

Efficient Markets

(Welch, Chapter 12)

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Did you bring your calculator? Did you read these notes and the chapter ahead of time?

All reasonable financial models impose the belief that there is an absence of both non-trivial great bets and non-trivial arbitrage opportunities.

What exactly is arbitrage?

What is a great bet?

Who would prefer an arbitrage to a great bet?

Is it easy to find either? Or something that is both?

Efficient Market

Perfect vs. Efficient Markets

- ▶ **An efficient market is one that sets the price correctly.**
 - ▶ Market efficiency is about asset **price** today, i.e., the exp. return.
 - ▶ Higher price \Leftrightarrow Lower expected return.
 - ▶ It is not about covariances, betas, variances, earnings, etc. It uses them, but they are not the point.
- ▶ Confusion reigns (for good reason): most mean **perfect** markets when they say **efficient** markets.
 - ▶ Perhaps, “efficient markets” is really “perfect markets,” but with more emphasis on informational considerations.
- ▶ More strictly (but perhaps not more sensibly),
Perfect Market \Rightarrow Efficient Market
(because of market forces), but
Perfect Market \nLeftarrow Efficient Market
(market could be efficient, e.g., with x-costs).

Our coverage is abbreviated.

(An investments course covers market efficiency (ME) in much more detail.)

Illustration and Most Usefulness

Efficiency offers useful distinction between “target setting” and “target hitting.”

The General Case

Market Assesses

The financial markets estimate the statistical distribution of future cash flows, including their expected cash flow values, covariances, liquidity, and anything else possibly of interest.

Pricing Model

Target Set

The financial market determines the appropriate expected rate of return, given all value-relevant characteristics.

Today's Price

Eff Mkt + Model

The market sets today's price, so that the expected rate of return is as the model states.

A Specific Example: ABC

The market estimates ABC's expected value next year to be \$55 per share. It also estimates all other interesting characteristics, such as cash flows, market-betas, covariances, liquidity, etc.

Say the CAPM is the correct pricing model. Then the financial market looks at ABC's market beta, the risk-free rate, and the expected rate of return on the market, and sets ABC's expected rate of return. Say this CAPM expected rate of return is 10%.

The price today is $\$55/1.1 = \50 per share.

- ▶ You cannot use information that the market has already used to outperform the model's set target.
- ▶ There are no (easy) superior returns to gathering information.

You do your research. You determine that the price of ABC is such that you expect it to earn 12% / 20% / 100% over the next year. Can you conclude that the market is inefficient?

What sort of claims would reject ME?

Is market efficiency a stronger concept with more bite over short intervals (a day) or over long intervals (a decade)?

In itself, is ME a very strong claim? As believer, how can you dispute someone doubting it?

What types of markets are more likely to be (in-)efficient?

Traditional Classifications (EM)

Focuses on information availability:

Strong Form: Price reflects all public and private information. You cannot outperform (“make money” = earn higher abnormal returns relative to the prevailing equilibrium model, given your exposures) even with insider information. (Noone believes this one.)

Semi-Strong Form: Price reflects public, but not all private information. You cannot make money with public information.

Weak Form: Price reflects enough public and private information that you cannot make money by plotting historical price patterns—but you could still make money analyzing other aspects, such as company fundamentals.

More Modern Classification (EM)

Focuses on the relation between price reflecting underlying value, and closely linked to behavioral finance:

True believer: Price is always PV of the firm's cash flow.

Firm believer: Price deviates from PV, but this is not exploitable.

Mild believer: Price deviates from PV, and exploiting it is possible, giving you as an investor a mild edge.

Non believer: Price deviates strongly from PV, so investors can easily get rich.

2018: What about Bitcoin?

Causality

- ▶ True market efficiency implies (short-term) near-unpredictable stock prices, i.e., a random walk (with a small drift).
- ▶ (Short-term) near-unpredictable stock prices do not imply true market efficiency. [Bitcoin? Roulette?]

Take “unpredictability” loosely here. It could be that expected returns themselves are time-varying, e.g., because the risk-profile is time-varying. In this case, it may be predictable that you (sometimes) get higher average returns when risk is higher. Unpredictable here means “relative to proper expectations.”

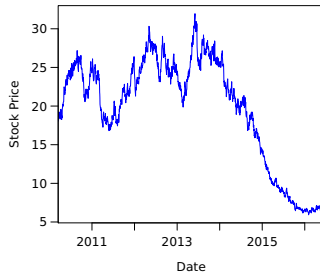
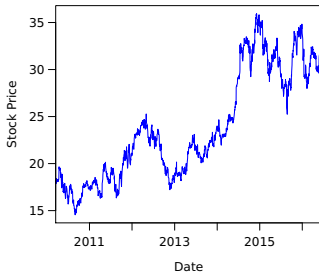
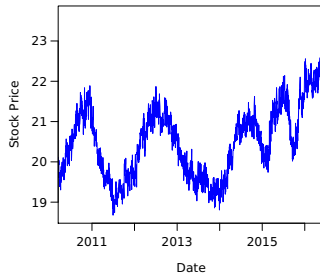
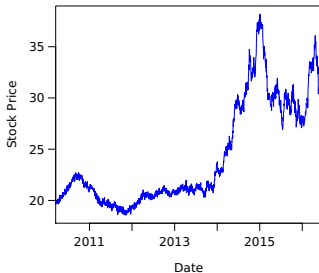
Diversion: Causality

- ▶ Philosophically, what is causality?
- ▶ Can causality be tested in physics?
- ▶ Can causality be tested in economics?

Reasonable Price Patterns

What is Technical Analysis? What sort of price/return patterns should not be observable?

What sort of price/return patterns is reasonable?



Warning: OLS on Time-Series

```
> set.seed(0) # so you can repeat it

> randwalk <- function(N) {
  x <- c(1.0, rep(NaN, N-1))
  for (t in 2:N) x[t] <- 0 + 1*x[t-1] + rnorm(1)
  x }

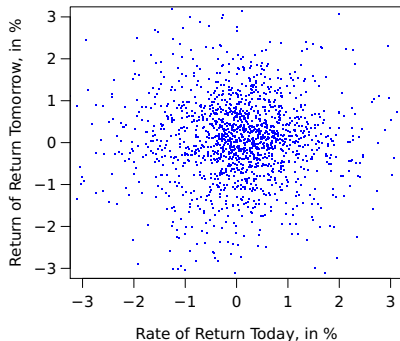
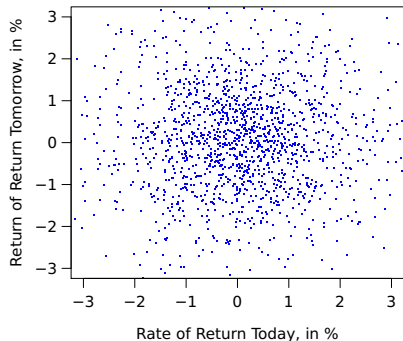
> MC <- 10000 # 10,000 Monte-Carlo Draws
> beta <- rep(NA,MC) # destination

> for (mc in 1:MC) {
  x <- randwalk(50) ## draw
  beta[mc] <- ((coef(lm(x ~ iaw$lagseries(x))))[2]) } ## estimate

> summary(beta)
  Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
0.322  0.854   0.913   0.896   0.956   1.086
```

Note: The expected outcome is not 1.0, but 0.9. This is because OLS does not work well if X's are related to past epsilon's.

How should the relation between yesterday's return and today's return look like?



The left graph is the IXIC, the right graph is Intel.

What is the historical empirical evidence?

First-order: the U.S. financial markets are reasonably efficient with respect to public information. It is very difficult to get rich easily. Few funds manage to outperform. It is close to random.

Second-order: There may be some “anomalies” that seem to offer a tiny bit more than what seems reasonable. The two main equities-related anomalies are

- ▶ Momentum (at least a specific form thereof)—although much of momentum’s average rate of return of 1% per month is probably simply compensation for risk. We learned this in the financial crisis, where the zero-investment momentum portfolio (\$1 long, \$1 short) lost more than \$1 in one year!
- ▶ Value vs. growth—value firms prefer much better than glamorous growth stocks, but they did not do so in all situations.

There are non-equities and other more specialized anomalies, too.

Superior Traders

According to sane equilibrium models, what do you expect the expected rate of return of a stock / portfolio / index to be on an average trading day?

What is the typical move (sdv) up or down of a stock / a portfolio / an index to be on an average trading day?

How does risk (standard deviation) grow with the holding period duration (time) in a random walk?

What is a T-statistic that gives you statistical confidence that the underlying mean performance is not zero?

What kind of an investment edge does it mean to be an investments superstar?

Over

- ▶ 1 day,
- ▶ 100 days,
- ▶ 10,000 days

if you are a true superstar investor, then what would you expect your performance's T-statistic to turn out to be?

If you can beat the market, who would you tell?

How do (hedge/mutual) funds get started?

How many funds should outperform the market 10 years in a row *if* **none** have skills?

How many funds should outperform the market 10 years in a row *if* **some** have skills?

Among *existing*, large funds, how many funds should have outperformed the market with/without skills?

Is Berkshire-Hathaway a good investment?

Who would get the rents from Buffett's abilities?

If you were an investment manager having made 5% per year above your benchmark five years in a row, what would you think of your capabilities?

What do you think of contingent compensation—you pay me only if I give you a profitable stock pick? Will this not remedy the problem of ignorant managers not wanting to get into the business?

Is the following a superior investment manager / strategy?
Write options 15% out of the market.

Alpha?

Overall Perspectives and Consequences

What is the empirical evidence for ME?

Event Studies

Event studies are another way to determine value without having to forecast cash flows. They work in some circumstances, but not others.

They allow you to ask and answer very convincingly such questions as:

- ▶ Does paying dividends increase or decrease stock price?
- ▶ Does Trump's election increase or decrease hospital stocks?
- ▶ Does Trump's election increase or decrease Mexican Pesos?
- ▶ Does Deepwater Horizon increase or decrease Oil Price?
- ▶ Does Divestment hurt divested stocks or divesting managers?

Are there any corporate consequences of ME?

- ▶ You can learn from your own market value.
- ▶ You can learn from your competitors' values.
- ▶ You can learn from other values.
- ▶ You cannot add value by doing things that investors can do (or undo). [splits, dividends, etc.]
- ▶ You cannot make money by trying to time interest rates or gambling on commodities.

As the CEO, what should you do if your shares are undervalued, relative to your (possibly private) information?

As the CEO, what should you do if your shares are overvalued, relative to your (possibly private) information?