Econ 219B
Psychology and Economics: Applications
(Lecture 9)

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Outline

1. Response to Earning Announcements
2. Introduction to Asset Pricing
3. Arbitrage
4. Noise Traders
5. Event Studies

1 Response to Earning Announcements

- See problem set on earning announcements

2 Introduction to Asset Pricing

- Asset Pricing I: How do people trade financial assets given prices?
  - When to buy?
  - Which assets?

- Asset pricing II: How are the prices of financial assets determined?

- Asset Pricing is 95 percent about the second set of issues

2.1 Asset Pricing I

- Brief overview of anomalies in Asset Pricing I (from Barberis and Thaler, 2004)

  1. **Underdiversification.**

     (a) Too few companies.

     - Investors hold an average of 4-6 stocks in portfolio.
     - Improvement with mutual funds

     (b) Too few countries.

     - Investors heavily invested in own country.
     - Own country equity: 94% (US), 98% (Japan), 82% (UK)
     - Own are: own local Bells (Huberman, 2001)

(c) Own company

- In companies offering own stock in 401(k) plan, substantial invesment

2. **Naive diversification.**

- Investors tend to distribute wealth 'equally' among alternatives in 401(k) plan (Benartzi and Thaler, 2001)

- More on this in Section on Persuasion

3. **Excessive Trading.**

- Trade too much given transaction costs (Odean, 2001)

- More on this in Section on Overconfidence

4. **Disposition Effect in selling**

   - Investors more likely to sell winners than losers
   - Covered in Section on Reference Dependence

5. **Attention Effects in buying**

   - Stocks with extreme price or volume movements attract attention (Odean, 2003)
   - More on this in Section on Attention

- Explanations?
  - Tendency to trust familiar things
  - Persuasion: Tendency to trust (implicit) advice of others
  - Overconfidence
  - Reference Dependence
  - Attention

2.2 Asset Pricing II

- Investor preferences
  - Risk Aversion (CRRA)
  - Habit Formation
  - Loss Aversion
- Trading environment
- Derive pricing of financial assets:
  - CAPM
  - APT

  - Multi-Factor Model

- Bad news: for this, need to take asset-pricing course

- Good news: three fundamental themes:

  1. Arbitrage and Limits thereof

  2. Short-Run Announcement Effects

  3. Long-Run Performance

3 Arbitrage

- Arbitrage:
  - Individuals attempt to maximize individual wealth
  - They take advantage of opportunities for free lunches
- Implications of arbitrage: 'Strange' preferences do not affect pricing
- For Asset Pricing II, no need to worry about behavioral stories
- (Still need to worry for Asset Pricing I)
- Is it true?

- Fictitious example:
  - Asset A returns \$1 tomorrow with $p = .5$
  - Asset B returns \$1 tomorrow with $p = .5$
  - Price of A has to equal price of B
  - If $p_A > p_B$,
    - sell A and buy B
    - keep selling and buying until $p_A = p_B$
  - Viceversa if $p_A < p_B$

- Problem: Arbitrage is limited (de Long et al., 1991; Shleifer, 2001)

- Example: can buy/sell A or B and tomorrow get fundamental value

- Real world: prices can diverge from fundamental value

- Real world example. Royal Dutch and Shell
  - Companies merged financially in 1907
  - Royal Dutch shares: claim to 60% of total cash flow
  - Shell shares: claim to 40% of total cash flow
  - Shares are nothing but claims to cash flow

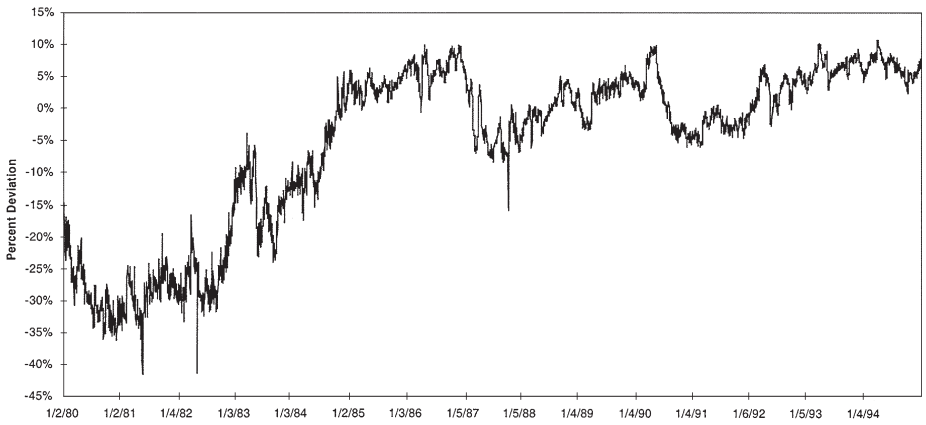

Fig. 1. Log deviations from Royal Dutch/Shell parity. Source: Froot and Dabora (1999).

Netherlands, are a claim to 60% of the total cash flow of the two companies, while Shell, which trades primarily in the UK, is a claim to the remaining 40%. If prices equal fundamental value, the market value of Royal Dutch equity should always be 1.5 times the market value of Shell equity. Remarkably, it isn't.

Figure 1, taken from Froot and Dabora's (1999) analysis of this case, shows the ratio of Royal Dutch equity value to Shell equity value relative to the efficient markets benchmark of 1.5. The picture provides strong evidence of a persistent inefficiency. Moreover, the deviations are not small. Royal Dutch is sometimes 35% underpriced relative to parity, and sometimes 15% overpriced.

This evidence of mispricing is simultaneously evidence of limited arbitrage, and it is not hard to see why arbitrage might be limited in this case. If an arbitrageur wanted to exploit this phenomenon – and several hedge funds, Long-Term Capital Management included, did try to – he would buy the relatively undervalued share and short the other. Table 1 summarizes the risks facing the arbitrageur. Since one share is a good substitute for the other, fundamental risk is nicely hedged: news about fundamentals should affect the two shares equally, leaving the arbitrageur immune. Nor are there

Table 1
Arbitrage costs and risks that arise in exploiting mispricing

Example	Fundamental risk (FR)	Noise trader risk (NTR)	Implementation costs (IC)
Royal Dutch/Shell	×	√	×
Index Inclusions	√	√	×
Palm/3Com	×	×	√

  - Price of Royal Dutch should be 60/40=3/2 price of Shell

- p_{RD}/p_S differs substantially from 1.5 (Fig. 1)

- Plenty of other example (Palm/3Com)

- What is the problem?
  - Noise trader risk
  - In the long run, convergence to cash-flow value
  - In the short-run, divergence can even increase

4 Noise Traders

- Vikram

Limits to Arbitrage: Outline

- LTCM case
- Noise traders
  - Model setup & solution
  - Interpreting the equilibrium demand & price
  - Relative returns & welfare
- Why the limits to Arbitrage?
- Comments

LTCM: Arbitrage going wrong

- Hedge Fund started by John Meriwether in 1994
- Included Merton, Scholes, leading PhDs and fixed income traders
- Idea: Identify and exploit “arb” opportunities in fixed income markets globally
- Hedge using complex models to find the optimal replicating portfolios
- Relative value or convergence trades
- Large bets, small gains: “Suck up nickels around the world!”

LTCM

Example of a trade

- Bet on convergence of European treasury yields after introduction of Euro
- German bunds overpriced (yield too low)
- Belgian bonds underpriced (yield too high)
- Yields must converge
- Long Belgian bonds, short bunds
- Large bet

- How long to converge?
- What if prices diverge in the interim?

LTCM

- ROE of 43% & 41% in first 2 years of full operation
- High margins require high leverage!
- Crises in East Asia, Russia in Fall 1998
- Flight to safety: US & German treasuries
- German yields fall further relative to Belgian!
- Other trades included:
  - Short US treasuries versus long Russian bonds
  - Short US treasuries versus long US corporate bonds.
- Massive losses (e.g. $550 mil. on Aug 21 alone)
- Margin calls, forced liquidation, bailout

The Noise Trader Model*

- OLG with 2-period lifespan
- 1st period: no consumption, exogenous labor supply, have to choose portfolio
- 2 assets paying identical dividends, r:
  - Safe (s): elastic supply, 1:1 conversion into consumption, price normalized to 1
  - Unsafe (u): fixed supply of 1 unit, fundamental price is also 1
- 2 types of agents:
  - noise traders in measure μ
  - Sophisticated investors in measure $1-\mu$

*De Long et al, JPE, 1990

The Model contd..

- Noise traders misperceive expected price of u by:

$$\rho_t \sim N(\rho^*, \sigma_\rho^2)$$

- CARA preferences:

$$U = -e^{-(2\gamma)w}$$

- At time t, both types choose how much to invest in risky asset so as to max E(U), given their own beliefs on ex ante distribution of price at t+1, p_{t+1}
- 2nd period: old sell risky asset holdings at p_{t+1} to new young, and consume all their wealth.

Sketch of solution

$$E(U) = -e^{-(\bar{w}-\gamma\sigma_w^2)}$$

- Sophisticated investors buy λ^i units so as to:

$$\max E(U) = \bar{w} - \gamma\sigma_w^2 = c_0 + \lambda_t^i[r + E(p_{t+1}) - p_t(1+r)] - \gamma(\lambda_t^i)^2(E(\sigma_{t+1}^2))$$

$$\Rightarrow \boxed{\lambda_t^i = \frac{r + E(p_{t+1}) - p_t(1+r)}{2\gamma(E(\sigma_{t+1}^2))}}$$

- Noise traders:

$$\max E(U) = c_0 + \lambda_t^n[r + E(p_{t+1}) - p_t(1+r)] - \gamma(\lambda_t^n)^2(E(\sigma_{t+1}^2)) + \lambda_t^n(\rho_t)$$

$$\Rightarrow \boxed{\lambda_t^n = \frac{r + E(p_{t+1}) - p_t(1+r)}{2\gamma(E(\sigma_{t+1}^2))} + \frac{\rho_t}{2\gamma(E(\sigma_{t+1}^2))}}$$

Interpreting the demand

- Demand for u proportional to perceived excess return & inversely linked to perceived variance
- Noise traders demand more than sophisticated if bullish, $\rho_t > 0$ and vice versa
- Variance is due to noise traders and limits demand of both types

Solution sketch

- Market clearing implies demand sum to 1:

$$p_t = \frac{1}{1+r}[r + E(p_{t+1}) - 2\gamma(E(\sigma^2_{t+1})) + \mu\rho_t]$$

- Solving recursively for steady state equilibrium:

$$p_t = 1 + \frac{\mu(\rho_t - \rho^*)}{1+r} + \frac{\mu\rho^*}{r} - \frac{2\gamma\mu^2\sigma^2_\rho}{r(1+r)^2}$$

Variation in noise trader misperceptions

Average misperception by noise traders

Effect of volatility created by noise traders

Interpreting the price

- Price = 1 if no noise traders
- If noise traders more bullish than average ($\rho_t - \rho^* > 0$), then price goes up
- If $\rho^* > 0$, noise traders optimistic on average and price high
- Both types believe that there is mispricing but price risk in next period limits demand; finite bets
- Asset risky with excess return though no fundamental risk

Relative Returns

- If noise traders own relatively more of risky asset, they can earn higher average return
- Difference in return:

$$\Delta R_{n-i} = (\lambda_t^n - \lambda_t^i)[r + p_{t+1} - p_t(1+r)]$$

$$E(\Delta R_{n-i}) = \rho^* - \frac{(1+r)^2(\rho^*)^2 + (1+r)^2\sigma_\rho^2}{(2\gamma)\mu\sigma_\rho^2}$$

"Hold more" if >0

"Price Pressure"

"Buy High Sell Low"

- Lower average return if bearish or too bullish

Relative Welfare

- Sophisticated investors have higher expected utility
- Noise traders
  - If bullish on average, have higher average return but more risky holding implies lower E(U)
  - If bearish, noise have lower average return *and* E(U)
- Sophisticated investors better off in presence of noise traders
- Noise traders have higher average but also more variable consumption

Applications

- Excessive volatility and mean reversion in stocks
  - Noise traders create price risk beyond fundamental risk
  - Can be magnified if large number of passive investors
  - Mean reversion if pricing errors are temporary
- Discount on closed-end mutual funds
  - Noise traders misperceive fund returns separate from that of constituent stocks
- Asset prices and fundamental values

Why the limits to Arbitrage?

In De Long et al's model:

- Arbitrageurs:
  - Are risk averse (reduce bets as volatility rises)
  - Have short horizons (cannot count on reversion to fundamentals)
- One risky market
  - Noise traders create risk that cannot be diversified away

Limits to Arbitrage

- Institutional constraints
  - Margin requirements, no short sales etc
- Arbitrage is often risky and requires capital
  - Specialized arbitrageurs in each market
  - Manage other people's capital
  - Agency problems
  - Forced liquidations, or fear of the same
  - Idiosyncratic risk may matter
- Good reference:
  - Shleifer & Vishny, Journal of Finance, March 1997

Comments

- Arbitrage in financial markets:
  - Powerful force
  - Puts bounds on deviations from fundamental values
- More limited in some markets than others
  - Uncertain fundamental values
  - Long time to convergence
  - High volatility
- Anomalies:
  - Newly discovered ones can persist for long periods
  - Older ones do get mitigated over time

- Noise trader models imply that biases may affect market prices:
  - Reference Dependence
  - Attention
  - Persuasion
- Effects on Asset Pricing I and II
- Noise Trader model is also first example in the course of Market Interaction of Biased and Non-Biased Agents

- Here:
  - Biased investors
  - Non-biased investors
- Elsewhere:
  - Investors (biased)
  - CEOs (smart)
- Also:
  - Consumers (biased)
  - CEOs (smart)
- Later Section in our course

5 Event Studies

- Event Studies analyze the response of stock prices to an event:
  - Earning Announcement
  - Merger
  - Appearance of CEO in media
  - Change of CEO
  - Anti-takeover Law
  - Other ideas?

- Two types of measures:
  1. Short-term event study
  2. Long-term event study

1. Short-term event Study

   - Examine reaction of stock price of company k to news over short horizon:
     - Same-day returns: (0,0)
     - (0,1) around day of announcement
     - (-1,1) around day of announcement
   - Idea: What do markets think about the new information?
   - Efficient Markets: This captures real value for companies of new information
   - More realistic: This may NOT capture the real value for companies, but rather the immediate response of markets

2. Long-term event Study

- Examine reaction of stock price of company k to news over longer horizon:
  - (3,60) after day of announcement
  - (3 days, 1 year) after day of announcement
  - (3 days, 2 years) after day of announcement
- Idea: What is long-term performance following event?
- Efficient Markets: Should be zero (Stock prices random walk)
- More realistic: Together with immediate response, this is likely to capture the real value for companies of new information

- Example: response to earning announcement

- Short-term response:

$$r_{t,k}^{(0,1)} = \alpha + \phi s_{t,k} + \varepsilon_{t,k}$$

  where $s_{t,k}$ is measure of earning surprise

- Response strongly positive (not surprising)

- Response varies for:
  - positive/negative surprise
  - small/large surprise
  - small/large companies
  - business cycle
  - industry

- time period

- quarter and within-quarter

- Long-term response:

$$r_{t,k}^{(3,75)} = \alpha + \phi s_{t,k} + \varepsilon_{t,k}$$

  where $s_{t,k}$ is measure of earning surprise

- Response positive (surprising)

- Post-Earning Announcement Drift

- Evidence of initial underreaction to earning surprise

- Inattention?

- Most of the delayed response occurs around the next announcement.

- Next time:
  - Use CAPM to motivate using β-adjusted stock returns
  - Portfolio-based event study methodology