Economics H195A
Professor Craine
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Team Assignment 1: 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**. If you want to read more a good, but difficult, reference is Campbell, Lo, and MacKinlay, The Econometrics of Financial Markets, Chapters 1 & 2.

Let's start with Fama's model. Define the (logarithmic)[1] return, r, as,

$$r_{t+1} \equiv \ln(\frac{S_{t+1} + d_{t+1}}{S_t}) \tag{0.1}$$

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[1] The CRSP data set uses geometric returns. This is not a big deal.

the log of stock payoffs—the price, *S,* plus distributions, *d,* next period—divided by the price this period.

The most basic efficient markets model—the one tested by Fama—assumes that returns are normally distributed and that expected returns are constant,

$$r_{t+1} \sim N(\bar{r}, \sigma^2), \forall t \tag{0.2}$$

Equation (0.2) can be rearranged in a user friendly format that emphasizes the fact that the excess return is an unpredictable random error,

$$r_{t+1} = \bar{r} + e_{t+1}, where$$
$$e_{t+1} \sim N(0, \sigma^2) \tag{0.3}$$

Tests

A test of the weak-form efficient markets hypothesis *and* the constant expected return model (0.2) 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, or check the autocorrelation of returns, see C-L-M 2.4.

Elmo says, "Another easy way to do the test is to add variables to the linear regression",

$$r_{t+1} = a + b'X_t + u_{t+1} \tag{0.4}$$

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:

$$a = r$$
$$b = 0$$
$$u = e$$

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

The data are in Excel Spreadsheets labeled Daily Data and Monthly Data on the webpage. RET and retd stands for return with distributions (with distributions--usually dividends but it includes any distributions). There five series GM , vw (value weighted return on the NYSE, AMEX, and NASDEQ—a very broad index), UAL (United Airlines), CISCO, and IBM plus dates.

Each team
    1. does the tests, and
    2. should be prepared to discuss the results in class, and
Each Team

3. turns in a short (3-5 page) paper that explains the economic model, the hypothesis, results, and conclusion