



# **Beyond the “Torpedo Effect” – An Examination of Factor-Based Portfolio Construction Techniques**

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# Overview

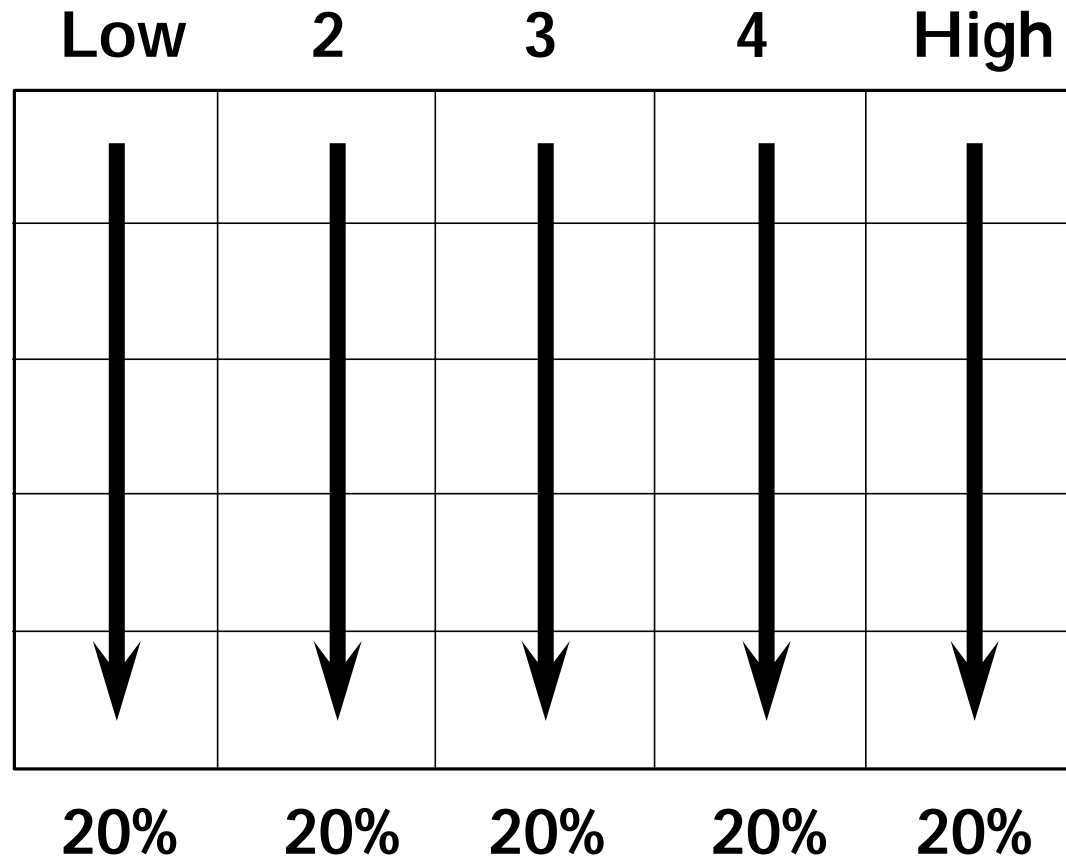
- ➔ Take a brief look at the “Torpedo Effect”
- ➔ Show how the methodology used to discover the “Torpedo Effect” reveals important insights into how financial markets behave (and, explain why these insights are often missed by classical regression analysis)
- ➔ Look at “Factor-Based Portfolios”

## Most Active Investors Use Earnings Forecasts

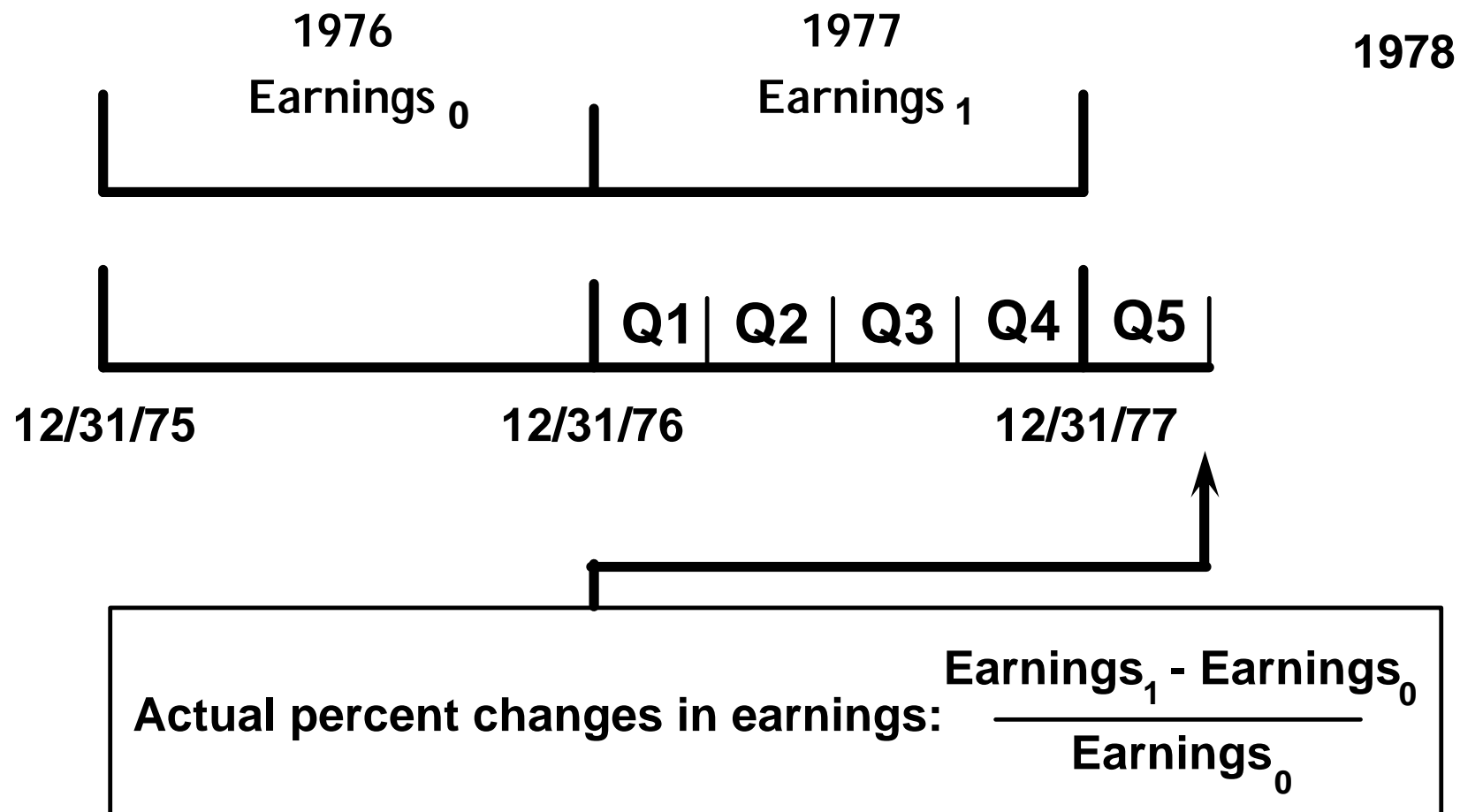
- ➔ However, few investors have evaluated the usefulness of perfect earnings forecasts – much less less-than-perfect forecasts
- ➔ Question: If you can forecast year-over-year changes in earnings, can you use this information to attain above-average investment returns?

# Analytical Framework

## ACTUAL EPS CHANGES



# Data Conventions – An *Ex Post* Factor

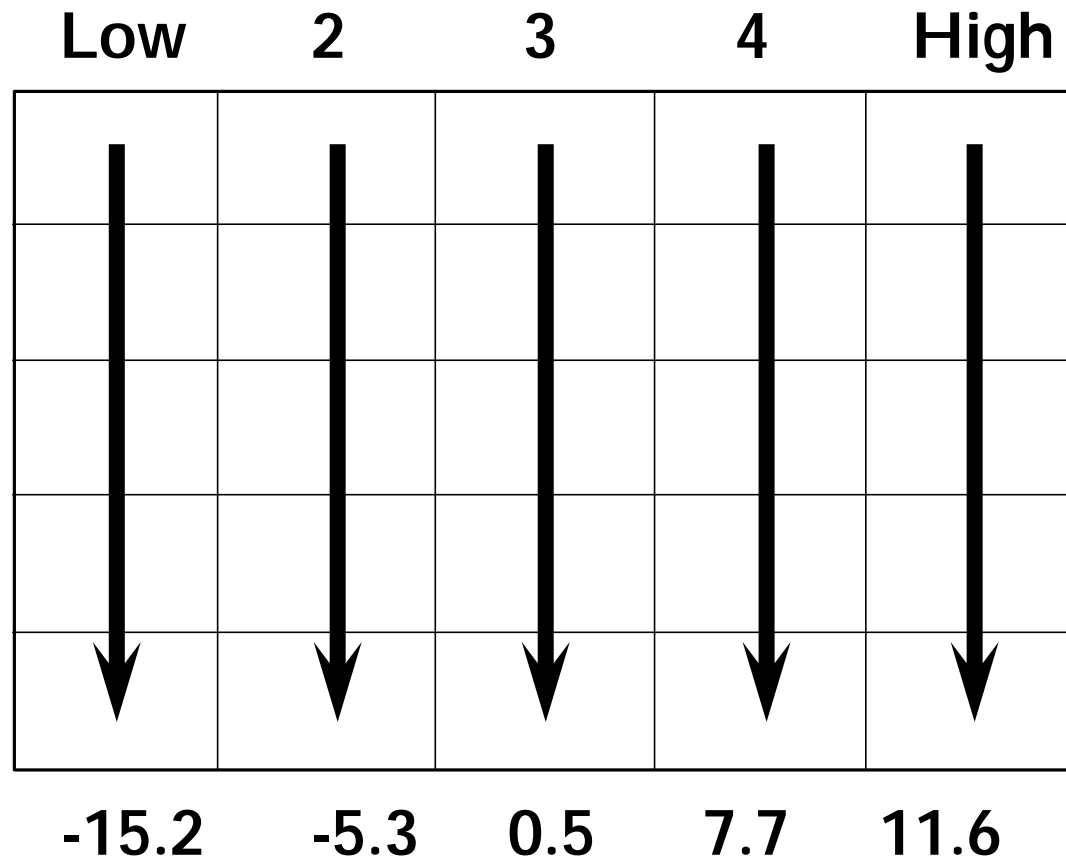


## Note the Simplicity of the Study

- ➔ One observation (trade) per year for 25 years
- ➔ 500-800 large closely followed stocks
- ➔ Holding periods – four consecutive quarters
- ➔ December fiscal year companies
- ➔ Metric: Five categories of percentage changes in **actual year-over-year earnings**; NOT the changes in expected versus actual earnings
- ➔ Later: I/B/E/S consensus forecasts

# Average Universe-Relative Returns for 25 One-Year Holding Periods

## ACTUAL EPS CHANGES



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**Fact:**

There is an extremely strong

**COINCIDENT**

“Earnings-Change Return-Change Effect”



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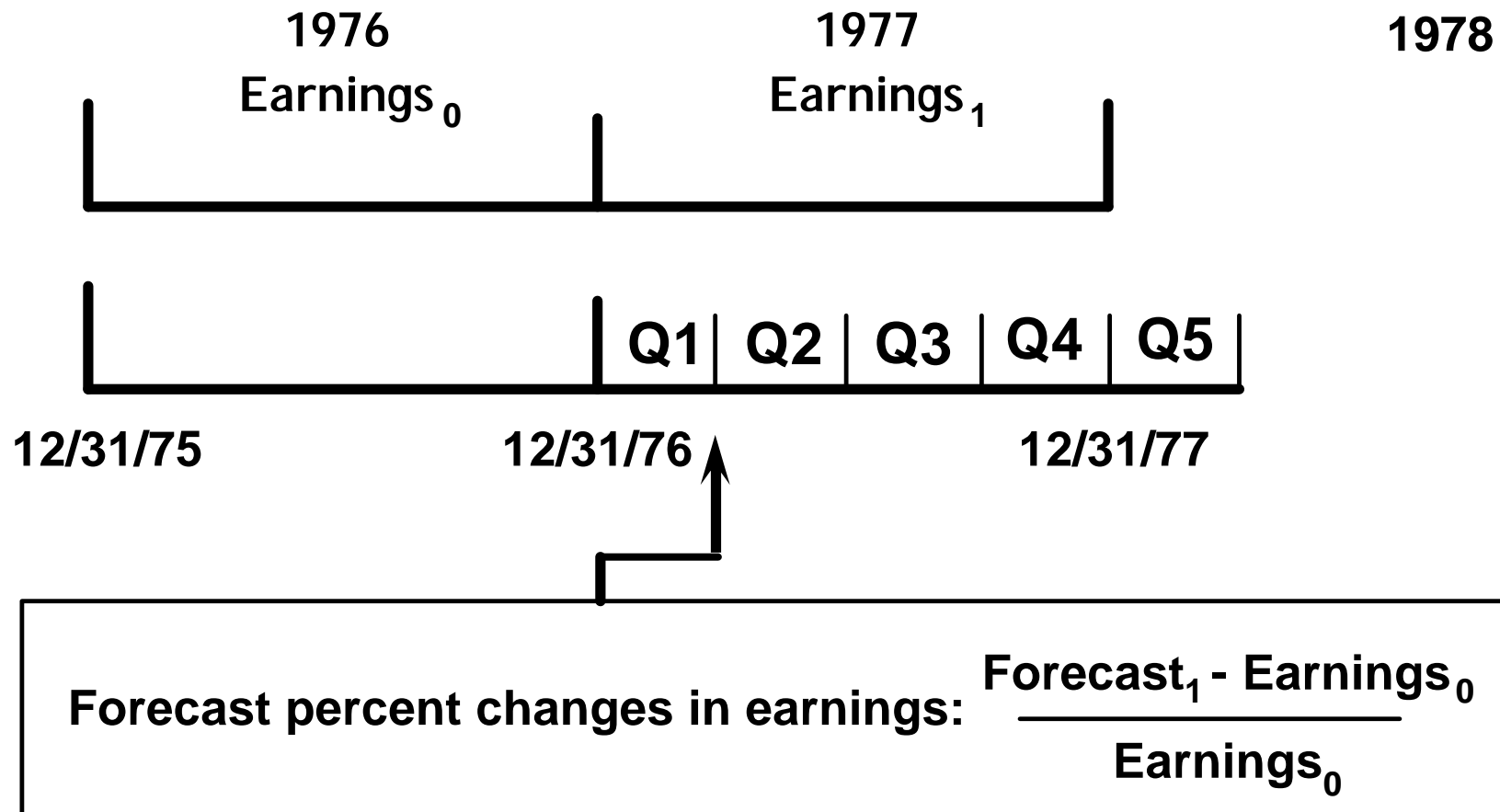
## Fact:

- ➔ Today's prices (of large actively traded stocks) do not accurately discount one-year-ahead earnings changes

## Therefore:

- ➔ A limited number of persons who can forecast relative year-over-year earnings changes (with sufficient accuracy to rank a 500-800 stock portfolio into five coming year-over-year earnings-change categories) can earn \$\$\$\$\$.

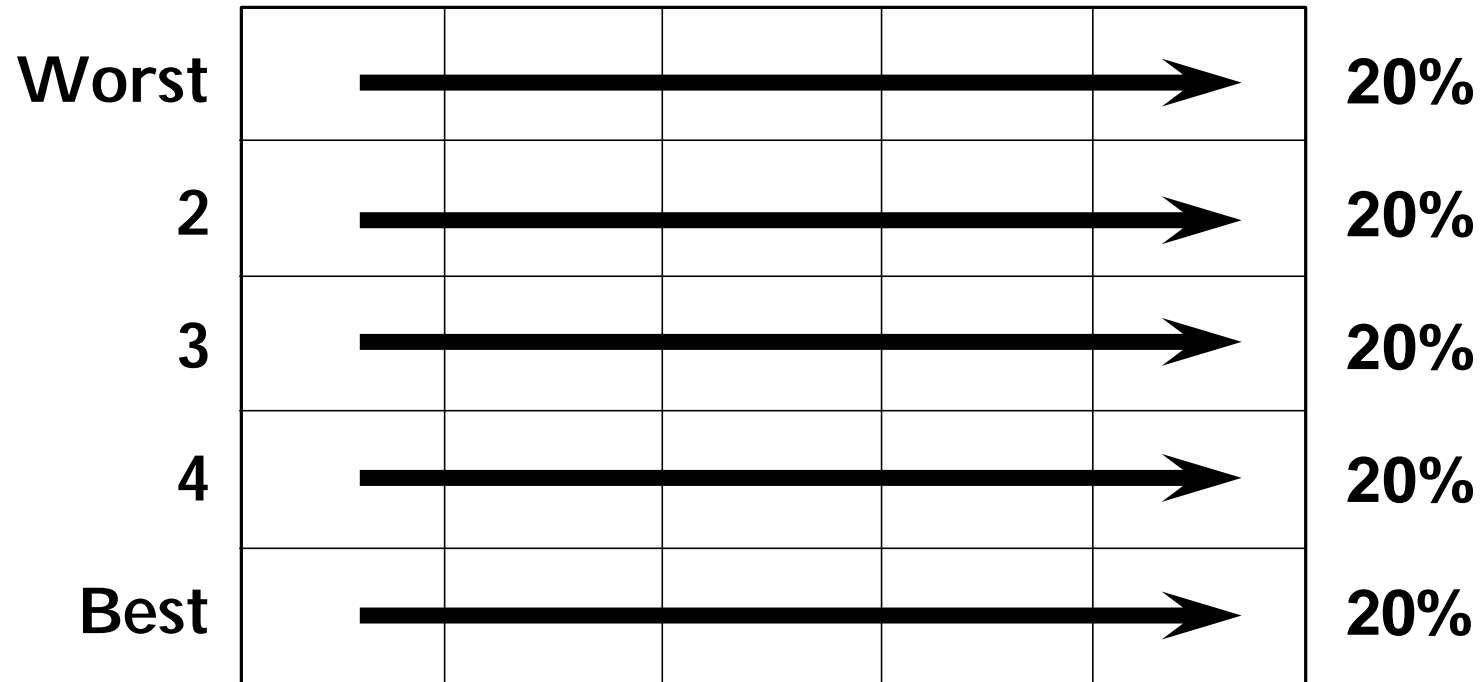
# Data Conventions- An *Ex Ante* Factor



# Can Forecasters Forecast?

**FORECAST  
EPS CHANGES**

**FREQUENCY**



# Perfect Forecasts

## ACTUAL EPS CHANGES

|          |      | Low | 2   | 3   | 4   | High | Total |
|----------|------|-----|-----|-----|-----|------|-------|
| FORECAST | Low  | 20% |     |     |     |      | 20%   |
|          | 2    |     | 20% |     |     |      | 20%   |
|          | 3    |     |     | 20% |     |      | 20%   |
|          | 4    |     |     |     | 20% |      | 20%   |
|          | High |     |     |     |     | 20%  | 20%   |
| Total    |      | 20% | 20% | 20% | 20% | 20%  |       |

# No Forecasting Skill

## ACTUAL EPS CHANGES

|          |      | Low | 2   | 3   | 4   | High | Total |
|----------|------|-----|-----|-----|-----|------|-------|
| FORECAST | Low  | 4%  | 4%  | 4%  | 4%  | 4%   | 20%   |
|          | 2    | 4%  | 4%  | 4%  | 4%  | 4%   | 20%   |
|          | 3    | 4%  | 4%  | 4%  | 4%  | 4%   | 20%   |
|          | 4    | 4%  | 4%  | 4%  | 4%  | 4%   | 20%   |
|          | High | 4%  | 4%  | 4%  | 4%  | 4%   | 20%   |
| Total    |      | 20% | 20% | 20% | 20% | 20%  |       |

# Forecasters Can Forecast + Pleasant Surprises

## ACTUAL EPS CHANGES

|          |      | Low | 2   | 3   | 4   | High |
|----------|------|-----|-----|-----|-----|------|
| FORECAST | Low  | 5.6 | 5.9 |     |     |      |
|          | 2    |     | 4.6 | 6.0 | 4.3 |      |
|          | 3    |     |     | 5.2 | 5.9 |      |
|          | 4    |     |     |     | 5.0 | 4.4  |
|          | High | 5.0 |     |     |     | 8.7  |

Total (Frequencies greater than 4%)

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So...

If forecasters can forecast accurately they can earn \$\$\$\$\$.

Forecasters *can forecast ...*

Therefore, persons who use I/B/E/S consensus forecasts can earn \$\$\$\$\$.



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So...

If forecasters can forecast accurately they can earn \$\$\$\$\$.

Forecasters *can forecast ...*

Therefore, persons who use forecasts can earn \$\$\$\$\$.

**Sorry. "Torpedoes" change the picture!**

# Earnings Surprises

## ACTUAL EPS CHANGES

|          |                            | Low  | 2    | 3    | 4    | High |
|----------|----------------------------|------|------|------|------|------|
| FORECAST | Low                        |      |      | 3.9% | 2.5% | 2.1% |
|          | 2                          | 2.9% |      |      |      | 2.3% |
|          | 3                          | 2.6% | 3.8% |      |      | 2.5% |
|          | 4                          | 3.9% | 3.4% | 3.2% |      |      |
|          | High                       | 5.0% | 2.3% | 1.7% | 2.3% |      |
| Total    | (Off-diagonal frequencies) |      |      |      |      |      |

# Average Universe-Relative Returns for 25 One-Year Holding Periods

## ACTUAL EPS CHANGES

|          |      | Low          | 2 | 3 | 4 | High |
|----------|------|--------------|---|---|---|------|
| FORECAST | Low  | <b>-8.6</b>  |   |   |   |      |
|          | 2    | <b>-13.2</b> |   |   |   |      |
|          | 3    | <b>-18.1</b> |   |   |   |      |
|          | 4    | <b>-19.6</b> |   |   |   |      |
|          | High | <b>-19.8</b> |   |   |   |      |
| Total    |      | <b>-15.2</b> |   |   |   |      |

# Average Universe-Relative Returns for 25 One-Year Holding Periods

## ACTUAL EPS CHANGES

|          |       | Low   | 2     | 3 | 4 | High |
|----------|-------|-------|-------|---|---|------|
| FORECAST | Low   | -8.6  | -0.7  |   |   |      |
|          | 2     | -13.2 | -4.0  |   |   |      |
|          | 3     | -18.1 | -6.8  |   |   |      |
|          | 4     | -19.6 | -10.7 |   |   |      |
|          | High  | -19.8 | -11.0 |   |   |      |
| Total    | -15.2 | -5.3  |       |   |   |      |

# Average Universe-Relative Returns for 25 One-Year Holding Periods

## ACTUAL EPS CHANGES

|          |      | Low   | 2     | 3    | 4 | High |
|----------|------|-------|-------|------|---|------|
| FORECAST | Low  | -8.6  | -0.7  | 4.1  |   |      |
|          | 2    | -13.2 | -4.0  | 2.5  |   |      |
|          | 3    | -18.1 | -6.8  | 0.3  |   |      |
|          | 4    | -19.6 | -10.7 | -5.7 |   |      |
|          | High | -19.8 | -11.0 | -6.6 |   |      |
| Total    |      | -15.2 | -5.3  | 0.5  |   |      |

# Average Universe-Relative Returns for 25 One-Year Holding Periods

## ACTUAL EPS CHANGES

|          |       | Low   | 2     | 3    | 4    | High |
|----------|-------|-------|-------|------|------|------|
| FORECAST | Low   | -8.6  | -0.7  | 4.1  | 10.3 |      |
|          | 2     | -13.2 | -4.0  | 2.5  | 10.9 |      |
|          | 3     | -18.1 | -6.8  | 0.3  | 9.0  |      |
|          | 4     | -19.6 | -10.7 | -5.7 | 4.2  |      |
|          | High  | -19.8 | -11.0 | -6.6 | 1.0  |      |
| Total    | -15.2 | -5.3  | 0.5   | 7.7  |      |      |

# Average Universe-Relative Returns for 25 One-Year Holding Periods

## ACTUAL EPS CHANGES

|          |      | Low   | 2     | 3    | 4    | High |
|----------|------|-------|-------|------|------|------|
| FORECAST | Low  | -8.6  | -0.7  | 4.1  | 10.3 | 15.1 |
|          | 2    | -13.2 | -4.0  | 2.5  | 10.9 | 17.1 |
|          | 3    | -18.1 | -6.8  | 0.3  | 9.0  | 16.6 |
|          | 4    | -19.6 | -10.7 | -5.7 | 4.2  | 11.8 |
|          | High | -19.8 | -11.0 | -6.6 | 1.0  | 8.1  |
| Total    |      | -15.2 | -5.3  | 0.5  | 7.7  | 11.6 |

# Average Universe-Relative Returns for 25 One-Year Holding Periods

## ACTUAL EPS CHANGES

|          |       | Low   | 2     | 3    | 4    | High | Total |
|----------|-------|-------|-------|------|------|------|-------|
| FORECAST | Low   | -8.6  | -0.7  | 4.1  | 10.3 | 15.1 | 1.4   |
|          | 2     | -13.2 | -4.0  | 2.5  | 10.9 | 17.1 | 2.6   |
|          | 3     | -18.1 | -6.8  | 0.3  | 9.0  | 16.6 | 1.4   |
|          | 4     | -19.6 | -10.7 | -5.7 | 4.2  | 11.8 | -2.5  |
|          | High  | -19.8 | -11.0 | -6.6 | 1.0  | 8.1  | -3.3  |
|          | Total | -15.2 | -5.3  | 0.5  | 7.7  | 11.6 |       |



## Why Do Value *And* Momentum Strategies Both Work?

- ➔ Value investors use a stock-selection process that systematically avoids the torpedoes that sink high-expectation portfolios
- ➔ Momentum investors ride the tide of the unfolding coincident earnings-change return-change effect

# Value versus Growth Over Long Periods

- ➡ Measured over long periods, certain value-based strategies produce above-average returns
- ➡ Similarly, over long periods, certain growth-based strategies produce above-average returns
- ➡ Unfortunately, both value and growth strategies experience agonizing periods with below-average returns

## Key – Uncorrelated Alphas

- ➔ Value strategies tend to work when growth strategies falter – and vice versa
- ➔ Combine value, growth, **and other appropriately-designed factor-based strategies** in a “core” portfolio that captures the long-term above-average returns with lower volatility

# Approach: Combine Factor-Based Portfolios

**ALPHA-  
GENERATION  
PORTFOLIOS**

**A**

**B**

**C**

**D**

**F**

- ➔ WITHIN each alpha-generation portfolio is a cluster of stocks that have SIMILAR (and desirable) return, variance, and covariance characteristics
- ➔ BETWEEN the different alpha-generation portfolios are DIFFERENT return, variance, and covariance characteristics

# Factor-Category (FatCat) Software

Select

- ➔ Any factor or category in the rows
- ➔ Any factor or category in the columns
- ➔ Any number of rows or columns
- ➔ Equal- or capitalization-weighted portfolios
- ➔ Single or multiple linked holding periods
- ➔ Estimated transaction costs. . .

## Factor-Category (FatCat) Software

Output for each portfolio (cell in the matrix):

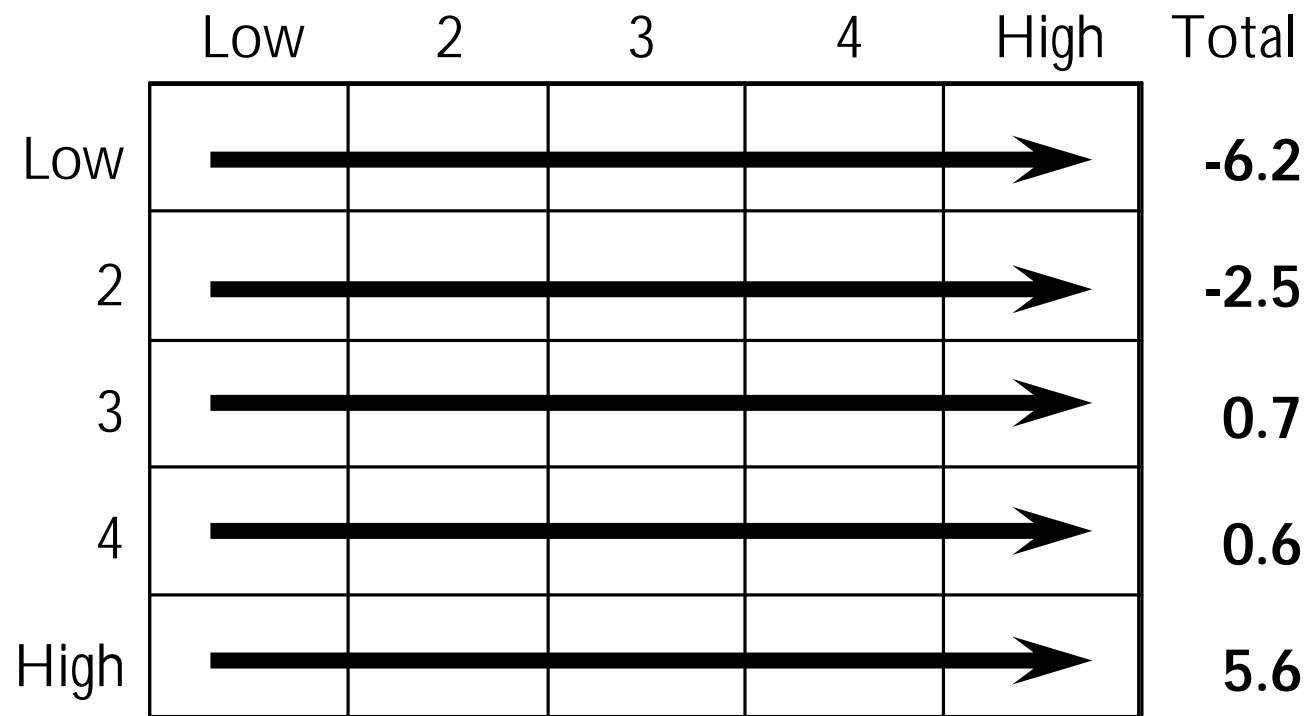
- ➔ Absolute return
- ➔ Universe-relative return
- ➔ Average capitalization
- ➔ Number of stocks (“click” to see names)
- ➔ “Hit ratio”
- ➔ Turnover

# Annualized Universe-Relative Return (%)

20 years  
monthly  
returns

Universe:  
700 largest  
capitalization  
companies

**EPS /  
Price**

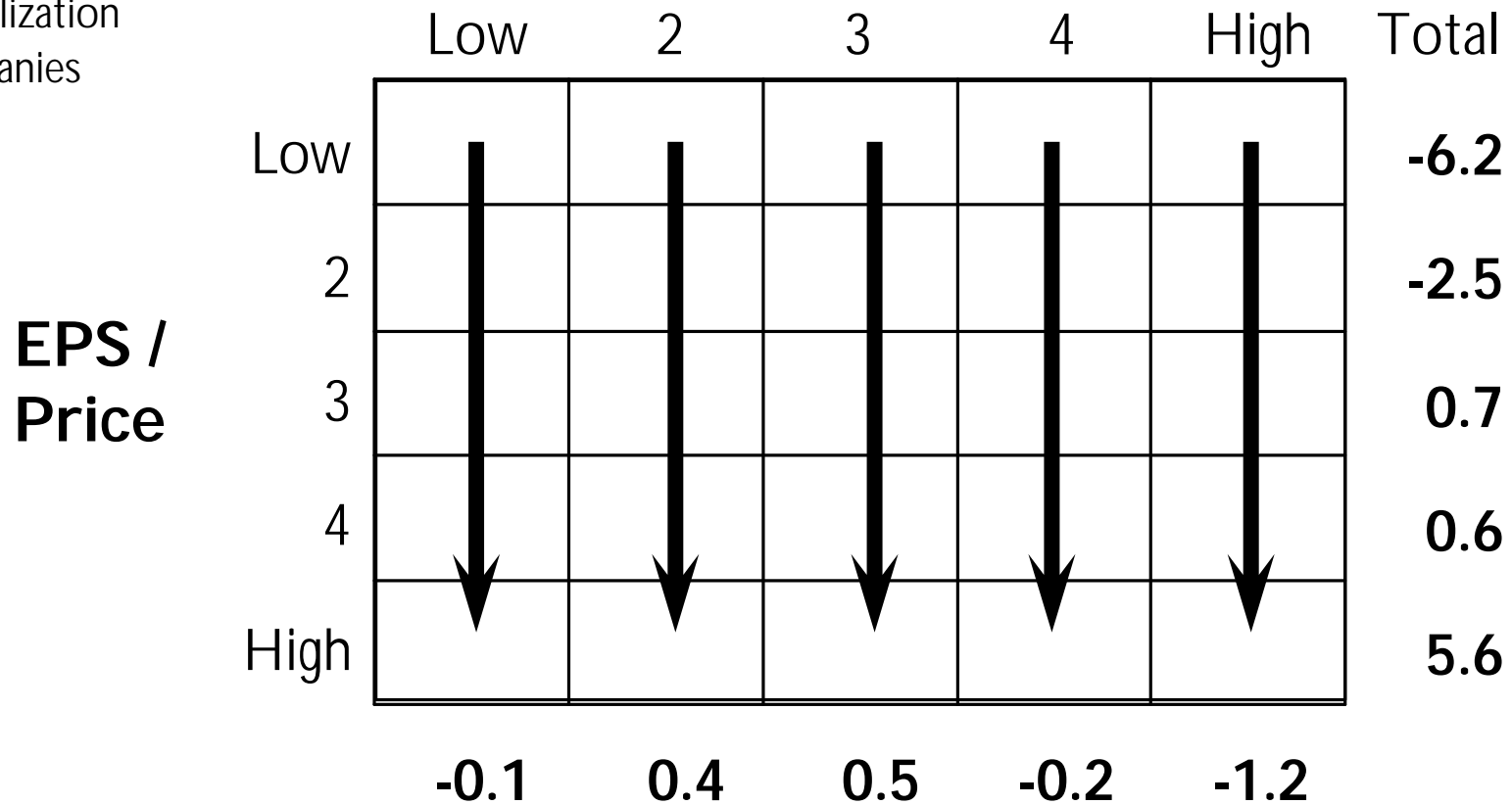


# Annualized Universe-Relative Return (%)

20 years  
monthly  
returns

Universe:  
700 largest  
capitalization  
companies

## MARKET CAPITALIZATION





# Annualized Universe-Relative Return (%)

20 years  
monthly  
returns

Universe:  
700 largest  
capitalization  
companies

## MARKET CAPITALIZATION

**EPS /  
Price**

|      | Low          | 2          | 3          | 4           | High        | Total       |
|------|--------------|------------|------------|-------------|-------------|-------------|
| Low  | <b>-10.9</b> |            |            |             |             | <b>-6.2</b> |
| 2    | <b>-6.1</b>  |            |            |             |             | <b>-2.5</b> |
| 3    | <b>2.0</b>   |            |            |             |             | <b>0.7</b>  |
| 4    | <b>1.2</b>   |            |            |             |             | <b>0.6</b>  |
| High | <b>10.8</b>  |            |            |             |             | <b>5.6</b>  |
|      | <b>-0.1</b>  | <b>0.4</b> | <b>0.5</b> | <b>-0.2</b> | <b>-1.2</b> |             |

# Annualized Universe-Relative Return (%)

20 years  
monthly  
returns

Universe:  
700 largest  
capitalization  
companies

## MARKET CAPITALIZATION

**EPS /  
Price**

|      | Low          | 2           | 3          | 4           | High        | Total       |
|------|--------------|-------------|------------|-------------|-------------|-------------|
| Low  | <b>-10.9</b> | <b>-5.5</b> |            |             |             | <b>-6.2</b> |
| 2    | <b>-6.1</b>  | <b>0.1</b>  |            |             |             | <b>-2.5</b> |
| 3    | <b>2.0</b>   | <b>0.3</b>  |            |             |             | <b>0.7</b>  |
| 4    | <b>1.2</b>   | <b>0.7</b>  |            |             |             | <b>0.6</b>  |
| High | <b>10.8</b>  | <b>4.9</b>  |            |             |             | <b>5.6</b>  |
|      | <b>-0.1</b>  | <b>0.4</b>  | <b>0.5</b> | <b>-0.2</b> | <b>-1.2</b> |             |

# Annualized Universe-Relative Return (%)

20 years  
monthly  
returns

Universe:  
700 largest  
capitalization  
companies

## MARKET CAPITALIZATION

**EPS /  
Price**

|      | Low   | 2    | 3    | 4    | High | Total |
|------|-------|------|------|------|------|-------|
| Low  | -10.9 | -5.5 | -8.3 |      |      | -6.2  |
| 2    | -6.1  | 0.1  | 0.0  |      |      | -2.5  |
| 3    | 2.0   | 0.3  | 1.2  |      |      | 0.7   |
| 4    | 1.2   | 0.7  | 1.1  |      |      | 0.6   |
| High | 10.8  | 4.9  | 5.6  |      |      | 5.6   |
|      | -0.1  | 0.4  | 0.5  | -0.2 | -1.2 |       |

# Annualized Universe-Relative Return (%)

20 years  
monthly  
returns

Universe:  
700 largest  
capitalization  
companies

## MARKET CAPITALIZATION

|                |      | Low   | 2    | 3    | 4    | High | Total |
|----------------|------|-------|------|------|------|------|-------|
| EPS /<br>Price | Low  | -10.9 | -5.5 | -8.3 | -4.9 |      | -6.2  |
|                | 2    | -6.1  | 0.1  | 0.0  | -2.8 |      | -2.5  |
|                | 3    | 2.0   | 0.3  | 1.2  | 0.4  |      | 0.7   |
|                | 4    | 1.2   | 0.7  | 1.1  | 0.1  |      | 0.6   |
|                | High | 10.8  | 4.9  | 5.6  | 3.6  |      | 5.6   |
|                |      | -0.1  | 0.4  | 0.5  | -0.2 | -1.2 |       |

# Market Capitalization Does Matter

20 years  
monthly returns

Universe:  
700 largest  
capitalization  
companies

## MARKET CAPITALIZATION

EPS /  
Price

|      | Low   | 2    | 3    | 4    | High | Total |
|------|-------|------|------|------|------|-------|
| Low  | -10.9 | -5.5 | -8.3 | -4.9 | -3.6 | -6.2  |
| 2    | -6.1  | 0.1  | 0.0  | -2.8 | -5.0 | -2.5  |
| 3    | 2.0   | 0.3  | 1.2  | 0.4  | -0.4 | 0.7   |
| 4    | 1.2   | 0.7  | 1.1  | 0.1  | -0.4 | 0.6   |
| High | 10.8  | 4.9  | 5.6  | 3.6  | 2.6  | 5.6   |
|      | -0.1  | 0.4  | 0.5  | -0.2 | -1.2 |       |

Alpha-  
Generating  
Portfolio

# Research Database

Twenty years of monthly, quarterly, and annual financial and market history for the largest 1,100 companies.

Factor categories include:

- Economic
- Estimate Revision
- Growth
- Momentum
- Profitability
- Quality
- Value
- Variability

# Sales / Price is not useful by itself

20 years  
quarterly  
returns

Annualized  
Universe-Relative  
Returns

**Value: Sales  
/ Price**

|      | Low | 2 | 3 | 4 | High | Total |
|------|-----|---|---|---|------|-------|
| Low  | →   |   |   |   |      | -2.6  |
| 2    | →   |   |   |   |      | -1.7  |
| 3    | →   |   |   |   |      | -0.5  |
| 4    | →   |   |   |   |      | 1.5   |
| High | →   |   |   |   |      | 1.1   |

# Momentum is useful

20 years  
quarterly  
returns

Annualized  
Universe-Relative  
Returns

## Momentum Return (previous 12 months)

**Value: Sales  
/ Price**

|       | Low  | 2    | 3    | 4   | High | Total |
|-------|------|------|------|-----|------|-------|
| Low   |      |      |      |     |      | -2.6  |
| 2     |      |      |      |     |      | -1.7  |
| 3     |      |      |      |     |      | -0.5  |
| 4     |      |      |      |     |      | 1.5   |
| High  |      |      |      |     |      | 1.1   |
| Total | -4.9 | -1.9 | -1.7 | 0.4 | 6.1  |       |



# Combined the Result is Better

20 years  
quarterly  
returns

Annualized  
Universe-Relative  
Returns

## Momentum Return (previous 12 months)

Value: Sales  
/ Price

|       | Low   | 2     | 3    | 4    | High | Total |
|-------|-------|-------|------|------|------|-------|
| Low   | -16.0 | -13.3 | -9.6 | -2.5 | -6.2 | -2.6  |
| 2     | -5.4  | -3.4  | -3.3 | -1.7 | 2.6  | -1.7  |
| 3     | -6.6  | 0.1   | -1.7 | 1.2  | 1.6  | -0.5  |
| 4     | 1.3   | -2.1  | 0.8  | 0.1  | 11.0 | 1.5   |
| High  | -1.4  | -0.1  | 1.4  | 4.5  | 15.1 | 1.1   |
| Total | -4.9  | -1.9  | -1.7 | 0.4  | 6.1  |       |

Alpha-  
Generating  
Portfolio

# Revision Variability is not useful by itself

20 years  
quarterly  
returns

Annualized  
Universe-  
Relative  
Returns

**Estimate  
Revisions:  
Variability**

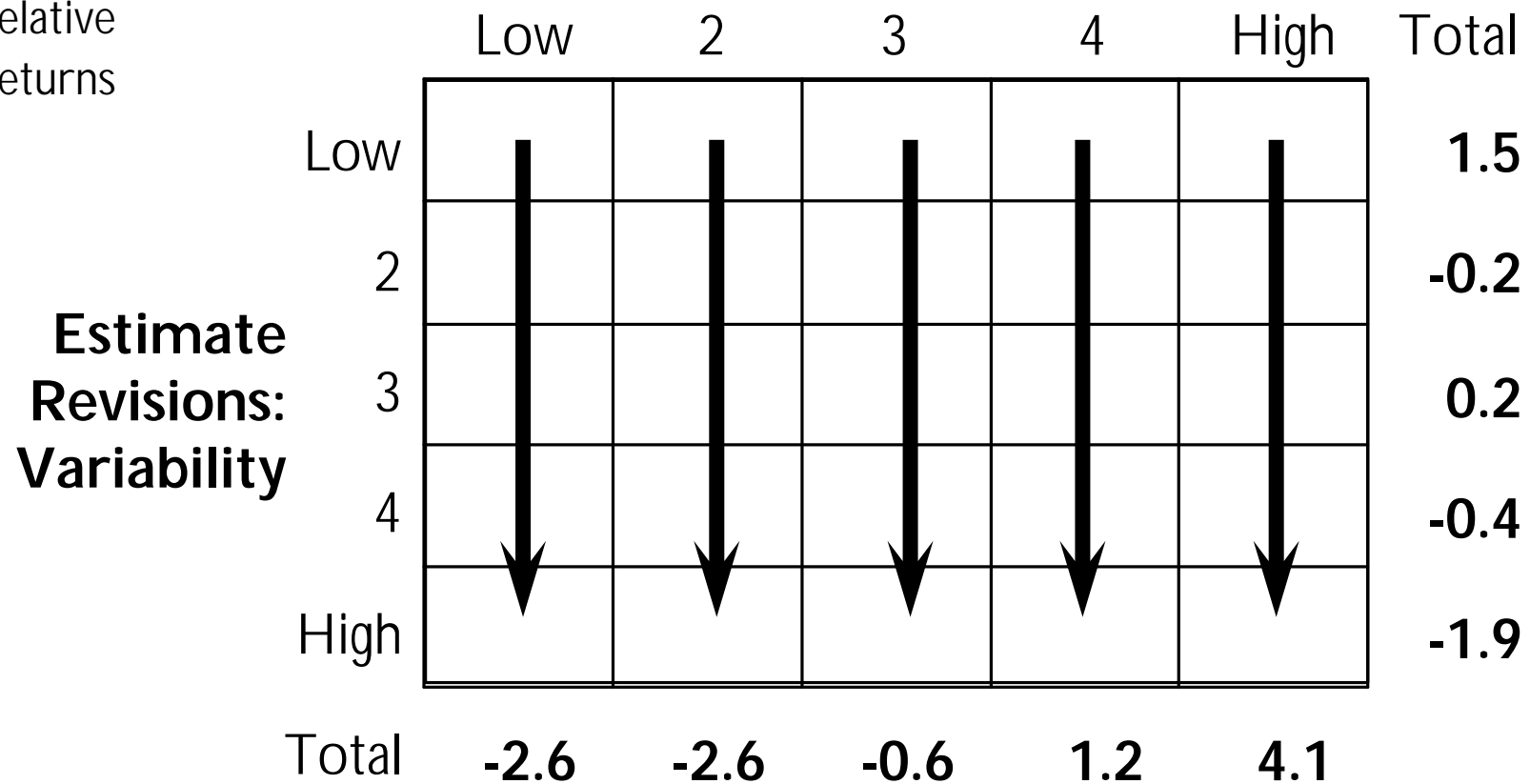
|      | Low | 2 | 3 | 4 | High | Total |
|------|-----|---|---|---|------|-------|
| Low  | →   |   |   |   |      | 1.5   |
| 2    | →   |   |   |   |      | -0.2  |
| 3    | →   |   |   |   |      | 0.2   |
| 4    | →   |   |   |   |      | -0.4  |
| High | →   |   |   |   |      | -1.9  |

# Estimate Revisions are more useful

20 years  
quarterly  
returns

Annualized  
Universe-  
Relative  
Returns

## Estimate Revisions: Pct. Ups vs. Downs (6 mos)



# Combined the result is much better

20 years  
quarterly  
returns

Annualized  
Universe-  
Relative  
Returns

## Estimate Revisions: Pct. Ups vs. Downs (6 mos)

Estimate  
Revisions:  
Variability

|      | Low  | 2    | 3    | 4    | High        | Total |
|------|------|------|------|------|-------------|-------|
| Low  | -5.2 | -2.9 | -2.2 | 2.5  | <b>12.0</b> | 1.5   |
| 2    | -2.5 | -2.8 | 0.0  | -1.2 | 2.4         | -0.2  |
| 3    | -3.1 | 0.4  | 1.6  | 2.0  | -1.3        | 0.2   |
| 4    | -0.4 | -4.1 | 0.0  | 0.1  | 2.2         | -0.4  |
| High | -4.0 | -2.0 | -3.4 | -0.1 | 3.4         | -1.9  |
|      | -2.6 | -2.6 | -0.6 | 1.2  | 4.1         |       |

**Alpha-  
Generating  
Portfolio**

# With semi-annual rebalancing . . .

20 years  
semi-annual  
returns

Annualized  
Universe-  
Relative  
Returns

## Estimate Revisions: Pct. Ups vs. Downs (6 mos)

Estimate  
Revisions:  
Variability

|      | Low  | 2    | 3    | 4    | High       | Total |
|------|------|------|------|------|------------|-------|
| Low  | -3.4 | -1.0 | -0.2 | 8.1  | <b>9.7</b> | 3.4   |
| 2    | -1.4 | -1.0 | -1.0 | 0.2  | -0.4       | -0.5  |
| 3    | -4.0 | -0.6 | -1.6 | -0.4 | -1.6       | -1.3  |
| 4    | -1.3 | -2.6 | -2.5 | 1.6  | 2.2        | -0.4  |
| High | -2.7 | -2.2 | -4.5 | -0.2 | -0.7       | -2.1  |
|      | -2.5 | -1.4 | -1.8 | 2.6  | 2.5        |       |

**Alpha-  
Generating  
Portfolio**

# With annual rebalancing . . .

20 years  
annual  
returns

Annualized  
Universe-  
Relative  
Returns

## Estimate Revisions: Pct. Ups vs. Downs (6 mos)

Estimate  
Revisions:  
Variability

|      | Low  | 2    | 3    | 4    | High        | Total |
|------|------|------|------|------|-------------|-------|
| Low  | -7.1 | -1.0 | -0.1 | 9.2  | <b>14.3</b> | 4.4   |
| 2    | -3.4 | -3.5 | -1.1 | -0.5 | 3.4         | -2.0  |
| 3    | -2.2 | 0.6  | -1.3 | -2.7 | -3.1        | -1.6  |
| 4    | -2.1 | -1.9 | -4.5 | -1.5 | 2.7         | -1.6  |
| High | -0.5 | -0.5 | -3.9 | -0.9 | 2.1         | -0.6  |
|      | -2.2 | -1.1 | -1.9 | 1.8  | 3.0         |       |

**Alpha-  
Generating  
Portfolio**

# An example over the last 20 years

20 years  
quarterly  
returns

Annualized  
Universe-  
Relative  
Returns

## Value: Free Cash Flow / Price

Variability:  
Beta

|      | Low   | 2    | 3    | 4   | High       | Total |
|------|-------|------|------|-----|------------|-------|
| Low  | -3.8  | -3.5 | -0.7 | 0.8 | 2.3        | -0.8  |
| 2    | -2.9  | -3.4 | 0.6  | 3.5 | 2.4        | 0.4   |
| 3    | -4.7  | -1.0 | 4.6  | 4.4 | 1.2        | 1.0   |
| 4    | 8.5   | -5.0 | 0.1  | 3.3 | 2.4        | -1.7  |
| High | -11.3 | -6.1 | 0.5  | 6.4 | <b>9.9</b> | -1.8  |
|      | -6.6  | -3.3 | 1.6  | 3.6 | 3.8        |       |

**Alpha-  
Generating  
Portfolio**

# Over the last 15 years . . .

last 15 years  
quarterly  
returns

Annualized  
Universe-  
Relative  
Returns

## Value: Free Cash Flow / Price

Variability:  
Beta

|      | Low   | 2    | 3    | 4   | High | Total |
|------|-------|------|------|-----|------|-------|
| Low  | -6.1  | -4.4 | -2.2 | 2.3 | 2.0  | -1.2  |
| 2    | -4.0  | -4.0 | -1.1 | 3.7 | 2.2  | -0.4  |
| 3    | -5.1  | -1.9 | 5.2  | 4.0 | 2.1  | 0.9   |
| 4    | -9.4  | -6.0 | -0.4 | 4.2 | 4.7  | -1.7  |
| High | -11.4 | -7.1 | 2.6  | 7.5 | 12.7 | -1.1  |
|      | -7.4  | -4.0 | 1.7  | 4.5 | 4.2  |       |

**Alpha-  
Generating  
Portfolio**



Over the last 10 years . . .

last 10 years  
quarterly  
returns

Annualized  
Universe-  
Relative  
Returns

**Value: Free Cash Flow / Price**

**Variability:  
Beta**

|      | Low   | 2    | 3    | 4   | High | Total |
|------|-------|------|------|-----|------|-------|
| Low  | -8.7  | -4.7 | -4.0 | 3.3 | 3.7  | -1.4  |
| 2    | -3.4  | -4.3 | -0.8 | 3.8 | 2.8  | 0.1   |
| 3    | -2.7  | -1.7 | 6.6  | 5.3 | 3.5  | 2.4   |
| 4    | -9.7  | -7.1 | -0.2 | 3.4 | 3.3  | -2.1  |
| High | -15.8 | -9.2 | 0.1  | 9.9 | 13.1 | -3.2  |
|      | -8.4  | -4.8 | 1.5  | 5.8 | 4.6  |       |

**Alpha-  
Generating  
Portfolio**

Over the last 5 years . . .

last 5 years  
quarterly  
returns

Annualized  
Universe-  
Relative  
Returns

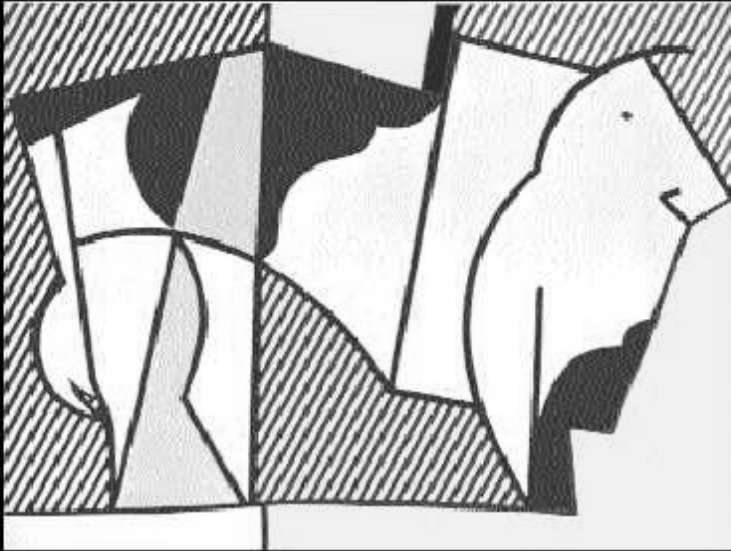
**Value: Free Cash Flow / Price**

**Variability:  
Beta**

|      | Low   | 2     | 3    | 4   | High | Total |
|------|-------|-------|------|-----|------|-------|
| Low  | -3.6  | -5.0  | -5.0 | 8.7 | 6.9  | 1.3   |
| 2    | 1.5   | -5.0  | -0.5 | 6.3 | 5.4  | 2.1   |
| 3    | -2.7  | 1.6   | 7.4  | 3.7 | 3.4  | 3.2   |
| 4    | -8.5  | -6.4  | -1.8 | 2.9 | 0.8  | -2.4  |
| High | -23.5 | -15.5 | 6.3  | 2.3 | 13.4 | -10.5 |
|      | -8.7  | -5.4  | 0.2  | 6.0 | 5.9  |       |

**Alpha-  
Generating  
Portfolio**

WILEY FINANCE



# Investment Management

*Portfolio Diversification, Risk, and Timing  
Fact and Fiction*

**Robert L. Hagin**