MGMT 237M2 **Statistical Arbitrage**

Lecture 8: Short-Term Alphas

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Wall Street Job Interview Question

- You order pizza for 6 people
- The diameter of the pizza is 12 inches
- What would the diameter have to be to feed 8 people?

Plan of Lecture 08

1. Complement on Portfolio Optimization
2. Short-Term Mean-Reversion Alpha
3. Analyst Recommendations

Follow-up on Optimization

- Dynamic Trading with Predictable Returns and Transaction Costs
- Nicolae Gârleanu, Finance Professor, Haas School of Business , University of California Berkeley
- Lasse Heje Pedersen, Finance Professor, Stern School of Business , New York University
- *Journal of Finance* (2013)

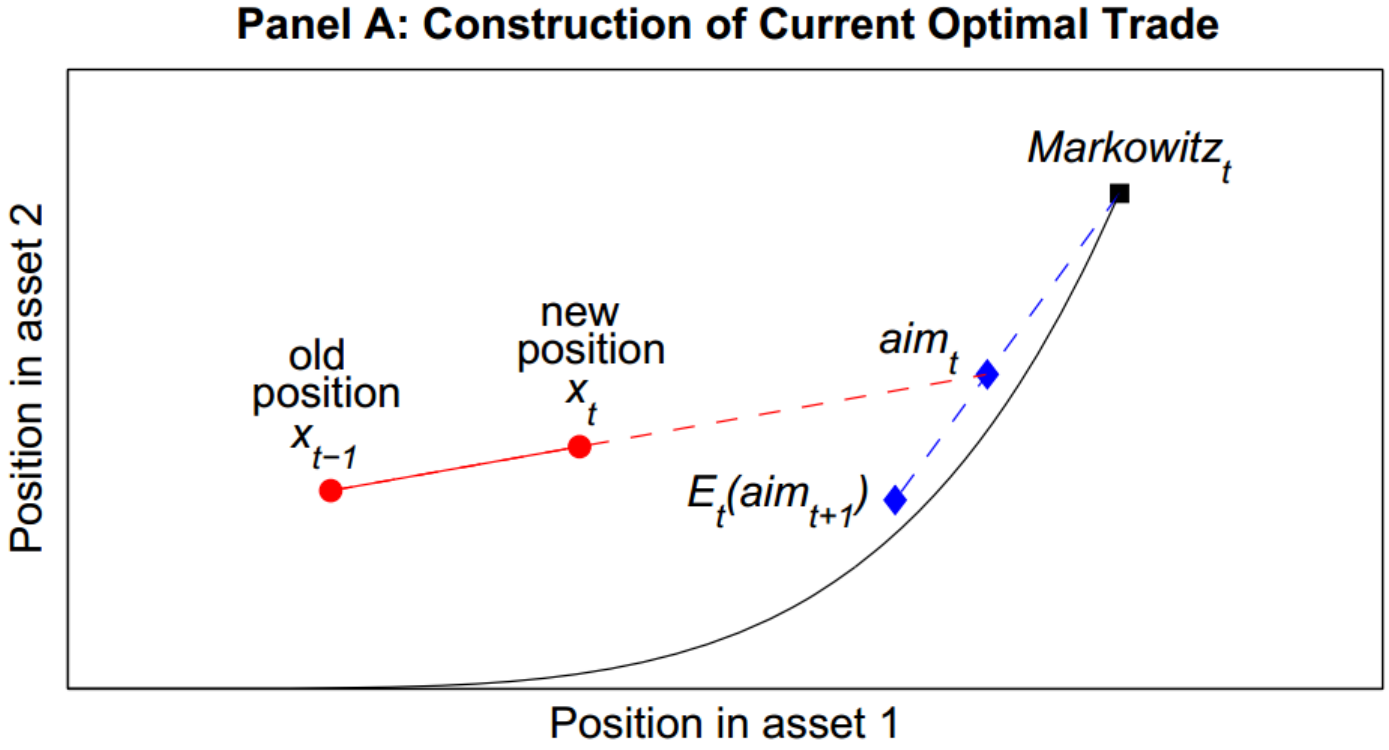
Non-Myopic Trading Rule

- Some alphas have a quick half-life (two weeks)
- Other alphas are very sticky, e.g., value (>1 year)

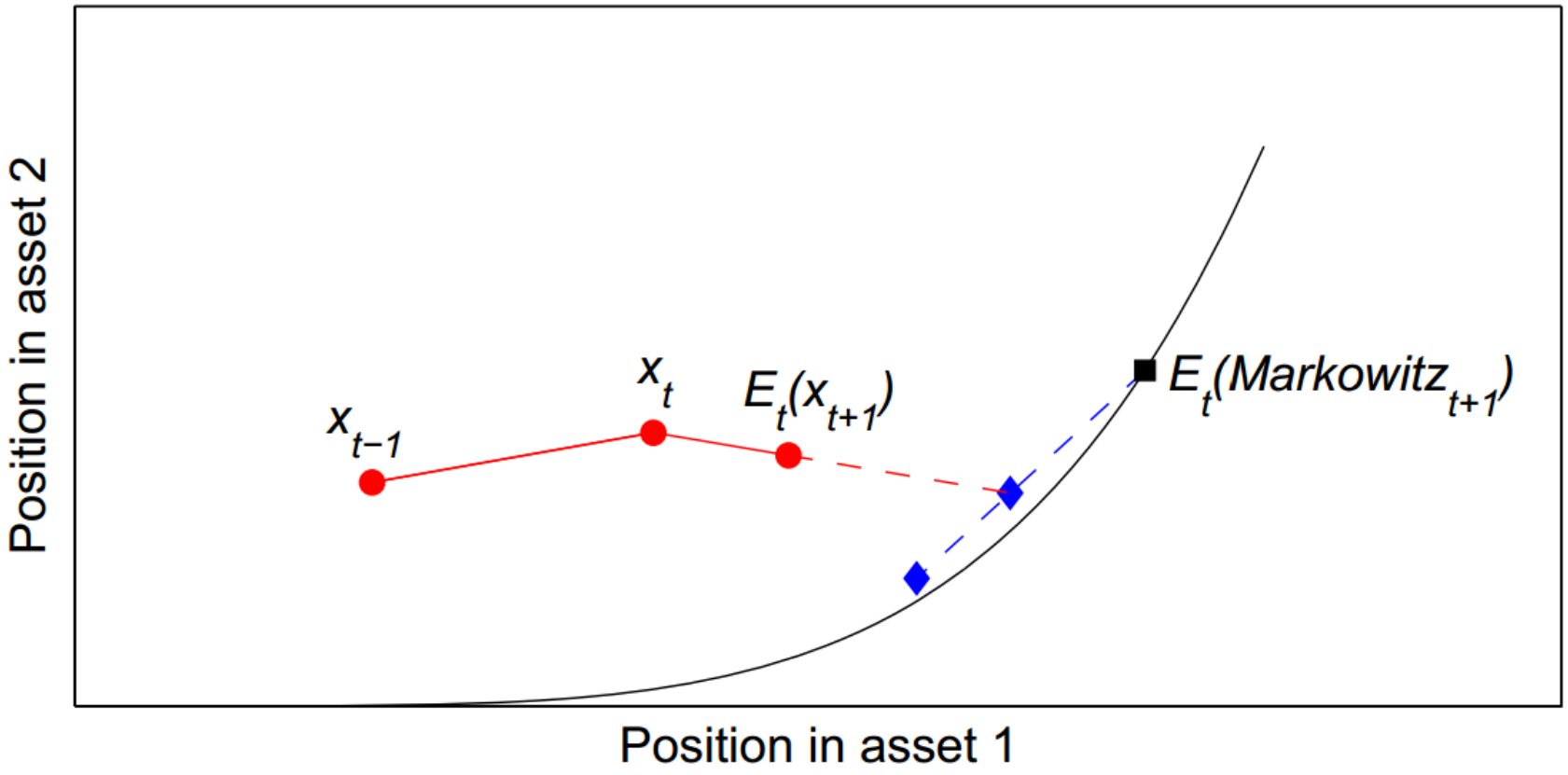
- Not just take into account the value of your alphas today
- Also consider the expected future evolution of your alphas

Hunter aims ahead of the duck

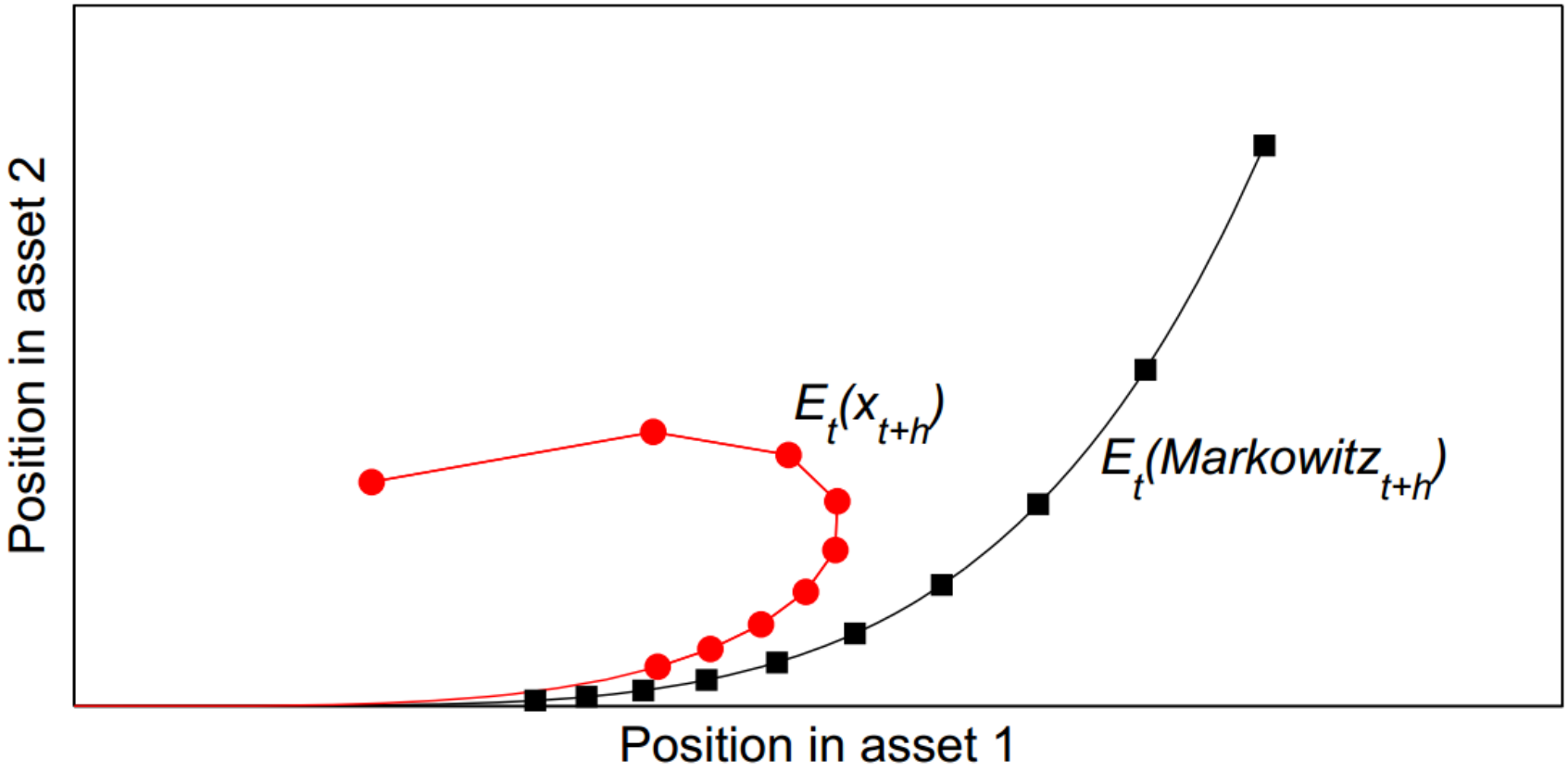
- The aim portfolio is a weighted-average of the current and future Markowitz portfolios



Expected Next Optimal Trade



Expected Evolution of Portfolio



Bottom Line

- More advanced method is useful if you trade very big portfolio (>$500M)

- For small-to-medium size portfolios: Can be approximated by underweighting fast-decay signals

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Short-Term Mean Reversion Alpha

- Bruce Lehmann (1990) “Fads, Martingales and Market Efficiency” *Quarterly Journal of Economics*
- Stocks that went up (down) relative to their industry peers over the past 21 days will underperform (outperform) going forward
- High-turnover factor, but very strong!
- Works even better when there is high volatility

Differences with Pairs Trading

- Pairs trading looks at cointegration
- Reversion is relative to all the stocks in the same industry, not just one
- Pairs trading has entry/exit points
- Reversion uses all the stocks, whereas pairs trading selects certain pairs

Industry Dummy

- ρ industries
- Boolean matrix R of dimension ($n \times \rho$)
- R(i,j) = 1 if i^{th} stock belongs to j^{th} industry
- R(i,j) = 0 if i^{th} stock does not belong to j^{th} industry
- Every row of matrix R has exactly one entry equal to 1; all other entries are equal to 0

Mathematical Definition

- r_{ti} = arithmetic return on day t for stock i using Total Return Index
- $\underline{\alpha}_{ti} = -\left(r_{ti} + r_{t-1,i} + \ldots + r_{t-20,i}\right) / 21$
- $\alpha_t = \underline{\alpha}_t \cdot \left[I - R\,(R'\,R)^{-1}\,R'\right]$

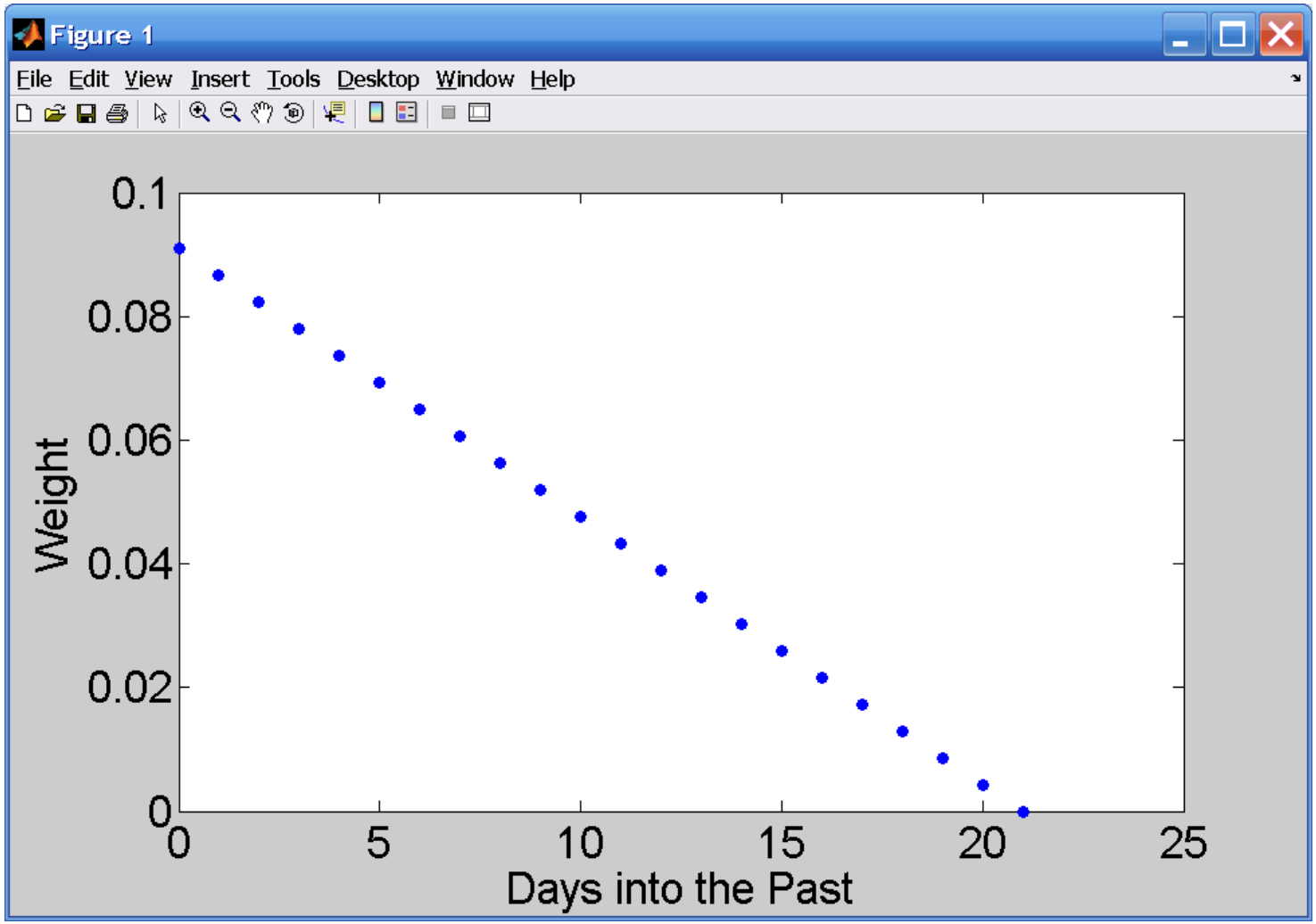
(1×n) (1×n) (n×n)

- Cross-sectionally demean, standardize and windsorize every day

How to Improve It

- Triangular Decay Window
- Linearly decreasing weighting scheme so that weight on day t–21 is zero
- weight on day t–j: $w_j = a - b \cdot j$
- $w_{21} = a - b \cdot 21 = 0$
- Weights sum to one: $w_0 + w_1 + \ldots + w_{20} = 1$
- $a \cdot 21 - b \cdot (0+1+2+\ldots+20) = 1$
- Solution: $w_j = (1/11) - (1/231) \cdot j$ for j=0,...,21

Underweight Distant Past



Improved Reversion Alpha

- r_{ti} = return on day t for stock i
- $\underline{\alpha}_{ti} = -\left(w_0 \cdot r_{ti} + w_1 \cdot r_{t-1,i} + \ldots + w_{20} \cdot r_{t-20,i}\right)$

- $\alpha_t \quad = \quad \underline{\alpha}_t \cdot \left[I - R\,(R'\,R)^{-1}\,R'\right]$

(1×n) (1×n) (n×n)

- Cross-sectionally demean, standardize and windsorize every day

Other Refinements

- Truncate stock returns that are too extreme
- If stock outperformed equally weighted average return of all active stocks that day by more than 5%, say it only outperformed by 5%
- If stock underperformed equally weighted average return of all active stocks that day by more than -5%, say it only underperformed by 5%

Cleaning the Reversion Alpha

- b_{ti} = market beta of stock t on day i
- Beta-driven moves do not revert because the market index follows a random walk
- Can improve reversion alpha by cleaning it with respect to beta:
- Use $\underset{(1\times n)}{\alpha_t} \cdot \underset{(n\times n)}{\left[I - b_t\,(b_t'\,b_t)^{-1}\,b_t'\right]}$
- Can also clean reversion alpha w.r.t. momentum

Information Moves Do Not Revert

For the purpose of computing the reversion alpha, set the return on an earnings announcement day to zero

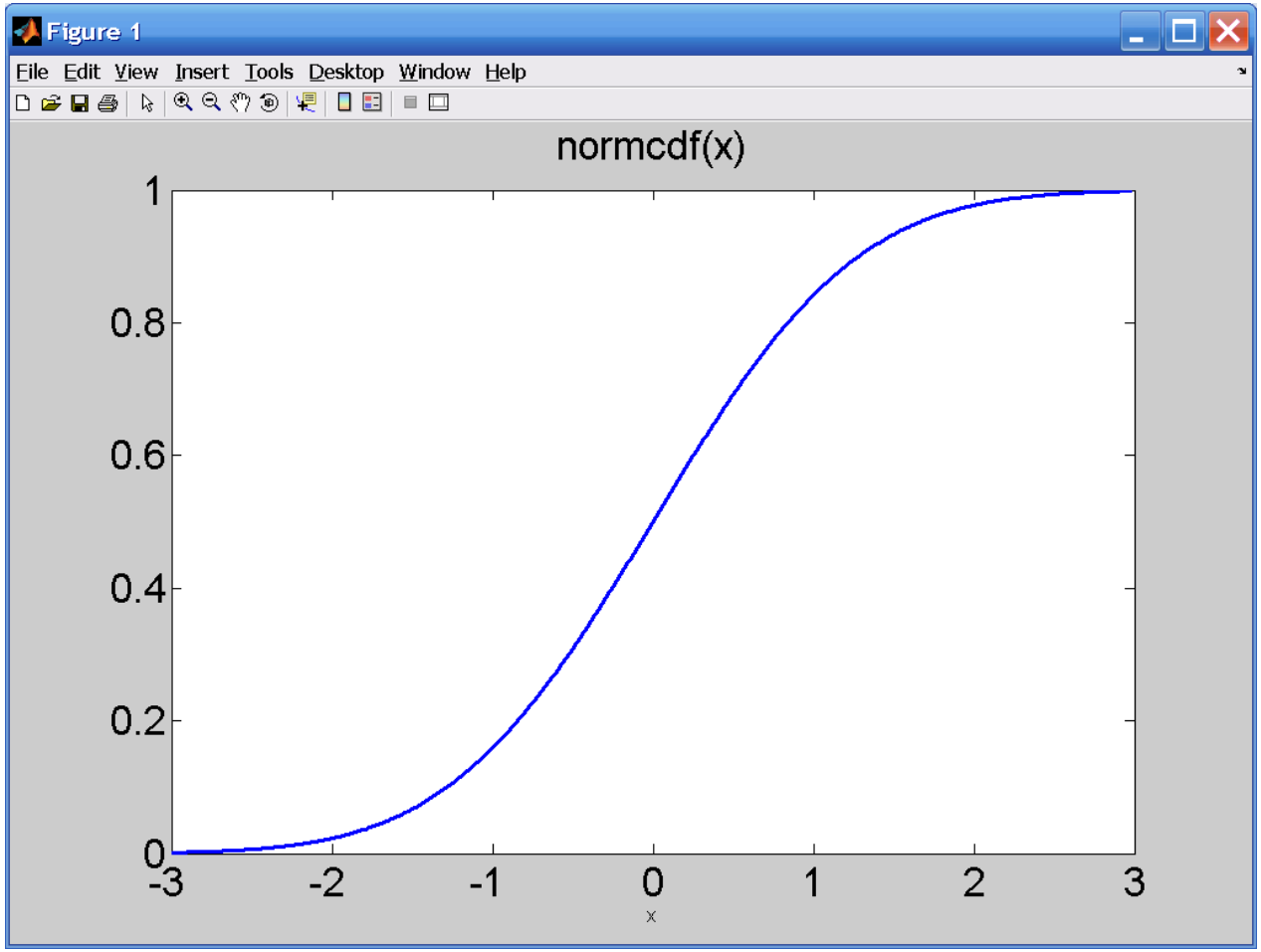
Modulating the Reversion Alpha

- Volume and Autocovariances in Short-Horizon Individual Security Returns
- Journal of Finance (1994)
- Jennifer Conrad, Allaudeen Hameed and Cathy Niden
- High-volume stocks experience price reversals, while the returns of low-volume securities are positively autocovarying

General Approach

- Suppose you have some variable θ_{ti} which tells you when the signal works and when it doesn't work
- Cross-sectionally demean, standardize and windsorized
- Modulated alpha: $\alpha_{ti} \times \text{normcdf}(\theta_{ti})$

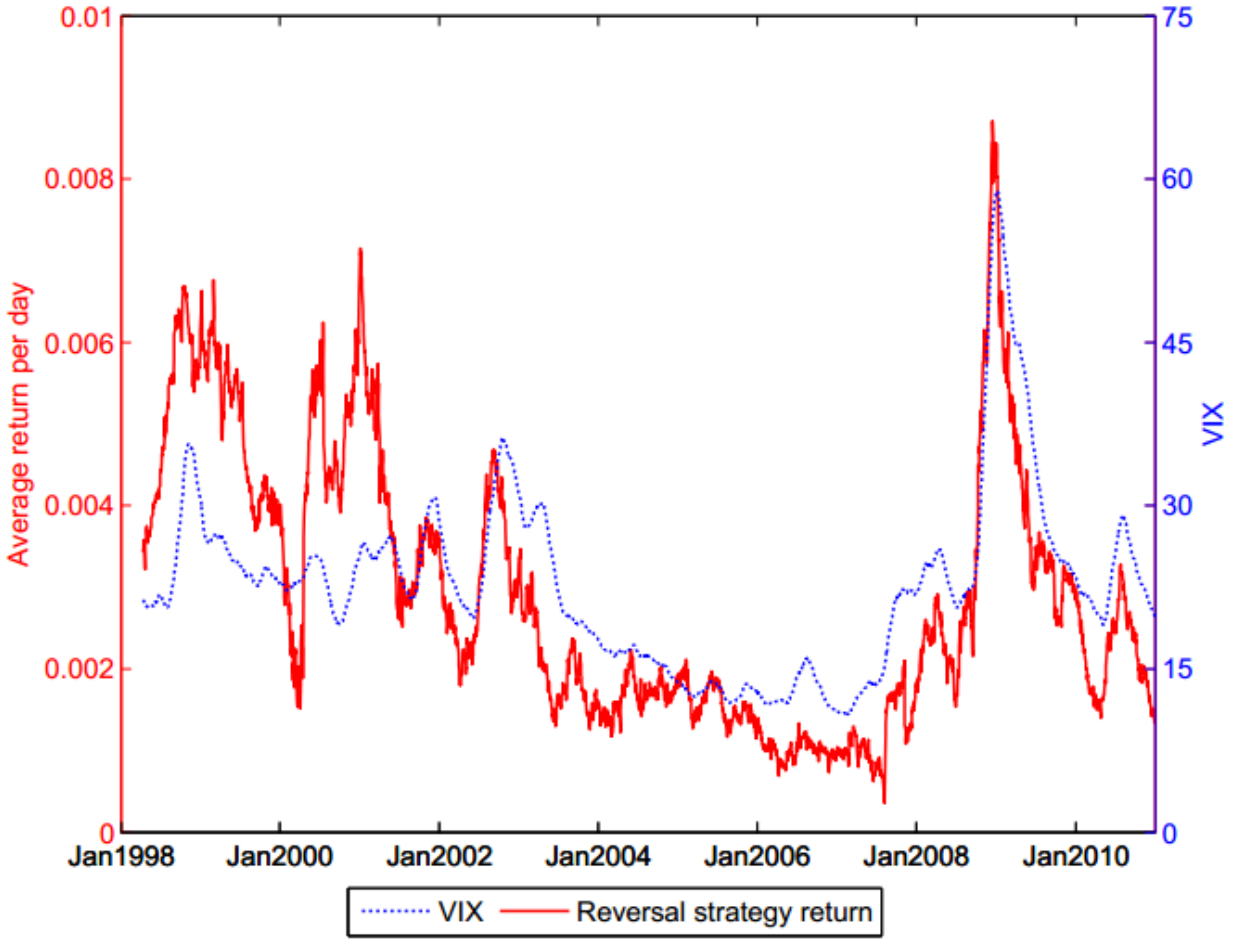
Normal Cumulative Distribution Function



When Reversion Works Well

- Evaporating Liquidity, Stefan Nagel (Stanford)
- Review of Financial Studies (July 2012)
- Expected return from reversal strategies is strongly time-varying and highly predictable with the VIX index
- Reversion works better when there is more volatility
- Reversion profit = reward for providing liquidity

5-Day Reversal



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Recommendation Revision Alpha

- Analyzing the Analysts: When Do Recommendations Add Value?
- Narasimhan Jegadeesh, Joonghyuk Kim, Susan D. Krische and Charles M. C. Lee
- Journal of Finance (2004)
- Recommendation levels have no predictive power
- Recommendation changes do!

6-month return post revision

Panel C: Market-adjusted Returns by Consensus Recommendation Change Quintile			
Quintile	Coded as	Mean	Median
Best = Increase	1.00	−0.004	−0.025
	0.75	−0.007	−0.015
	0.50	−0.022	−0.044
	0.25	−0.004	−0.023
Worst = Decrease	0.00	−0.031	−0.051
Increase – Decrease		+0.027***	+0.031***

Mathematical Definition

- x_{ti} = number of upgrades – number of downgrades on day t for stock i
- $\alpha_{ti} = (x_{ti} + x_{t-1,i} + \ldots + x_{t-44,i}) / 45$
- Cross-sectionally demean, standardize and windsorize every day

Triangular Decay

- x_{ti} = number of upgrades – number of downgrades on day t for stock i
- $w_j = (1/23) – (1/1035) \cdot j$ for j=0,...,45

$$\alpha_{ti} = w_0 \cdot x_{ti} + w_1 \cdot x_{t-1,i} + \ldots + w_{44} \cdot x_{t-44,i}$$

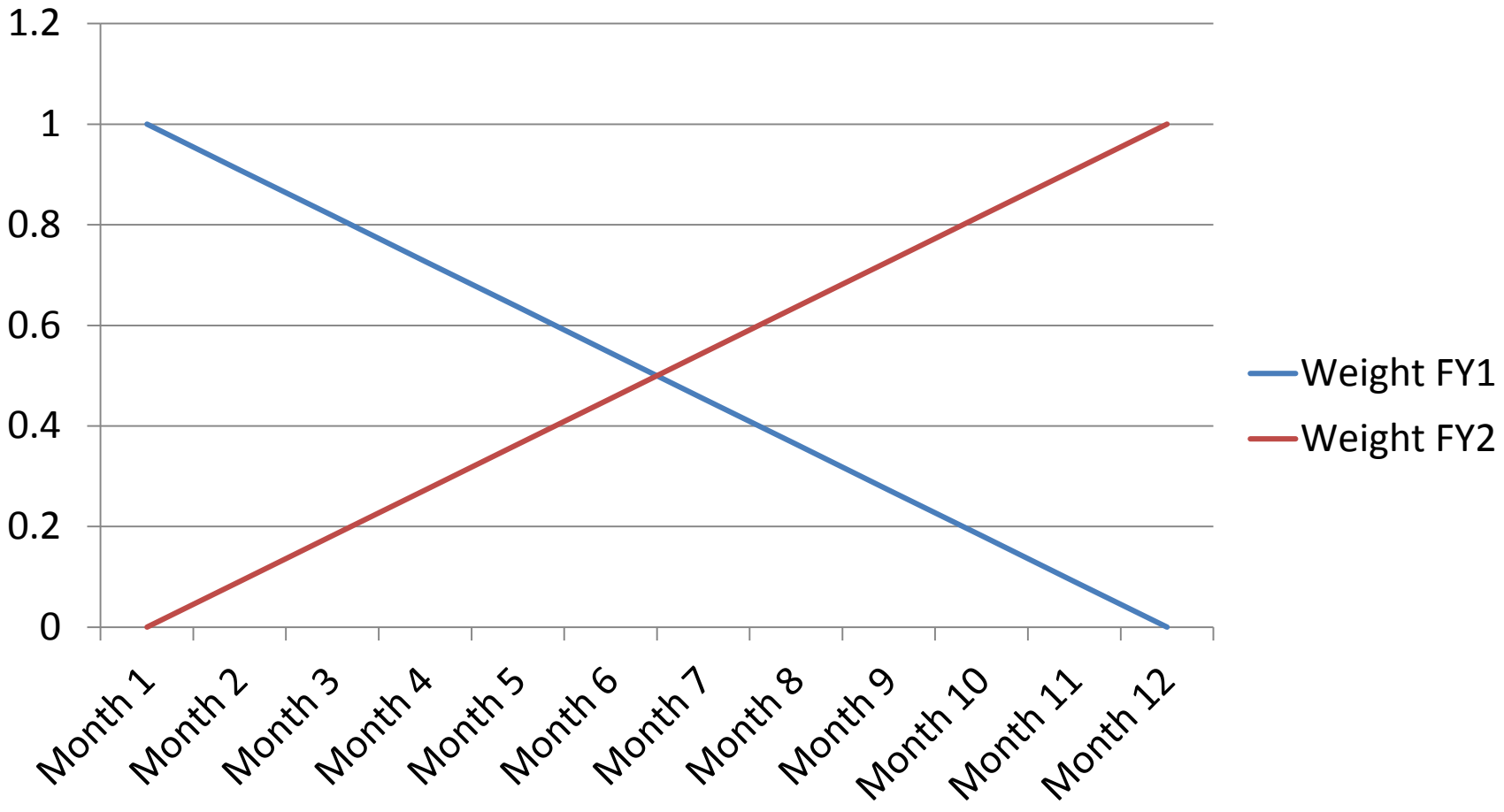
- Cross-sectionally demean, standardize and windsorize every day

Variations on the Theme

- Analyst price target revisions

- Analyst earnings forecast revisions
- Analyst sales forecast revisions
- Analyst dividends forecast revisions
- Analyst cash flow forecast revisions

Combine Next 2 Fiscal Years



Modulating Factors

Analyst Forecast Revisions and Market Price Discovery (2003), Cristi Gleason & Charles Lee

- Whether the revision moves towards the consensus or away from it
- Whether the analyst is a celebrity or not
- Number of analysts covering the stock

Problem Set 3

- Run a realistic backtest

- Short-term mean-reversion
- Analyst recommendation revisions
- Value
- Momentum

- Due Next Thursday 10am before class