Econ 219B
Psychology and Economics:
Applications
(Lecture 10)

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Outline

1. CAPM for Dummies (Taught by a Dummy)
2. Event Studies
3. Event Study: Iraq War
4. Attention: Introduction
5. Attention: Oil Prices

1 CAPM for Dummies (Taught by a Dummy)

1.1 Summary

- Capital Asset Pricing Model: Sharpe (1964) and Lintner (1965)

- Tenet of Asset Pricing II

Assumptions:

- All investors are price-takers.
- All investors care about returns measured over one period.
- There are no nontraded assets.
- Investors can borrow or lend at a given riskfree interest rate (Sharpe-Lintner version of the CAPM).
- Investors pay no taxes or transaction costs.
- All investors are mean-variance optimizers.
- All investors perceive the same means, variances, and covariances for returns.

Implications:

- All investors face the same mean-variance tradeoff for portfolio returns

- All investors hold a mean-variance efficient portfolio.

- Since all mean-variance efficient portfolios combine the riskless asset with a fixed portfolio of risky assets, all investors hold risky assets in the same proportions to one another.

- These proportions must be those of the market portfolio or value-weighted index that contains all risky assets in proportion to their market value.

- Thus the market portfolio is mean-variance efficient.

1.2 Mean-Variance Optimization

- Assume investors care only about mean (positively) and variance (negatively)

- (Can motivate with normally distributed assets)

- Mean-variance analysis with one riskless asset and N risky assets.

- The solution finds portfolios that have minimum variance for a given mean return, $\overline{R}_p$.

- These are called "mean-variance efficient" portfolios and they lie on the "minimum-variance frontier".

- Define:
  - $\overline{R}$ as the vector of mean returns for the N risky assets and R_f as the return of the riskless asset
  - $\boldsymbol{\Sigma}$ as the variance-covariance matrix of returns
  - w as the vector of portfolio weights for the risky assets
  - ι as a vector of ones and $1 - w'\iota$ is the weight in the portfolio for the riskless asset

- Rewrite maximization as min Variance s.t. given return $\overline{R}_p$:

$$\min_{w} \ \frac{1}{2} w' \boldsymbol{\Sigma} w \text{ s.t. } (\overline{R} - R_f \iota)' w = \overline{R}_p - R_f$$

Lagrangian:

$$\mathcal{L}(w,\lambda) = \frac{1}{2}w'\mathbf{\Sigma}w + \lambda(\overline{R}_p - R_f - (\overline{R} - R_f\iota)'w)$$

First Order Conditions:

$$\begin{aligned}
\frac{\partial \mathcal{L}(w,\lambda)}{\partial w} &= \mathbf{\Sigma}w - \lambda^*(\overline{R} - R_f\iota) = 0 \\
\frac{\partial \mathcal{L}(w,\lambda)}{\partial \lambda} &= \overline{R}_p - R_f - (\overline{R} - R_f\iota)'w^* = 0
\end{aligned}$$

Rearranging,

$$\begin{aligned}
w^* &= \lambda^*\mathbf{\Sigma}^{-1}(\overline{R} - R_f\iota) \\
\overline{R}_p - R_f &= (\overline{R} - R_f\iota)'w^*
\end{aligned}$$

Solve for λ?

Substitute for w^* in the second equation using the first equation

$$\begin{aligned}\overline{R}_p - R_f &= (\overline{R} - R_f\iota)'\lambda^*\boldsymbol{\Sigma}^{-1}(\overline{R} - R_f\iota) \\ \lambda^* &= \frac{\overline{R}_p - R_f}{(\overline{R} - R_f\iota)'\boldsymbol{\Sigma}^{-1}(\overline{R} - R_f\iota)}\end{aligned}$$

Consequently,

$$w^* = \left(\frac{\left(\overline{R}_p - R_f\right)}{(\overline{R} - R_f\iota)'\boldsymbol{\Sigma}^{-1}(\overline{R} - R_f\iota)}\right)\left(\boldsymbol{\Sigma}^{-1}(\overline{R} - R_f\iota)\right)$$

Implications:

- w_i^* increasing in return of asset i $\overline{R}_i$

- w_i^* decreasing in variance of asset i σ_i^2 (see $\mathbf{\Sigma}$)

- Different portfolio choices with different risk aversion?

  - Only $\overline{R}_p$ varies

  - more risk-averse $->$ lower $\overline{R}_p$ $->$ hold fewer risky assets, more riskless assets (w^* lower)

  - Everyone holds same share of risky assets: if write down w_i/w_j, the parenthesis disappears

1.3 Asset Pricing Implications

- Assume that w is a vector of weights for a mean-variance efficient portfolio with return R_p.

- Consider the effects on the variance of the porfolio return for very small change in the weights of two assets w_i and w_j such that $d\overline{R}_p = 0$.

$$dVar(R_p) = 2Cov(R_{i,}R_p)dw_i + 2Cov(R_j, R_p)dw_j$$

- Must be $dVar(R_p) = 0$, or initial portfolio was not optimal.

- Substituting,

$$\begin{aligned} 2Cov(R_{i,}R_p)dw_i &= 2Cov(R_j, R_p)\left(\frac{(\overline{R}_i - R_f)}{(\overline{R}_j - R_f)}\right)dw_i \\ \frac{\overline{R}_i - R_f}{Cov(R_{i,}R_p)} &= \frac{\overline{R}_j - R_f}{Cov(R_{j,}R_p)} \end{aligned}$$

- Use relationship for mean-variance return ($j = p$):

$$\begin{aligned}\frac{\overline{R}_i - R_f}{Cov(R_i, R_p)} &= \frac{\overline{R}_p - R_f}{Var(R_p)} \\ \overline{R}_i - R_f &= \frac{Cov(R_i, R_p)}{Var(R_p)}(\overline{R}_p - R_f)\end{aligned}$$

- Write for market return R_m (which is mean-variance efficient under null of CAPM):

$$\overline{R}_i - R_f = \frac{Cov(R_i, R_m)}{Var(R_m)}(\overline{R}_m - R_f)$$

- $Cov(R_i, R_m)/Var(R_m)$ is the famous Beta!

- Test of CAPM in a regression:

$$R_{it} - R_f = \alpha_i + \beta_{im}(R_{mt} - R_f) + \varepsilon_{it}$$

- Jensen's α_i should be zero for all assets. (rejected in data)

- Point of all this: stock return of asset i depends on correlation with market.

- High correlation with market –> higher return to compensate for risk

1.4 Implications for Event Studies

- Assume an event (merger announcement, earning announcement) happened to company i
- Want to measure effect on stock return i
- Can just look at R_{it} before and after event?
- Better not. Have to control for correlation with market
- Should look at $\Big(R_{it} - R_f\Big) - \beta_{im}(R_{mt} - R_f)$
- Otherwise bias.

- In reality two deviations from CAPM:

  1. Control for both α and β

  2. Neglect R_f

- Typical estimation of abnormal return:

  – Run (daily or monthly) regression:

  $$R_{it} = \alpha_i + \beta_i R_{mt} + \varepsilon_{it}$$

  for days (-150,-10) prior to event

  – Obtain $\hat{\alpha}_i$ and $\hat{\beta}_i$

  – Abnormal return is

  $$AR_{it} = R_{it} - \hat{\alpha}_i + \hat{\beta}_i R_{mt}$$

  – Use this as dependent variable

2 Event Studies

- Examine the impact of an event into stock prices:
  - merger announcement –> Mergers good or bad?
  - earning announcement –> How is company doing?
  - campaign-finance reform –> Effect on companies financing Reps/Dems
  - election of Bush/Gore –> Test quid-pro-quo parties-firms
  - Iraq war (later in class) –> Effect of war

- How does one do this?

- Three main methodologies:

    1. Regressions

    2. Deciles

    3. Portfolios

- Illustrate with earning announcement literature

- Event is earning surprise $s_{t,k}$

- **Methodology 1.** Run regression:

$$r_{t,k}^{(h,H)} = \alpha + \phi s_{t,k} + \varepsilon_{t,k}$$

- Details:

  – Use abnormal returns as dependent variable r

  – (For short-term event studies, can also use net returns $r_{t,k} - r_{t,m}$)

  – Look at returns at multiple horizons: (0,0), (1,1), (3,75), etc.

  – Worry about cross-sectional correlation: cluster by day

  – Can add control variables to allow for time-varying effects, size-related effects

- Identification:

- time-series (same company over time, different announcements)
- cross-sectional (same time, different companies)

- Issues:
  - Do you know event time?
    - earning *surprise?*
    - legal changes
  - Need unexpected changes in information

- **Methodology 2.** Create deciles (Fama-French)

- Sort event into deciles (quantiles):
  - Decile 1 $d^1_{t,k}$: Bottom 10% earnings surprises
  - Decile 2 $d^2_{t,k}$: 10% to 20% earnings surprises
  - etc.

- Estimate average return decile-by-decile

- Equivalent to running regression:

$$r^{(h,H)}_{t,k} = \sum_{j=1}^{10} \phi_j d^j_{t,k} + \varepsilon_{t,k}$$

- Details:
  - Use buy-and-hold returns
  - Worry about correlation of standard errors

- Issues:
  - Plus: Non-linear specification
  - Minus: Cannot control for variables

- Finance uses (abuses?) this ‘decile’ methodology

- Examples:
  - Small firms and large firms – deciles by size
  - Growth vs. value stocks – deciles by book-market ratios

- **Methodology 3.** Form portfolios

- Aggregate stock of a given category into one portfolio

- Observe its daily or monthly returns

- Idea: can you make money with this strategy??!

- Examples:

  - Size.

    * Form portfolio of companies by decile of size

    * Hold for one/2/10 years

    * Does a portfolio of small companies outperform a portfolio of large companies?

  - Momentum
    * Form portfolio of companies by measure of past performance
    * Hold for one/2/10 years
    * Do stocks with high past returns outperform other stocks?

- Big difference from methodology 2:
  - Now there is only one observation for time period (day/month)
  - Have aggregated all the small firms into one portfolio

- Details:
  - Run regression of raw portfolio returns on market returns as well as other factors:

$$r_t^{small} = \alpha + \beta r_{t,m} + \beta_2 r_{t,2} + \beta_3 r_{t,3} + \varepsilon_{t,k}$$

  - Standard Fama-French factors:
    * control for market returns $r_{t,m}$
    * control for size ‘factor’ $r_{t,2}$
    * control for book-to-market ‘factor’ $r_{t,3}$
  - Idea: Do you obtain outperformance of an event beyond things happening with the market, with firms size, and with book-to-market?

- Issues:
  - Pluses: Get rid of cross-sectional correlation — now only have one observation per time period
  - Minus: Cannot control for variables

3 Event Study: Iraq War

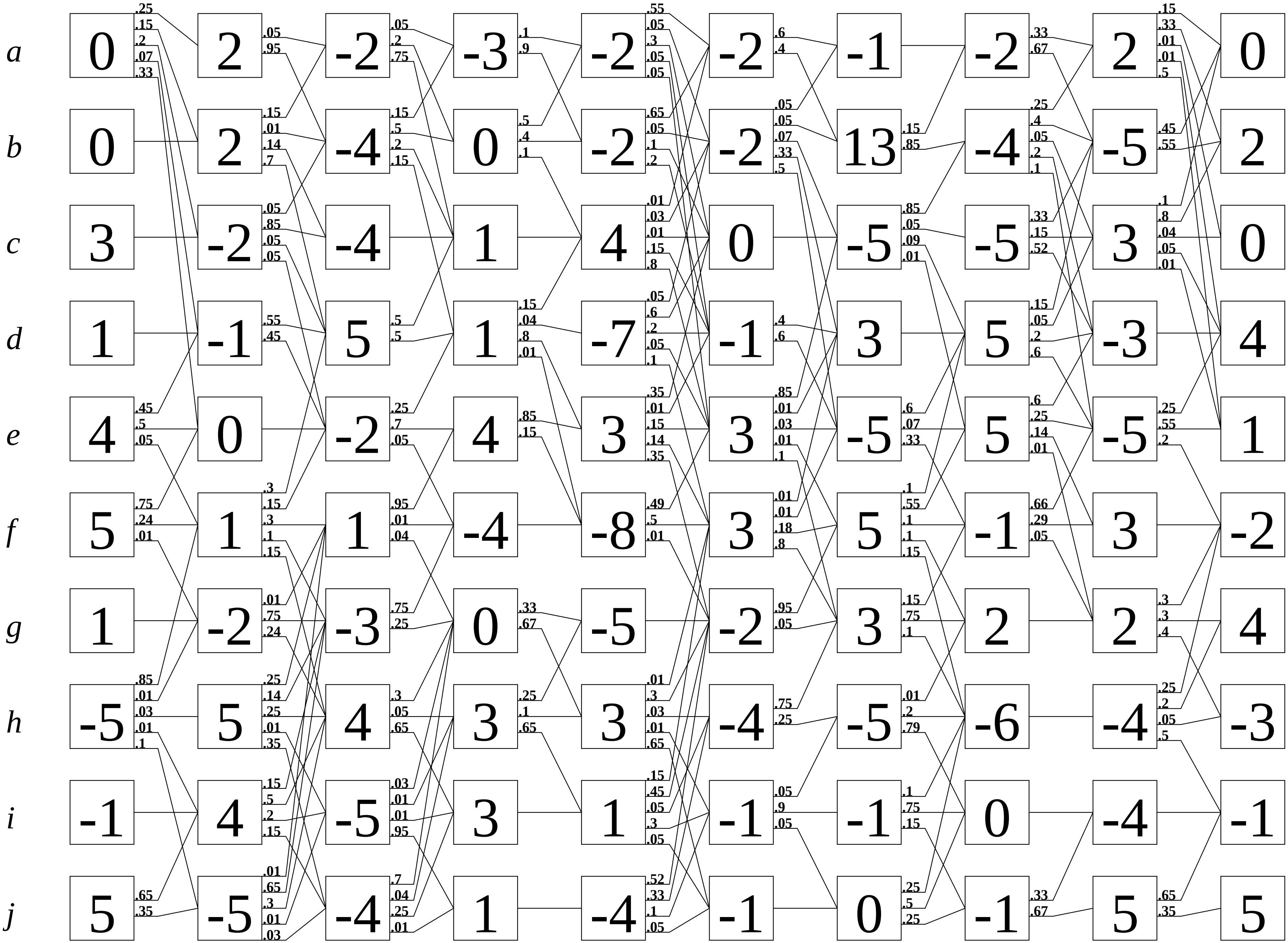
- See Additional slides

4 Attention: Introduction

- Attention as limited resource:
  - Satisficing choice (Simon, 1955)
  - Heuristics for solving complex problems (Gabaix and Laibson, 2002; Gabaix et al., 2003)

- In a world with a plethora of stimuli, which ones do agents attend to?

- Psychology: Salient stimuli (Fiske and Taylor, 1991)



a 0 2 -2 -3 -2 -2 -1 -2 2 0
b 0 2 -4 0 -2 -2 13 -4 -5 2
c 3 -2 -4 1 4 0 -5 -5 3 0
d 1 -1 5 1 -7 -1 3 5 -3 4
e 4 0 -2 4 3 3 -5 5 -5 1
f 5 1 1 -4 -8 3 5 -1 3 -2
g 1 -2 -3 0 -5 -2 3 2 2 4
h -5 5 4 3 3 -4 -5 -6 -4 -3
i -1 4 -5 3 1 -1 -1 0 -4 -1
j 5 -5 -4 1 -4 -1 0 -1 5 5

4.1 Attention to Non-Events

- Remember Huberman and Regev (2001)?

- Timeline:

  - October-November 1997: Company EntreMed has very positive early results on a cure for cancer

  - November 28, 1997: *Nature* "prominently features;" *New York Times* reports on page A28

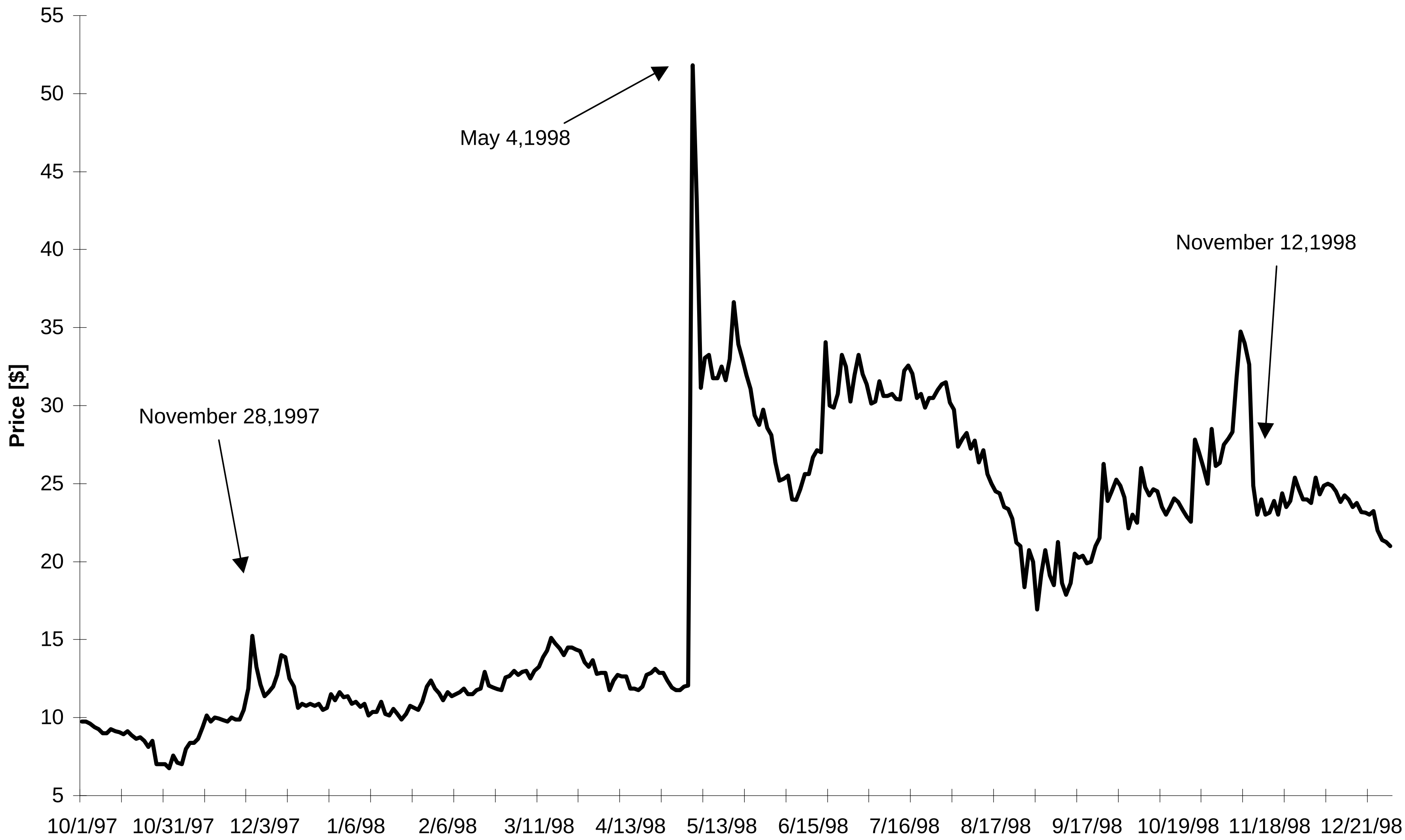
  - May 3, 1998: *New York Times* features essentially same article as on November 28, 1997 on front page

  - November 12, 1998: *Wall Street Journal* front page about failed replication

- In a world with unlimited arbitrage...

- In reality...

Figure 5: ENMD Closing Prices and Trading Volume 10/1/97-12/30/98



- Which theory of attention explains this?

- We do not have a theory of attention!

- However:

  - Attention allocation has large role in volatile markets

  - Media is great, underexplored source of data

- Suggests successful stategy on attention papers:

  - Do not attempt geneal model

  - Focus on specific deviation

5 Attention: Oil Prices

- Idea here: People do not think of indirect effects that much

- Josh's slides.