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

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March 31, 2004
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
  - $\Sigma$ as the variance-covariance matrix of returns
  - $w$ as the vector of portfolio weights for the risky assets
  - $\iota$ 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 $\overline{R}_p$:

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

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

First Order Conditions:

$$\frac{\partial \mathcal{L}(w, \lambda)}{\partial w} = \Sigma w - \lambda^* (\overline{R} - R_{f\ell}) = 0$$

$$\frac{\partial \mathcal{L}(w, \lambda)}{\partial \lambda} = \overline{R}_p - R_f - (\overline{R} - R_{f\ell})'w^* = 0$$

Rearranging,

$$w^* = \lambda^* \Sigma^{-1}(\overline{R} - R_{f\ell})$$

$$\overline{R}_p - R_f = (\overline{R} - R_{f\ell})'w^*$$
Solve for \( \lambda \)?

Substitute for \( w^* \) in the second equation using the first equation

\[
\bar{R}_p - R_f = (\bar{R} - R_{f\ell})' \lambda^* \Sigma^{-1} (\bar{R} - R_{f\ell})
\]

\[
\lambda^* = \frac{\bar{R}_p - R_f}{(\bar{R} - R_{f\ell})' \Sigma^{-1} (\bar{R} - R_{f\ell})}
\]

Consequently,

\[
w^* = \left( \frac{\bar{R}_p - R_f}{(\bar{R} - R_{f\ell})' \Sigma^{-1} (\bar{R} - R_{f\ell})} \right) (\Sigma^{-1} (\bar{R} - R_{f\ell}))
\]

Implications:

- \( w_i^* \) increasing in return of asset \( i \) \( \bar{R}_i \)
• $w_i^*$ decreasing in variance of asset $i$ $\sigma_i^2$ (see $\Sigma$)

• Different portfolio choices with different risk aversion?
  
  – Only $\overline{R}_p$ varies

  – more risk-averse $\rightarrow$ lower $\overline{R}_p$ $\rightarrow$ 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 portfolio return for very small change in the weights of two assets $w_i$ and $w_j$ such that $dR_p = 0$.

$$d\text{Var}(R_p) = 2\text{Cov}(R_i, R_p)dw_i + 2\text{Cov}(R_j, R_p)dw_j$$

- Must be $d\text{Var}(R_p) = 0$, or initial portfolio was not optimal.

- Substituting,

$$2\text{Cov}(R_i, R_p)dw_i = 2\text{Cov}(R_j, R_p)\left(\frac{\bar{R}_i - R_f}{\bar{R}_j - R_f}\right)dw_i$$

$$\frac{\bar{R}_i - R_f}{\text{Cov}(R_i, R_p)} = \frac{\bar{R}_j - R_f}{\text{Cov}(R_j, R_p)}$$
• Use relationship for mean-variance return \((j = p)\):

\[
\frac{\bar{R}_i - R_f}{\text{Cov}(R_i, R_p)} = \frac{\bar{R}_p - R_f}{\text{Var}(R_p)}
\]

\[
\bar{R}_i - R_f = \frac{\text{Cov}(R_i, R_p)}{\text{Var}(R_p)}(\bar{R}_p - R_f)
\]

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

\[
\bar{R}_i - R_f = \frac{\text{Cov}(R_i, R_m)}{\text{Var}(R_m)}(\bar{R}_m - R_f)
\]

• \(\text{Cov}(R_i, R_m)/\text{Var}(R_m)\) 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 \(\alpha_i\) 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 $\rightarrow$ 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 \((R_{it} - R_f) - \beta_{im}(R_{mt} - R_f)\)

• Otherwise bias.
• In reality two deviations from CAPM:

  1. Control for both $\alpha$ and $\beta$

  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 $\rightarrow$ Mergers good or bad?
  - earning announcement $\rightarrow$ How is company doing?
  - campaign-finance reform $\rightarrow$ Effect on companies financing Reps/Dems
  - election of Bush/Gore $\rightarrow$ Test quid-pro-quo parties-firms
  - Iraq war (later in class) $\rightarrow$ 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 $d_{t,k}^1$: Bottom 10% earnings surprises
  
  – Decile 2 $d_{t,k}^2$: 10% to 20% earnings surprises
  
  – etc.

• Estimate average return decile-by-decile

• Equivalent to running regression:

\[
r_{t,k}^{(h,H)} = \sum_{j=1}^{10} \phi_j d_{t,k}^j + \varepsilon_{t,k}
\]
• 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)
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
  
  
  
• In a world with unlimited arbitrage...

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

- May 4, 1998
- November 12, 1998
- November 28, 1997
• 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 strategy on attention papers:
  – Do not attempt general model
  – Focus on specific deviation
5 Attention: Oil Prices

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

- Josh’s slides.