

# Efficient Capital Markets

- Important concept: No Free Lunch
- From BRN 410 (Managerial Economics) you learned that competitive markets prevent firms from earning monopoly profits
- Efficient markets are an application of this general principle to financial markets
  - i.e., if you think you have a “profitable” trading strategy you should make sure you understand why others cannot compete away your “rents”

# Efficient Capital Markets

- Characteristics of capital markets:
- Standardized commodities (little product differentiation)
  - Claims on future cash flows
  - Differ by timing, risk & liquidity
- Many participants both buying and selling
  - Competition on both sides of the market
  - Even if a particular security isn't sold by a government or corporation, creative people like investment bankers will create them if there is enough demand

# Efficient Capital Markets

- More characteristics of capital markets:
- Costs of trading are small in organized markets
  - Stock exchanges, dealer markets for bonds
- Costs of obtaining information are small
  - => Looks like a good candidate for a highly competitive market

# Testing for Efficient Capital Markets

- Definitions: Prices reflect information available at time  $t-1$ 
  - Weak form: information in past prices,  $p(t-1), \dots, p(t-k)$
  - Semi-strong form: publicly available information
    - includes weak form as a special case
  - Strong form: private/inside information
    - includes semi-strong form as a special case
    - Nobody believes this should be true, so this definition is just there for “completeness”

# Testing for Efficient Capital Markets

Must have some model (hypothesis) about “normal” rates of return to assets to perform a test of market efficiency

- Given a model of equilibrium expected returns,  $E[R(it)|\phi(t-1)]$ , where  $\phi(t-1)$  represents information available at time  $t-1$
- Then deviations of actual returns from expected returns (which we might call “unexpected” or “abnormal” returns) should be random/unpredictable

$$\varepsilon(it) = R(it) - E[R(it)|\phi(t-1)]$$

# Testing for Efficient Capital Markets

Thus, all tests of efficient markets are joint tests of the model of expected returns that you are using

If “abnormal” returns seem to exist, you need to be sure that it is not just because you assumed a poor model of expected returns

# Weak Form Tests: Information in Past Prices

## Autocorrelation tests on returns

Assume that equilibrium expected returns are constant over time

$$E[R(it)|\phi(t-1)] = E[R(i)]$$

In an efficient market, the correlation of current returns with past returns should be zero

$$\text{corr}[R(it), R(it-k)] = 0$$

=> Random walk model for (log) stock prices

# Weak Form Tests: Information in Past Prices

## Autocorrelation tests on returns

If there is “persistence/momentum”

$$\text{corr}[R(it), R(it-k)] > 0$$

If there are “reversals/overreaction”

$$\text{corr}[R(it), R(it-k)] < 0$$

# Weak Form Tests: Information in Past Prices

## Facts

- Autocorrelations of daily and monthly stock returns are low
  - Slightly negative at lag 1 for small (less liquid) stocks (-.03 to -.06)
  - Slightly positive at lag 1 for large capitalization (more liquid) stocks (.01 to .05)
- Autocorrelations are slightly positive for portfolios of stocks (.05 to .15)
  - Probably due to nonsynchronous trading
    - e.g., information comes in at 2:15 P.M.
    - It takes a while for some stocks to trade, so S&P 500 seems to react slowly
    - It reflects the “last trade” prices, some of which are stale

# Weak Form Tests: Information in Past Prices

- Bid-ask spreads cause negative autocorrelations
  - If the last trade was buyer-initiated (ask price), it will be “high” (at the top of the spread)
  - The next trade has a 50% chance of being a buy or sell
  - So the price would be expected to be in the middle of the spread
  - Implies a drop in the stock price, so negative autocorrelation of adjacent returns
- There is no profit opportunity
  - Except for the specialist/dealer, who is providing the inventory service

# Weak Form Tests: Information in Past Prices

- Filter rule tests:  
(trying to take advantage of momentum)
  - Buy after prices rise by  $X\%$
  - Sell after prices fall by  $Y\%$
- Tests show that these work best for very small filters, implying a lot of trading (probably picking up bid-ask bounce)
  - After transaction costs and risk adjustment, there are no profit opportunities compared with a “buy-and-hold” strategy

# Weak Form Tests: Information in Past Prices

Filter rule vs. Buy-and-hold strategy:

- Assumes that equilibrium expected returns are positive

$$E[R(it)|\phi(t-1)] > 0$$

- Buy-and-hold assumes that you never want to sell (or short-sell)
- This is a passive (no information) strategy

# Weak Form Tests: Information in Past Prices

## Important points:

- Realize that you are making some kind of assumption about explicit (or implicit) expected returns
  - Probably want to adjust/control for risk of the active trading strategy
- Compare the active strategy (based on information) with a passive strategy
- Adjust/Control for costs of implementing the active strategy
  - Net out incremental transactions costs
  - Net out costs of acquiring/processing information

# Semi-strong Form Tests: Event Studies

- Literally thousands of these have been done
- General results: stock prices react in a (more-or-less) efficient way to new information
  - i.e., good news causes stock prices to rise quickly and there is no tendency to prices to then continue rising (indicating under-reaction), or to fall (indicating over-reaction)
  - The test of market efficiency is what happens after the information becomes public

# Semi-strong Form Tests: Event Studies

- Often there will be a pattern of abnormal returns leading up to the public announcement
  - This is most likely a description of how firms/stocks make it into the sample (sometimes called “sample selection bias”)
    - E.g., original event study (FFJR) found that stocks rose “abnormally” about 30% in the 30 months before they declared a stock split
    - This almost surely is a result of the fact that firms choose to split their stock (lowering the per share price) after the stock price has risen in the recent past
  - If it is not sample selection bias, then it is likely caused by leakage of the information prior to the formal public announcement
    - E.g., stock prices rise in the months before a proxy fight is announced
    - Almost surely due to the dissident shareholders polling large shareholders to see if they might vote against management
    - Hard to tell a story that proxy fights are triggered by recent “good” stock price performance . . .

# Example:

## Returns to Targets and Bidders

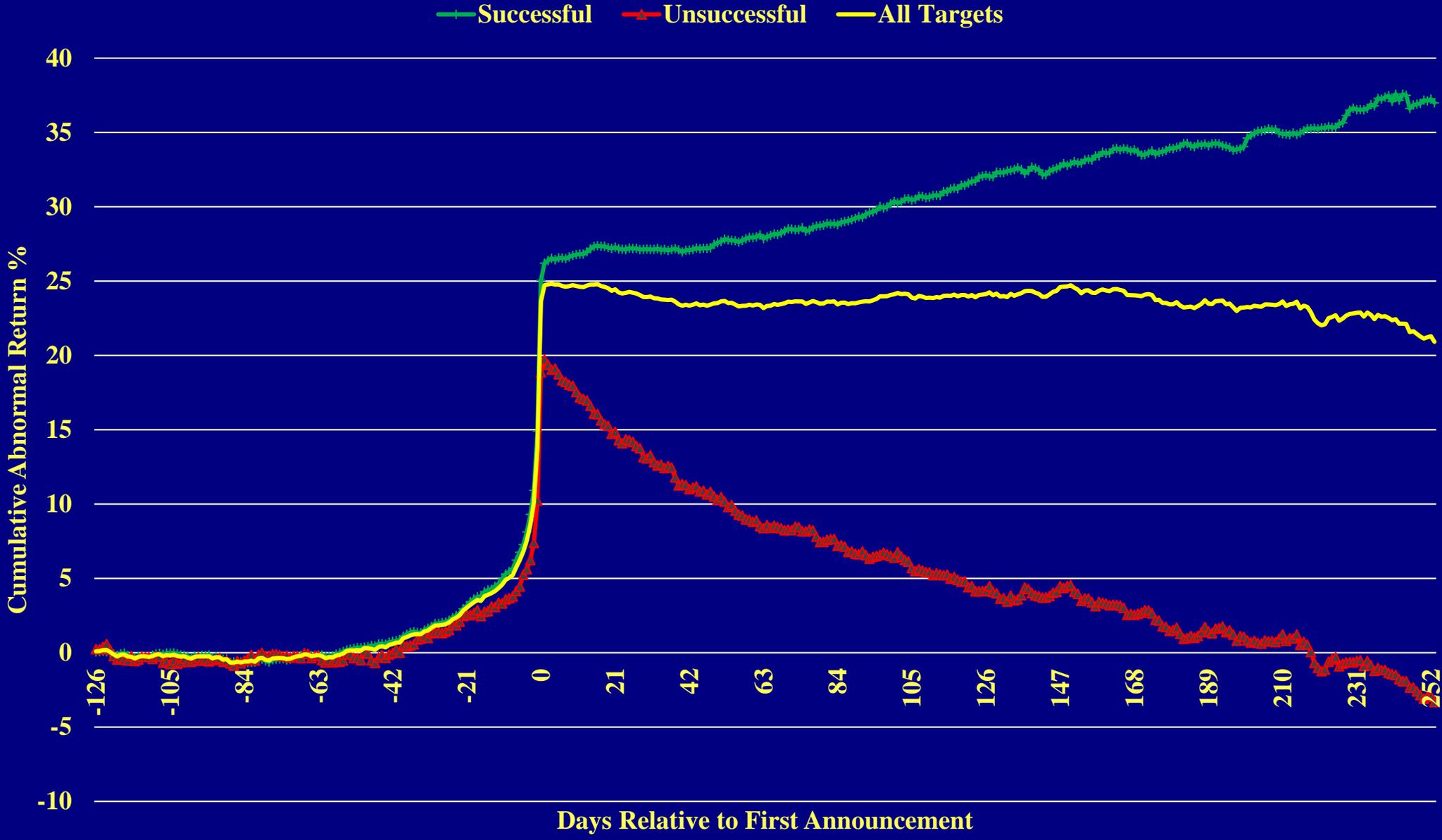
- Markup Pricing in Mergers & Acquisitions
  - *Journal of Financial Economics*, 41 (June 1996) 153-192
  - Use market model regression to control for variation in returns unrelated to merger news
  - Estimate the model using a year of data (253 trading days) ending 6 months before the first merger/tender offer announcement:

$$R(it) = a_i + b_i R(mt) + e(it), t = -379, \dots, -127$$

- Then calculate abnormal returns from day -126 to the delisting date (or 253 days after the first announcement)

$$e(it) = R(it) - a_i - b_i R(mt), t = -126, \dots, 253$$

# Cumulative Abnormal Returns (CARs) for Target Firms



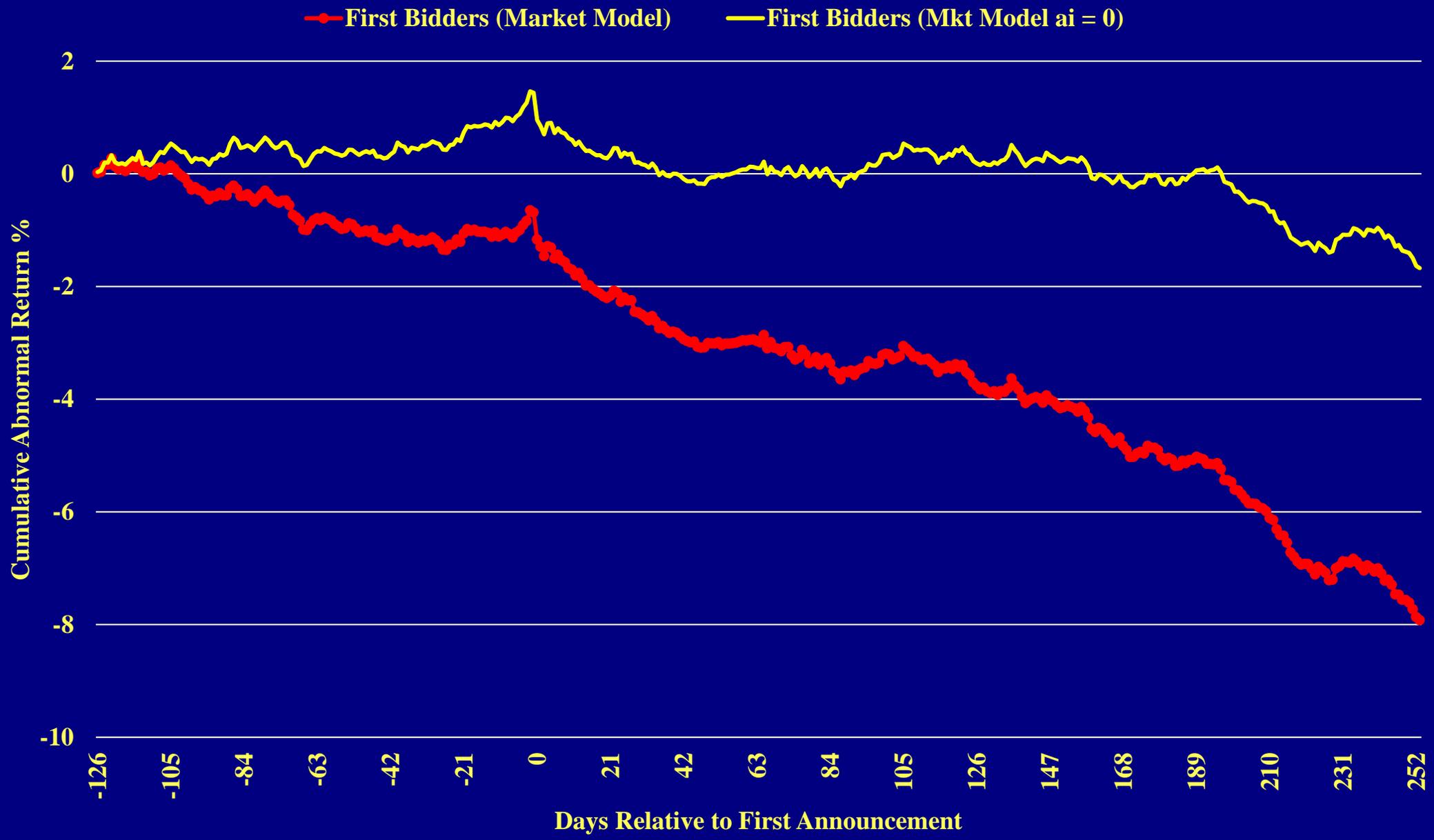
# Cumulative Abnormal Returns (CARs) for Target Firms

- The CAR for the sample of all 1,815 target firms (US exchange-listed, 1975-91) rises in the two months before the first formal bid
  - Likely caused by leakage (either pre-bid purchases to establish a “toehold” or insider trading by people who gain access to the news of the impending bid)
- The CAR for the sample of all 1,815 target firms is flat after the first bid announcement
  - i.e., there is no profit opportunity from buying the shares of target firms after the bid is announced

# Cumulative Abnormal Returns (CARs) for Target Firms

- The CAR for the sample of all 1,401 target firms that are successfully taken over rises by about 12% after the first bid announcement
  - This sample of firms has a higher CAR at date “0,” implying that stockholders think it is more likely these firms will be acquired
  - i.e., there is a profit opportunity if you have perfect foresight and can tell which deals will succeed
- The CAR for the sample of all 414 target firms that are not successfully taken over falls back to zero, losing about 22% after the first bid announcement
- Again, on average the portfolio of all target firms earn no abnormal returns after the first bid

# Cumulative Abnormal Returns (CARs) for Bidder Firms



# Cumulative Abnormal Returns (CARs) for Bidder Firms

- Two measures of CARs:
  - Red line uses the historical market model estimates (just as we did for target firms)
    - Note that this line drifts downwards steadily from day -126 to day +253
  - This strongly suggests that there is a problem with using the market model as a model of “normal” returns
    - Probably because bidder firms whose stock prices have risen in the past are more likely to engage in takeover activity
    - If average stock returns are “too high” in the past, the market model intercept will be biased upwards as an estimate of what we should expect in the future

# Cumulative Abnormal Returns (CARs) for Bidder Firms

- Two measures of CARs:
  - To fix this problem, I also show abnormal returns where the market model intercept is set equal to 0, so

$$e(it) = R(it) - b_i R(mt), t = -126, \dots, 253$$

- The yellow line stays pretty close to zero, except for a small runup before the first bid announcement, followed by a drop of 0.7% in the three days following the announcement (days 0,1,2)
- Note that even with this adjustment, it does not seem that bidders gain much from making takeover bids (a fact that is found generally in the finance literature)

# Return to BRN 481 Home Page

Data used for these slides can be accessed at:

<http://schwert.ssb.rochester.edu/brn481/brn481Emkt.xlsx>

<http://schwert.ssb.rochester.edu/brn481/brn481Emkt.zip>

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