Efficient Markets

September 2008
Library Class 09/12

Meets in Room 300t Haas across from Long Library Entrance
Honor’s Thesis Elements

1. Why is this interesting?
2. Economic Theory (model)
3. Can one refute the model (theory?)—testable implications
4. Hypothesis
5. Test
6. Results
7. Conclusion
Why is this interesting?

- An empirical puzzle led to Efficient Markets theory
- Empirical “fact”
- Stock prices look like random walks
- Why?
Overview

• Intuitive Story: no expected excess returns
• Simple Testable model
  – Compare random walk and mean reversion
• Rejecting the Constant Expected Returns Model—see Shiller
• Other tests—see Malkiel
Intuitive Economic Story

• Expected Excess Return
• => buy (or sell)
• Buying (or selling) changes current price
• Equilibrium: No Expected Excess Return
Malkiel’s Definition

• A capital market is said to be efficient if it fully and correctly reflects all relevant information in determining security prices. Formally, the market is said to be efficient with respect to some information set...if security prices would be unaffected by revealing that information to all participants. Moreover, efficiency with respect to an information set....implies that it is impossible to make economic profits by trading on the basis of [that information set].
Information Sets

• **Weak-form Efficiency**: The information set includes only the history of prices or returns.

• **Semistrong-form Efficiency**: The information set includes all publicly available information.

• **Strong-form Efficiency**: The information set includes all (public and private) information.
Statistical Tests require Formalization

• Mathematical model
  – Capture essential characteristics
  – Necessarily simplifies complex reality

• If you reject are you rejecting the economic hypothesis, or the simplified model?
Random Walk or Constant Expected Returns

\[ \ln(S_{t+1} + d_{t+1}) = r + \ln S_t + e_{t+1} \]

\[ e \sim N(0, \sigma^2) \quad \forall \ t \]

\[ e_{t+1} \equiv (\ln(S_{t+1} + d_{t+1}) - \ln S_t) - r, \ or \]

\[ e_{t+1} = r_{t+1} - r, \]

where \( r_{t+1} \equiv (\ln(S_{t+1} + d_{t+1}) - \ln S_t) \)

and \( E_t r_{t+1} = r \)
Properties of Constant Expected Return and Random Walk

- Expected returns are unpredictable (constant) => no expected excess returns
- Log payoffs (prices + dividends) follow a random walk with drift $r$

- Model satisfies definition of an efficient market and is testable
An Alternative: Mean-Reversion

\[
\ln(S_{t+1} + d_{t+1}) = \ln S_t + \bar{r} - \lambda((\ln(S_t + d_t) - \ln S_{t-1}) - \bar{r}) + u_{t+1}
\]

\[0 < \lambda < 1, u \sim N(0, \sigma^2)\]

or in returns, \( r_{t+1} = \bar{r} - \lambda(r_t - \bar{r}) + u_{t+1}; r_{t+1} \)

\[\equiv (\ln(S_{t+1} + d_{t+1}) - \ln S_t)\]
Properties of Mean Reverting Walk

• Expected returns are predictable
  => expected excess returns > \( r \)

• Log payoffs (prices + dividends) return to trend \( r \)

• Model does not satisfy simple definition of an efficient market
Test Constant Expected Returns

• If one can predict future returns, then the model and (this form of the) efficient markets hypothesis are rejected

\[ r_{t+1} = a + b' X_t + u_{t+1} \]
Project: Test the Constant Returns Model

• See the assignment on the class webpage

• If it rejects (an a few will), then (not this problem set) an honors thesis should ask:
  – Is this statistical (you reject 5% of the time when the null is true)
  – Is the model wrong or is the theory wrong
  – Is it economically significant? How much money can one make betting against the random walk model?
Surprisingly some resist testing
Theory Wrong: Shiller

• Rejects Constant Expected Returns Model
• Interprets the rejection as a rejection of
• The Efficient Markets Hypothesis
Shiller’s picture
Theory Correct—test wrong: Malkiel

- Mutual Fund Performance
- Model? Professional managers should beat amateurs
Malkiel’s Results

Exhibit 5
Percentage of Large Capitalization Equity Funds Outperformed by Index Ending 5/30/2002

<table>
<thead>
<tr>
<th></th>
<th>1 year</th>
<th>3 years</th>
<th>5 years</th>
<th>10 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>S&amp;P 500 vs. Large Cap Equity Funds</td>
<td>63%</td>
<td>56%</td>
<td>70%</td>
<td>79%</td>
</tr>
<tr>
<td>Wilshire 5000 vs. Large Cap Equity Funds</td>
<td>72%</td>
<td>64%</td>
<td>69%</td>
<td>74%</td>
</tr>
</tbody>
</table>

Source: Lipper Analytic Services.

Note: All large capitalization mutual funds in existence are covered with the exception of “sector” funds and funds investing in foreign securities.
More Sophisticated and Recent Test

• NY Times July 13 2008
• Strategies - The Prescient Are Few
• Mark Hulbert
• see webpage link in Elmo’s Corner
What to take away from today

• Model for a thesis
  1. Why is this interesting?
  2. Economic Theory (model)
  3. Can one refute the model (theory?)—
  4. Test hypothesis
  5. Results
• Resisting testing can restrict your degrees of freedom