MGMT MFE 431-3
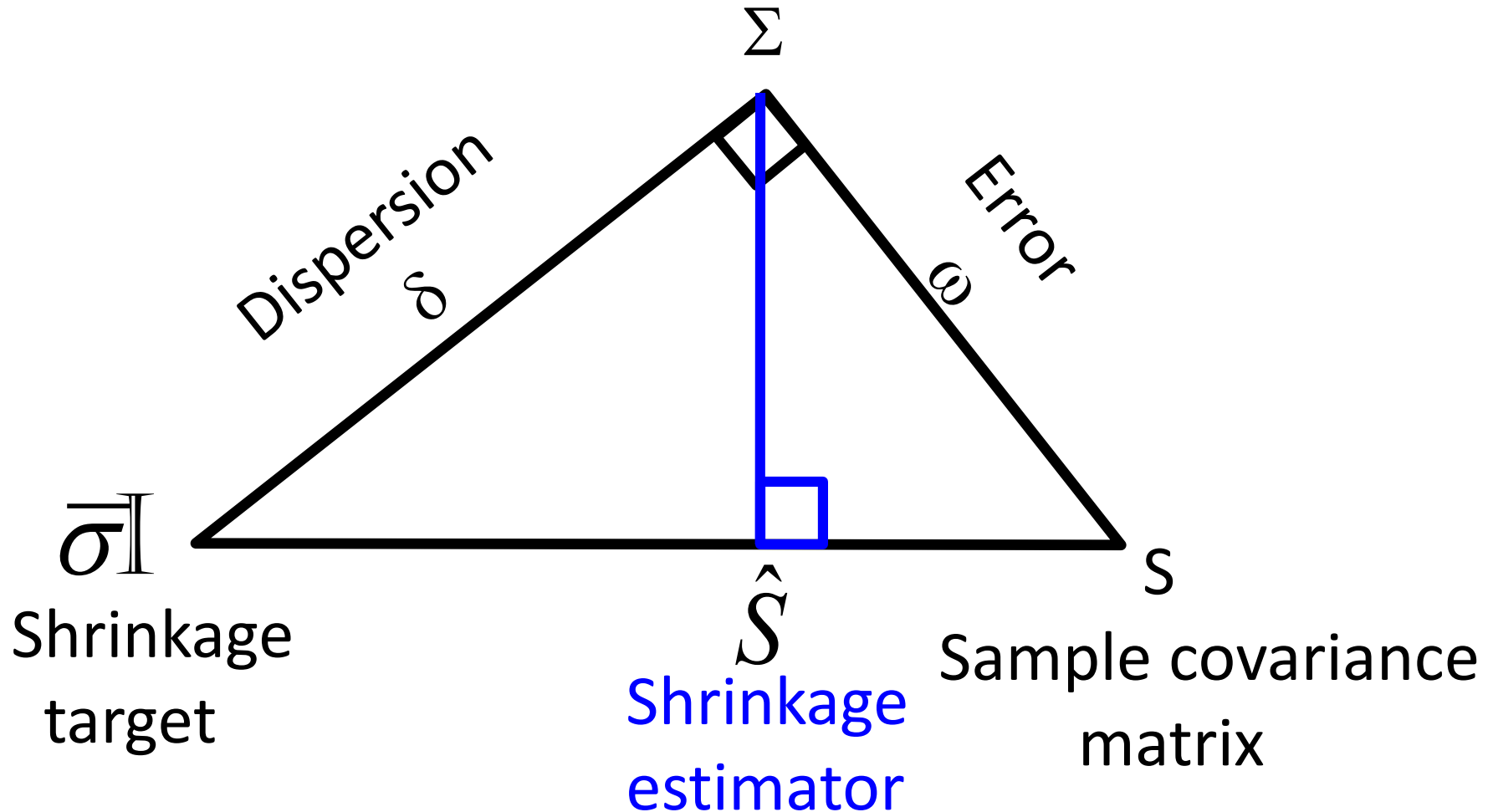# **Statistical Arbitrage**
Lecture 05: Alphas
Professor Olivier Ledoit

University of California Los Angeles
Anderson School of Management
Master of Financial Engineering
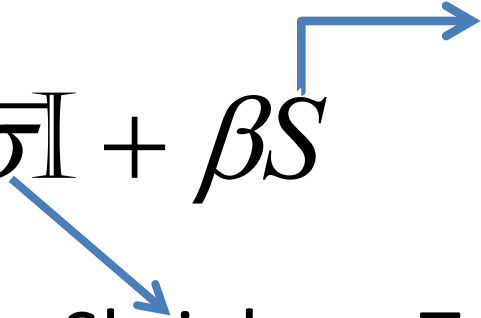Fall 2019

Geometric Interpretation

True covariance matrix

Σ

Dispersion δ

Error ω

$\overline{\sigma}\mathbb{I}$

Shrinkage target

$\hat{S}$

Shrinkage estimator

S

Sample covariance matrix

Shrinking the Covariance Matrix

$$\hat{S} = (1 - \beta)\overline{\sigma}\mathbb{I} + \beta S$$

Sample Covariance Matrix

Shrinkage Target

$$\overline{\sigma} = \frac{1}{n}\sum_{i=1}^{n}\sigma_{ii}$$

Scaling factor = average variance

Alpha

- Source of expected return over and beyond what is explained by market beta
- Time-varying $\rightarrow$ *(T × n)* matrix of alphas
  - T = number of days
  - n = number of stocks
- Cross-sectionally standardized every day:
  - Mean zero across all (active) stocks
  - Variance one across all (active) stocks

Winsorization

- Subtract robust estimate of the mean
- Divide by the standard deviation
- Every alpha > 3 is brought down to 3
- Every alpha < -3 is brought up to -3

- Reiterate a few times

Some Sources of Alpha

1) Value vs. Glamour
2) Long-term price momentum
3) High-volume premium
4) New issues puzzle
5) Post-earnings announcement drift

1) Value vs. Glamour

- Fama & French (1992): B/M Book-to-Market
- Basu (1983): E/P ratio: Earnings yield
- Kothari & Shanken (1997): D/P: Dividend Yield
- Lakonishok, Schleifer & Vishny (1994): C/P: Cash flow to price
- Etc…

- Long-term Contrarian bucket

General Structure of Value Alpha

- *<Fundamental>* divided by market price
- Not the other way around!
- Only market price is guaranteed to be > 0

Combining Alphas

- Let $\alpha_{ti}{}^{1}$ be a standardized winsorized alpha for stock i on date t

- Let $\alpha_{ti}{}^{2}$ be another alpha

- Aggregate Alpha:

$$\alpha_{ti} = w_1 \times \alpha_{ti}{}^{1} + w_2 \times \alpha_{ti}{}^{2}$$

- Winsorize aggregate alpha

Generalization

- Combine many flavors of the value alpha to make better aggregate value alpha

- Numerator:

  1. Last reported book value of equity
  2. Trailing earnings
  3. Trailing sales
  4. Trailing dividends
  5. Trailing cash flow

Forward-looking

- Use consensus of analyst forecasts
- Numerator:
  6. Analyst forecast of future earnings
  7. Analyst forecast of future sales
  8. Analyst forecast of future dividends
  9. Analyst forecast of future cash flow
- Choose the weights: judgement
- If use backtest

Combine Next 2 Fiscal Years
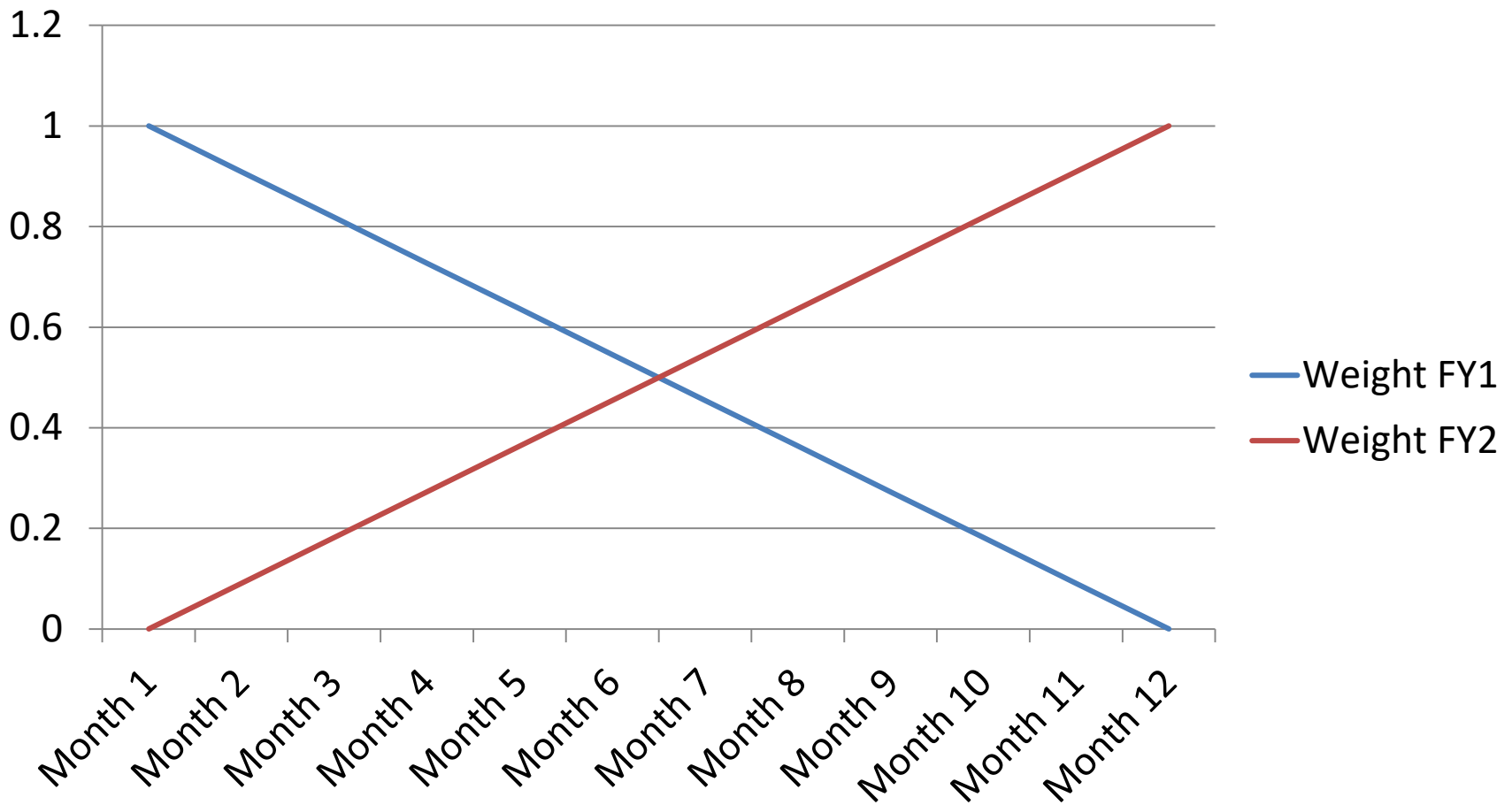
Aggregate Value Alpha

- Combine several value alphas together

- Flow alphas balance stock alphas
- Backward-looking balance forward-looking alphas

- Choose optimal weights using judgement
- If using backtest: beware of data-mining!

Accounting-Based Valuation Models

- Ohlson (1995) "Earnings, book values, and dividends in security valuation" *Contemporary Accounting*

- Residual Income Model (RIM) / Economic Value Added (EVA)

- Gishan Dissanaike and Kim-Hwa Lim (2010) "The Sophisticated and the Simple" *European Financial Management* $\Rightarrow$ C/P almost as good

2) Momentum

a) Straight momentum

b) Echo momentum

c) Momentum Consistency

d) Industry Momentum

e) Style Momentum

f) Momentum Acceleration

2a) Straight Momentum

- Jegadeesh and Titman (1993) "Returns to Buying Winners and Selling Losers: Implications for Stock Market Efficiency" *Journal of Finance*

- Compute stock return from T-12 months to T-1 month

- If high $\rightarrow$ buy the stock

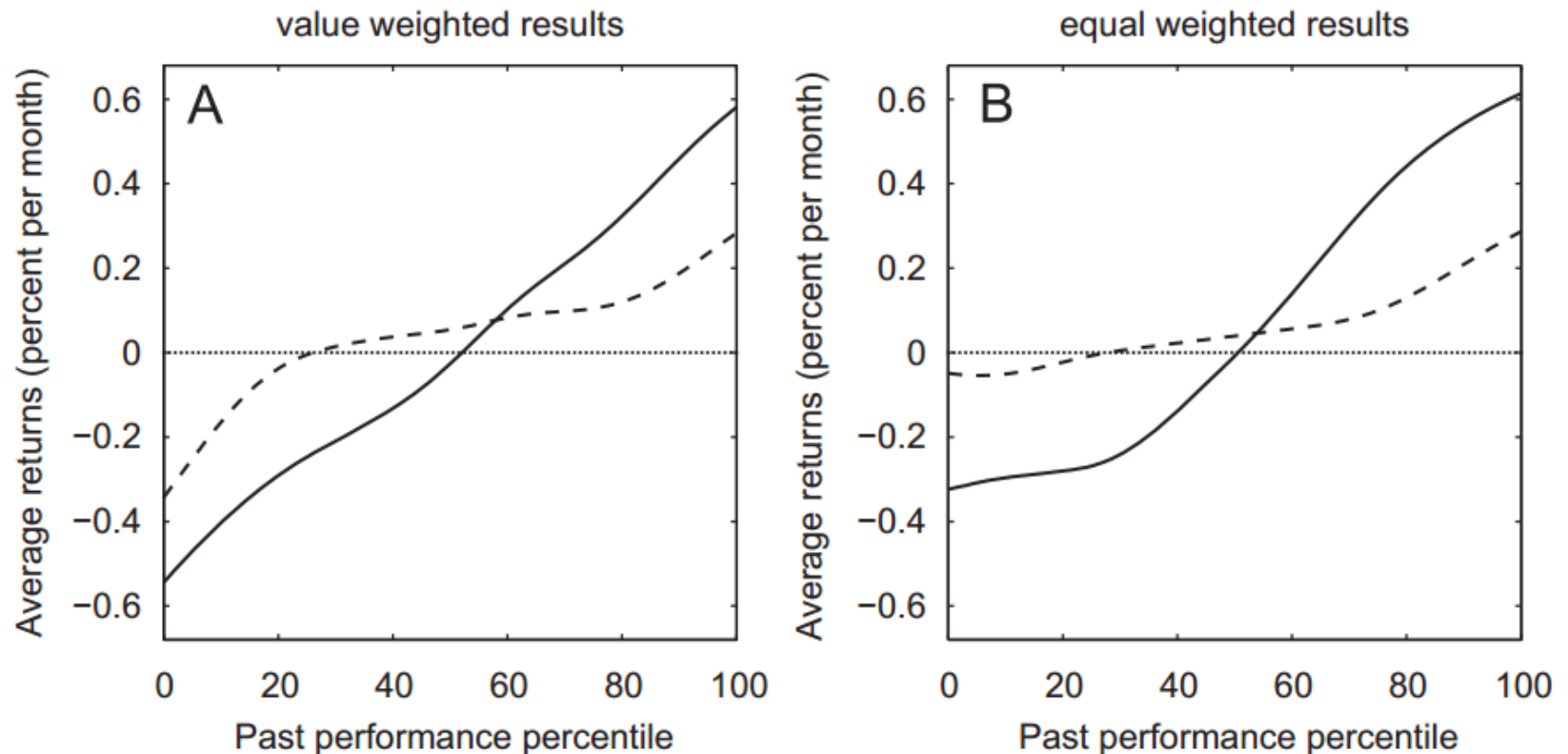- If low $\rightarrow$ sell the stock

Deutsche Bank – July 2011

Figure 39: Cumulative performance
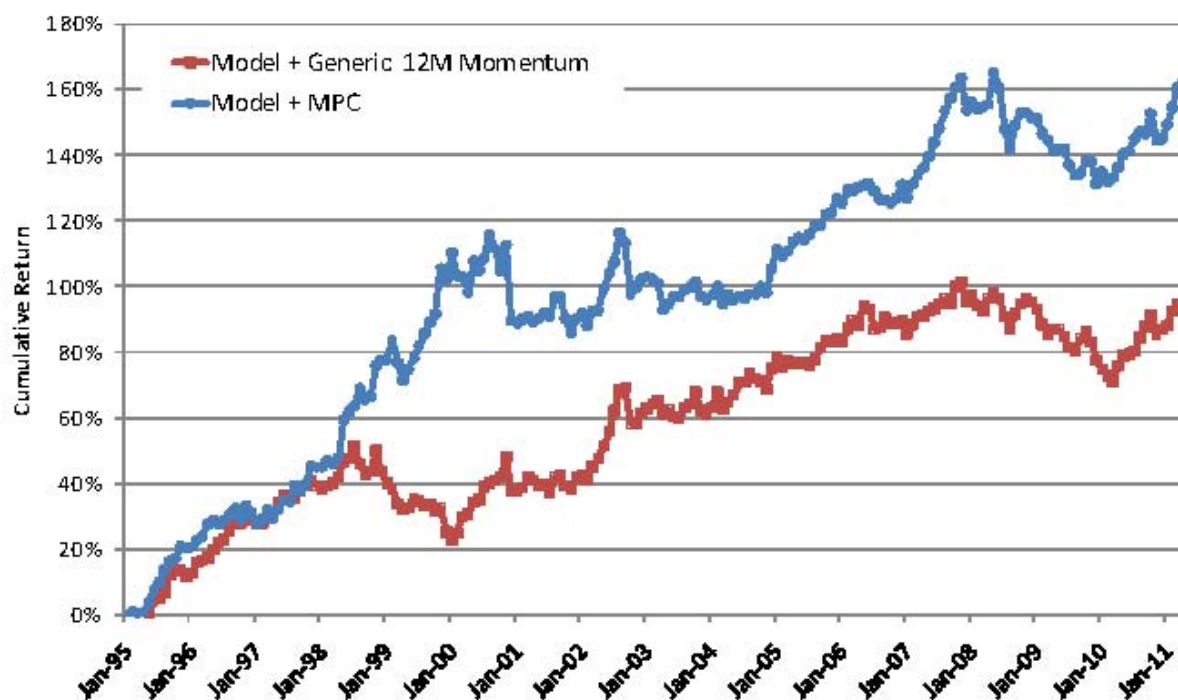
Source: Axioma, Compustat, Russell, IBES, Deutsche Bank

2b) Echo Momentum

- Momentum is primarily driven by firms' performance 12 to 7 months ago

value weighted results

equal weighted results

Novy-Marx (JFE 2012)

Independent variable	Full sample	Half samples	
	Whole	Early	Late
$r_{12,7}$	1.07	1.21	0.93
	[5.72]	[3.70]	[5.17]
$r_{6,2}$	0.49	0.62	0.36
	[1.88]	[1.40]	[1.32]
$r_{1,0}$	−7.77	−9.44	−6.10
	[−20.9]	[−16.0]	[−13.8]
log(ME)	−0.14	−0.18	−0.09
	[−4.08]	[−3.40]	[−2.29]
log(BM)	0.26	0.22	0.31
	[5.51]	[2.86]	[5.39]
$r_{12,7}-r_{6,2}$	0.58	0.60	0.57
	[2.47]	[1.46]	[2.42]

2c) Momentum Consistency

- Achieving a high past return with a series of steady positive months generates larger expected return than a high past return achieved with just a few extraordinary months

- One-year winner (loser) consistency dummy is one if the monthly return of the stock was positive (negative) in at least eight of the one-year horizon's 11 months

Grinblatt and Moskowitz (JFE 2004)

Dependent variable:	Cross-section of size, BE/ME, and industry hedged returns			
Regressors:	All months	January	February–November	December
$r_{-1:-1}$	−0.0472	−0.1002	−0.0436	−0.0431
	(−11.39)	(−4.44)	(−10.34)	(−3.54)
$r^L_{-1:-1}$	−0.0764	−0.2189	−0.0606	−0.0921
	(−9.63)	(−6.79)	(−7.19)	(−4.20)
$D^{CW}_{-1:-1}$	0.0051	0.0097	0.0048	0.0060
	(8.79)	(2.73)	(8.62)	(3.10)
$r_{-12:-2}$	0.0028	−0.0072	0.0029	0.0075
	(2.50)	(−1.88)	(2.38)	(2.17)
$r^L_{-12:-2}$	0.0113	−0.0725	0.0170	0.0440
	(2.97)	(−3.57)	(4.62)	(4.72)
$D^{CW}_{-12:-2}$	0.0046	0.0126	0.0042	0.0017
	(5.80)	(2.61)	(5.30)	(0.67)
$D^{CL}_{-12:-2}$	−0.0007	0.0044	−0.0014	0.0011
	(−0.76)	(1.18)	(−1.29)	(0.40)
$r_{-36:-13}$	−0.0015	−0.0002	−0.0021	0.0023
	(−3.47)	(−0.10)	(−4.28)	(1.42)
$r^L_{-36:-13}$	−0.0052	−0.0537	−0.0025	0.0159
	(−2.04)	(−3.91)	(−1.02)	(2.31)
$D^{CW}_{-36:-13}$	0.0014	0.0040	0.0011	0.0010
	(2.73)	(1.93)	(2.03)	(0.63)
$D^{CL}_{-36:-13}$	−0.0007	0.0108	−0.0015	−0.0036
	(−0.80)	(2.06)	(−1.78)	(−1.22)

2d) Industry Momentum

- Industry portfolios exhibit significant momentum, even after controlling for size, book-to-market equity (BE/ME), individual stock momentum, the cross-sectional dispersion in mean returns, and potential microstructure influences.

- Once returns are adjusted for industry effects, momentum profits from individual equities are significantly weaker and, for the most part, are statistically insignificant.

Moskowitz and Grinblatt (JF 1999)

- Industry momentum strategies are more profitable than individual stock momentum strategies.

- Industry momentum strategies are robust to various specifications and methodologies, and they appear to be profitable even among the largest, most liquid stocks.

2e) Style Momentum

1. Small-cap, growth
2. Small-cap, blend
3. Small-cap, value
4. Mid-cap, growth
5. Mid-cap, blend
6. Mid-cap, value
7. Large-cap, growth
8. Large-cap, blend
9. Large-cap, value
10. No-dividend

Chen and De Bondt (JEF 2004)

Table 3

The returns of style momentum portfolios

	Average monthly return during the test period					
	$K=3$	$K=6$	$K=9$	$K=12$	2nd Year	3rd Year
Panel A						
	Arbitrage portfolio holds two style portfolios					
$J=3$						
1 Winner	1.61	1.58	1.62	1.63	1.47	1.45
1 Loser	1.48	1.48	1.43	1.39	1.37	1.41
Arbitrage	0.13 (0.65)	0.10 (0.70)	0.19 (1.73)	0.23 (2.07)	0.11 (1.00)	0.04 (0.36)
$J=6$						
1 Winner	1.54	1.65	1.68	1.68	1.41	1.47
1 Loser	1.42	1.48	1.38	1.36	1.37	1.43
Arbitrage	0.12 (0.59)	0.18 (1.21)	0.30 (2.07)	0.32 (2.41)	0.04 (0.36)	0.04 (0.36)
$J=12$						
1 Winner	1.75	1.80	1.78	1.71	1.48	1.40
1 Loser	1.27	1.30	1.32	1.28	1.39	1.38
Arbitrage	0.48 (2.24)	0.50 (2.63)	0.46 (2.69)	0.43 (2.49)	0.09 (0.61)	0.02 (0.21)

2f) Momentum Acceleration

- Acceleration is defined as the change in six-month momentum relative to the cross-section of other firms.

- Trading strategies based on acceleration offer significant abnormal profits of approximately 4.5% annually when controlled for other known regularities in equity returns.
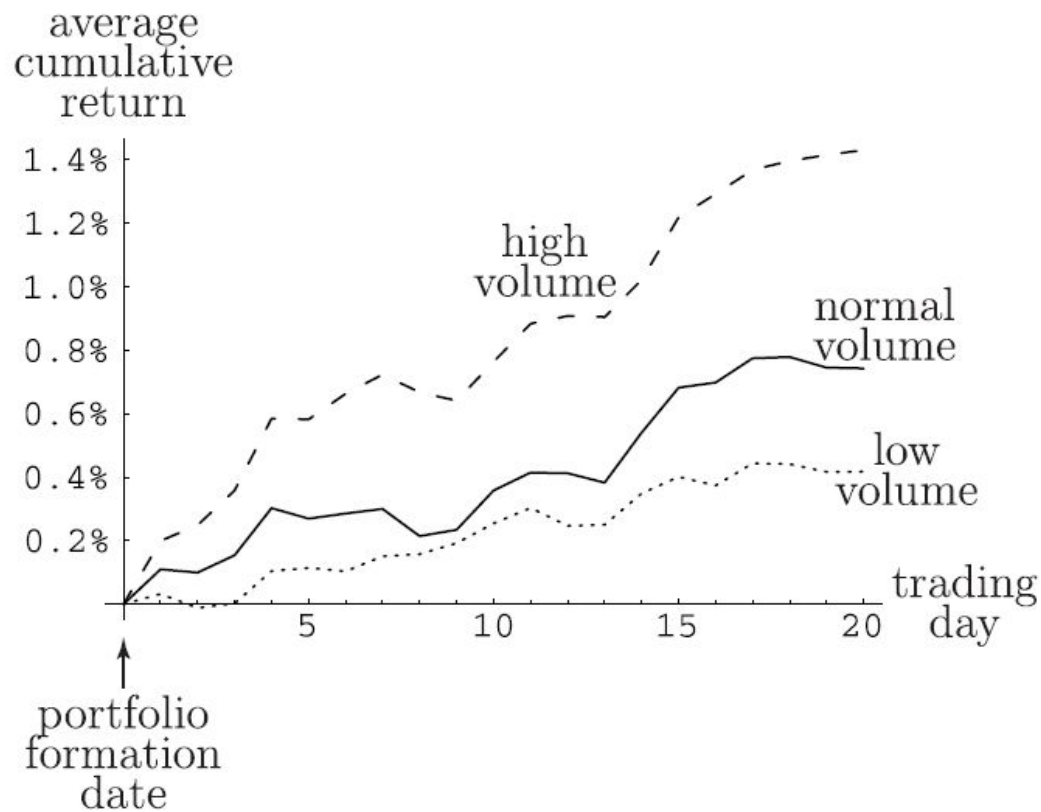
Gettleman and Marks (2006)
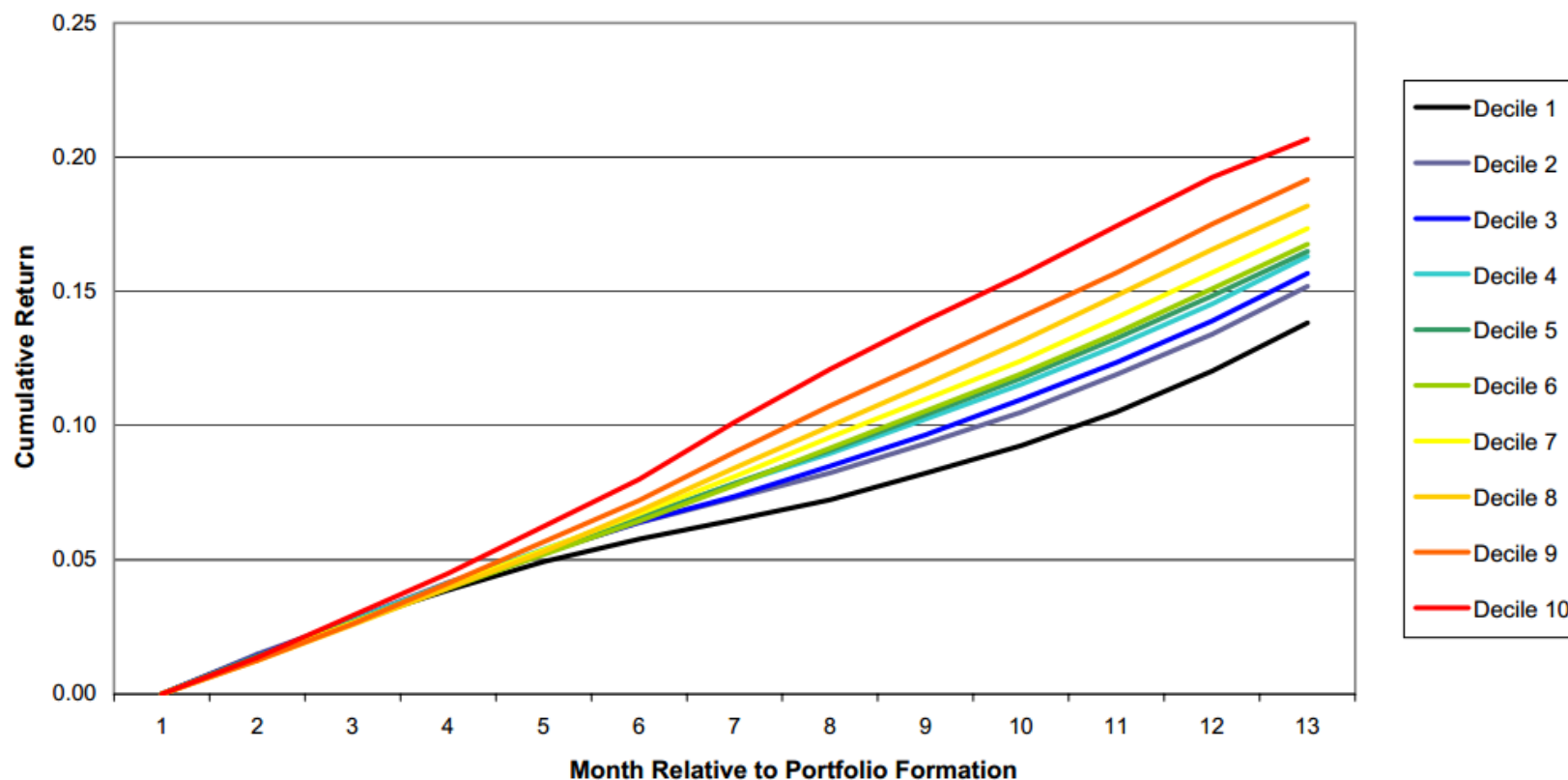
3) Volume

- Gervais, Kaniel and Mingelgrin (2001) "The high-volume return premium" *Journal of Finance*

- Stocks experiencing unusually high (low) volume over a day or a week tend to appreciate (depreciate) over the next month

Event Study

The Journal of Finance

29

Log Volume in Month *t-2*

- "Trading activity and expected stock returns"
- Chordia, Subrahmanyam & Anshuman
- Journal of Financial Economics (2001)

- If stocks had high volume 2 months ago then they tend to go down this month
- And vice-versa

Table 4

	Panel A: Dollar trading volume		
		Returns adjusted using Fama-French factors	
	Excess returns	Raw	Purged
Intercept	0.718	− 0.002	− 0.022
	(2.35)	(0.05)	(− 0.46)
SIZE	0.125	0.149	0.136
	(2.06)	(3.61)	(3.29)
BM	0.222	0.099	0.093
	(4.49)	(2.39)	(2.26)
PRICE	0.088	− 0.048	− 0.139
	(0.81)	(− 0.50)	(− 1.47)
DVOL	− 0.183	− 0.219	− 0.231
	(− 3.63)	(− 5.84)	(− 6.07)

4) New Issues Puzzle

- Loughran and Ritter (1995) "The New Issues Puzzle" *Journal of Finance*

- Companies that issue stock subsequently underperform over the next 5 years

- Worse for IPO's than for Seasoned Equity Offerings

- Cannot winsorize!

5) Post-Earnings Announcement Drift

- Bernard and Thomas (1989) "Post-Earnings-Announcement Drift: Delayed Price Response or Risk Premium?" *Journal of Accounting Research*

- Stocks whose earnings are above (below) analyst consensus outperform (underperform) for two months afterwards

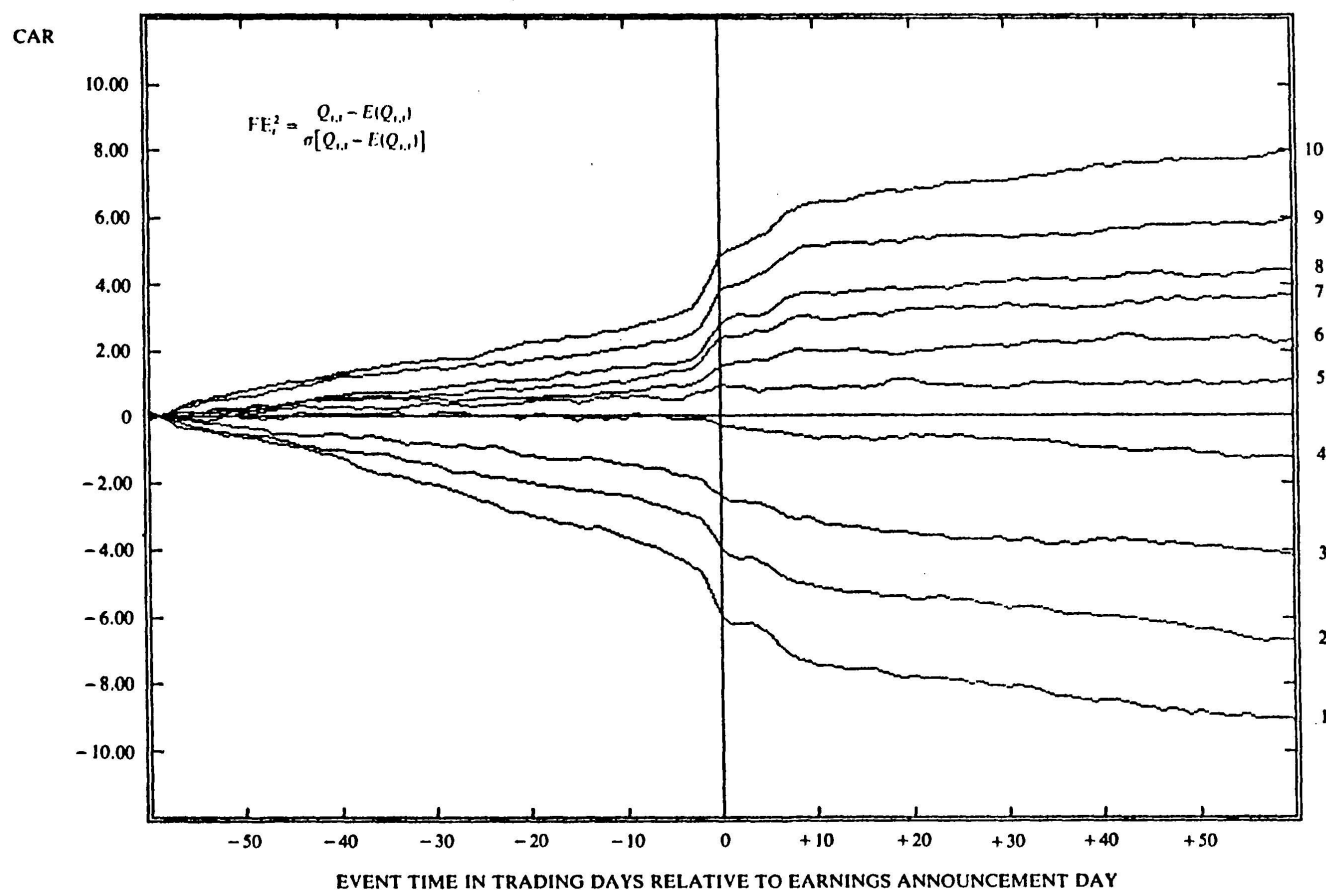- Do not winsorize!

Cumulative Abnormal Return

FIG. 1.—Cumulative abnormal returns for FOS earnings-based model (*EBM*) tests.

Earnings Announcement Premium

- On average, stock prices rise around scheduled earnings announcement dates.

- Earnings announcement premium is large, robust, and strongly related to the fact that volume surges around announcement dates.

- Stocks with high past announcement period volume earn the highest announcement premium, suggesting some common underlying cause for both volume and the premium.

- High premium stocks experience the highest levels of imputed small investor buying, suggesting that the premium is driven by buying by small investors when the announcement catches their attention.

Frazzini & Lamont (2006)
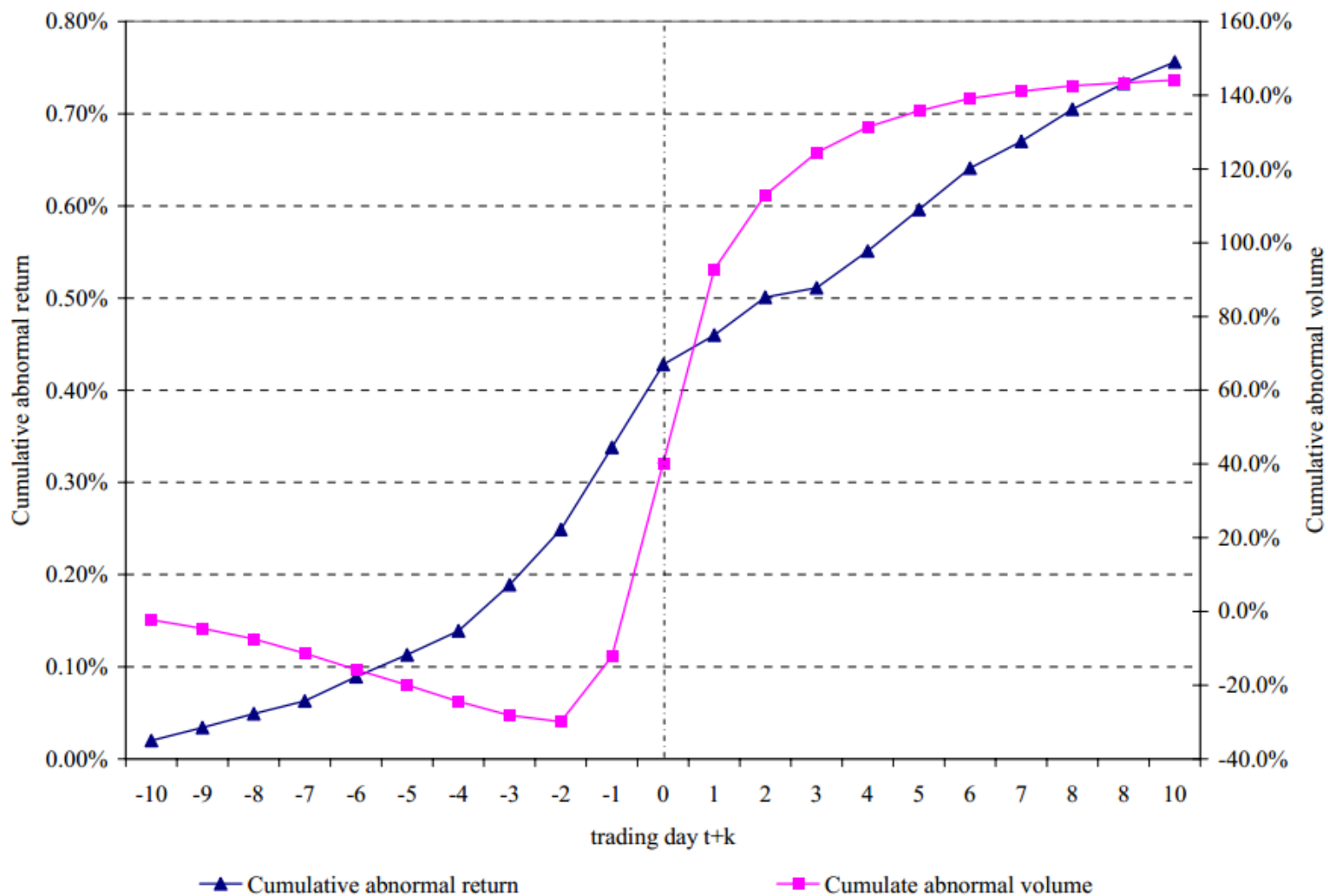
Alpha Aggregation

- Combine several alphas together

- Short-term alphas balance long-term alphas
- Technical alphas balance fundamental alphas
- Contrarian alphas balance momentum alphas

- Choose optimal weights using judgement
- If using backtest: beware of data-mining!

Assignment for Next Class

<u>Go to:</u>

- Social Science Research Network
  - Financial Economics Network
    - Subject Matter eJournals
      - Capital Markets
        - Market Efficiency

$\Rightarrow$ Find anomaly published in the past 12 months *(not explained in class today)*