Economics 137
Craine
9/03

Market Efficiency

The economic reasoning behind market efficiency is deceptively simple. If an investor knows that an asset price will increase tomorrow, then he buys it today. If all investors try to buy the asset today, then in market equilibrium the price increases today to equal tomorrow's expected price. Market efficiency implies there are no expected (excess) returns, or (approximately) that price changes are unpredictable.

Eugene Fama in a famous article(1970, Efficient Capital Markets: A Review of Theory and Empirical Work, Journal of Finance, 25, 383-417) formalized the notion of an efficient market and presented tests of efficiency. Burton Makiel (1992, Efficient Market Hypothesis, New Palgrave Dictionary of Money and Finance) expands on Fama'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].

The classic taxonomy of information sets distinguishes among

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.

Our task is to test for **Weak-form Efficiency**. A good starting reference is Campbell, Lo, and MacKinlay, The Econometrics of Financial Markets, Chapters 1 & 2.

Let's start with a simple statistical model of stock prices, *S*,

$$\begin{aligned} &\ln(S_{t+1} + d_{t+1}) = r + \ln S_t + e_{t+1} \\ &e \sim N(0, \sigma^2) \ \forall \ \text{t} \end{aligned} \tag{1.1}$$

the log of stock payoffs, the price plus distributions—$S+d$, follows a random walk with constant drift, r. Here e is an independent, identically distributed (I specified a normal,

but you can, but you don't want to, choose another distribution) error. This representation implicitly assumes that a constant expected returns economic model, $Er = r$.

Equation (1.1) can be rearranged in a user friendly format that emphasizes the fact that the excess return is an unpredictable random error,

$$\begin{aligned} &e_{t+1} \equiv (\ln(S_{t+1} + d_{t+1}) - \ln S_t) - r, or \\ &e_{t+1} = R_{t+1} - r, \\ &where\ \mathrm{R}_{t+1} \equiv (\ln(S_{t+1} + d_{t+1}) - \ln S_t) \end{aligned} \tag{1.2}$$

Tests

A test of the weak-form efficient markets hypothesis *and* the constant expected return model (1.1) is that the error term is not predictable from past history of prices or returns.

See if you can predict the error with data on past returns.

Hint: Elmo says, "The easy way to do the test is to add variables to the linear regression",

$$R_{t+1} = a + b' X_t + u_{t+1} \tag{1.3}$$

Where X is past own returns, or the returns from another stock. X can be a scalar, eg, R_t, or a vector of lags, R_t, R_{t-1},…

Under the null hypothesis:

$$\begin{aligned} a &= r \\ b &= 0 \\ u &= e \end{aligned}$$

So says Elmo, "Check the significance of the *b* coefficients."

Project 1:

Get equity data from CRSP

1. For an index (explain why you choose the index)
2. For five individual equities

For Different Frequencies

1. daily (five years)
2. monthly (25 years)
3. annual (from the beginning--1926)

Do the tests and think about the results.

For Class 9/18

Each team turns in one page summary of the assignment

a. securities
b. results

and a copy of the output.

Each team should be prepared to present and discuss their results.