SIX MONTH MOM. | ALPHA | IDIOS. RISK | ILLIQUIDITY |
|-----------------------------|--------|-------|-----------|----------------|--------------|-------------|-------------|
| Mean p.a. | -0.13% | 2.03% | 2.60% | 4.08% | 5.58% | 0.58% | 4.53% |
| T-stat. | -0.023 | 0.845 | 0.838 | 0.837 | 1.876 | 0.125 | 1.634 |
| P-value (t-stat.) | 0.981 | 0.398 | 0.402 | 0.403 | 0.061 | 0.901 | 0.103 |
| Median p.a. | 0.00% | 4.93% | 2.50% | 7.50% | 7.45% | 2.50% | 7.45% |
| Std. dev. p.a. | 13.09% | 5.85% | 7.53% | 11.89% | 7.25% | 11.34% | 6.77% |



VI.4. Correlations: Factor Portfolios

| Free-float weighted 1485 obs. | MARKET EXCESS RETURN | BETA | SIZE | VALUATION | SIX MONTH MOM. | ALPHA | IDIOS. RISK | ILLIQUIDITY |
|----------------------------------|-------------------------|--------|--------|-----------|----------------|--------|-------------|-------------|
| MARKET EXCESS RETURN | 1.000 | 0.685 | -0.330 | 0.349 | -0.361 | -0.092 | 0.606 | -0.032 |
| BETA | 0.685 | 1.000 | -0.132 | 0.446 | -0.443 | -0.065 | 0.920 | 0.241 |
| SIZE | -0.330 | -0.132 | 1.000 | -0.198 | 0.190 | 0.283 | 0.011 | 0.221 |
| VALUATION | 0.349 | 0.446 | -0.198 | 1.000 | -0.541 | -0.504 | 0.321 | -0.041 |
| SIX MONTH MOM. | -0.361 | -0.443 | 0.190 | -0.541 | 1.000 | 0.594 | -0.334 | 0.059 |
| ALPHA | -0.092 | -0.065 | 0.283 | -0.504 | 0.594 | 1.000 | 0.049 | 0.146 |
| IDIOS. RISK | 0.606 | 0.920 | 0.011 | 0.321 | -0.334 | 0.049 | 1.000 | 0.225 |
| ILLIQUIDITY | -0.032 | 0.241 | 0.221 | -0.041 | 0.059 | 0.146 | 0.225 | 1.000 |

| Equal weighted 1485 obs. | MARKET EXCESS RETURN | BETA | SIZE | VALUATION | SIX MONTH MOM. | ALPHA | IDIOS. RISK | ILLIQUIDITY |
|-----------------------------|-------------------------|--------|--------|-----------|----------------|--------|-------------|-------------|
| MARKET EXCESS RETURN | 1.000 | 0.737 | -0.363 | 0.288 | -0.405 | -0.206 | 0.692 | -0.354 |
| BETA | 0.737 | 1.000 | -0.237 | 0.255 | -0.560 | -0.279 | 0.941 | -0.164 |
| SIZE | -0.363 | -0.237 | 1.000 | -0.069 | 0.160 | 0.251 | -0.030 | 0.752 |
| VALUATION | 0.288 | 0.255 | -0.069 | 1.000 | -0.589 | -0.647 | 0.169 | -0.144 |
| SIX MONTH MOM. | -0.405 | -0.560 | 0.160 | -0.589 | 1.000 | 0.650 | -0.479 | 0.194 |
| ALPHA | -0.206 | -0.279 | 0.251 | -0.647 | 0.650 | 1.000 | -0.145 | 0.280 |
| IDIOS. RISK | 0.692 | 0.941 | -0.030 | 0.169 | -0.479 | -0.145 | 1.000 | -0.033 |
| ILLIQUIDITY | -0.354 | -0.164 | 0.752 | -0.144 | 0.194 | 0.280 | -0.033 | 1.000 |



VI. Summary and Outlook

- Summary of results
 - Wagner and Stocker (2008)
- Next steps:
 - Further analysis of indices (representativeness, substitutability, etc.)
 - Test of pricing relevancy
 - Analysis of different multifactor models
 - Mutual fund performance evaluation



VII. References

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