

Efficient Capital Markets (ECM)

(Welch, Chapter 12)

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Excursion Chapter

This chapter covers a lot of closely related phenomena,
... but only briefly for lack of time.

Making Sense

All reasonable financial models impose the belief that

- ▶ there is an absence of great bets, and
- ▶ there is an absence of arbitrage opportunities.

What Exactly is Arbitrage?

A: What Exactly is Arbitrage?

No possible negative CFs *ever*

Some positive CFs with non-zero probability.

- ▶ A positive investment is a negative CF up-front.
- ▶ Therefore, investing in a Treasury is not arbitrage.

Great Bets

What is a great bet that is not an arbitrage?

Arbitrage or Great Bet?

Do you prefer an arbitrage to a great bet?

Reasonable Models

For a reasonable model of the world, can/should we assume that

- ▶ it is easy to find arbitrages?
- ▶ it is easy to find great bets?

Implication of PCM

If the market is perfect, it's almost surely not easy to find either.

What can no arb and no great bets tell us in the absence of PCM?

An Efficient Capital Market (ECM)

ECM = Efficient Capital Market

- ▶ (not a common abbreviation; just us)

An efficient capital market (ECM) is one that sets the price correctly, given what it knows.

Put differently, it does not ignore information.

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

ECM Is About $E(R)$

ECM is all about asset *price* today

- ▶ equivalently, ECM is all about $E(R)$, because
- ▶ higher price \Leftrightarrow lower expected return.

ECM is not primarily about covariances, betas, variances, earnings, etc.

- ▶ But to make ECM empirically meaningful, we often need to use them.

Common Confusion: ECM vs PCM

Confusion reigns (for good reason):

- ▶ many investors mean **perfect** markets when they say **efficient** markets; or vice-versa;
- ▶ some investors mean **perfect**, but want to emphasize information aspects;
- ▶ some don't know the difference.
- ▶ even academics are *often* sloppy!
 - ▶ many do not know what they are debating.

Causation?

Again,

$$\text{PCM} \Rightarrow \text{ECM}$$

because of market forces, but not necessarily the opposite.

A markets could be an ECM, e.g., with X-costs.

Parts: ECM and Model

ECM offers a useful distinction between “target setting” and “target hitting.”

Let me explain.

Market Assesses

The financial market assesses the statistical distribution of future cash flows, including

- ▶ their expected cash flow values,
- ▶ their covariances,
- ▶ their liquidity,
- ▶ and anything else possibly of pricing relevance.

Market Assesses Example

The market estimates ABC's expected value next year to be \$55/s.

It also estimates all other price-relevant aspects, such as

- ▶ cash flows,
- ▶ market-betas,
- ▶ covariances,
- ▶ liquidity, etc.

Pricing Model (Target)

A pricing model relates characteristics to appropriate expected RoRs.

Typically, pricing models also identify the value-relevant characteristics.

Pricing Model Example

Say the CAPM is the correct pricing model.
The financial market assesses ABC's price next year,
ABC's market beta, the r_f , and $E(r_m)$,
and then sets ABC's P today based on its best
estimate of these.
So, say, ABC's CAPCM $E(r)$ is 10%.

ECM Plus Model = Price

The market sets ABC's price today, so that the $E(r_i)$ is just as the (CAPCM) model states.

The price of ABC today should be $\$55/1.1 = \$50/s$.

Consequence / Usefulness

If the market has already used information, then you cannot use the same information to outperform the market.

⇒ There are no (easy) superior returns to be had based on already public information.

Concluding Inefficient?

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?

Concluding Efficient?

What sort of claims would reject ECM?

Religion vs Science

Science: Falsifiability based on data.

If data cannot realistically falsify, it's religion

Religion: do we live in a multiverse?

Market-efficiency: part religion, part science. Not all religion, not all science.

ECM: Long vs Short View

Is ECM a stronger concept (more bite)

- ▶ over short intervals (a day), or
- ▶ over long intervals (a decade)?

Strength of ECM Claim

In itself, is ECM a very strong claim?

As an ECM believer, how can you dispute someone doubting your religion?

Market Pricing Model I

What is the correct market pricing model?

Market Pricing Model II

What is the correct model of market pricing over 1 day?

What is the correct model of market pricing over 10 years?

Applicability

What types of markets are more likely to be

- ▶ efficient?
- ▶ inefficient?

Traditional Classifications I

Focus on information availability:

Strong Form:

- ▶ Price reflects all public and private information.
- ▶ You cannot outperform even with insider info.

Semi-Strong Form:

- ▶ Price reflects public, but not all private information.
- ▶ You cannot outperform with public information.

Traditional Classifications II

Weak Form:

- ▶ Price reflects enough public and private information that you cannot make money by plotting historical price patterns.
- ▶ But you could still outperform analyzing other aspects, such as company fundamentals.

Modern Classification (ECM)

Focuses on the relation between price reflecting underlying value. Sometimes 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.

Modern Classification (ECM)

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.

What about Bitcoin?

Random Walks

Does ECM imply unpredictable stock prices?

- ▶ i.e., a daily random walk (**RW**), perhaps with a small drift.

Does a RW of stock prices imply an ECM?

Necessary vs Sufficient

- ▶ Is roulette a ECM?
- ▶ Is bitcoin?

Careful: Predictability in a PCM

What does *unpredictable* mean?

- ▶ It must mean *relative to correct expectations*.
- ▶ It could be that $E(R)$ themselves are time-varying, e.g., because the risk-profile is time-varying.
- ▶ Then it may be predictable that you (sometimes) get higher average returns when risk is higher.
- ▶ Think: known release date of drug trial results.

Diversion: Causality

Philosophically, what is causality?

Can causality be tested in physics?

Can causality be tested in economics?

Technical Analysis

Technical Analysis is “charting.”

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

These “weak form” ECM tests were central to the creation of early modern finance.

Graph: Realistic TS I?

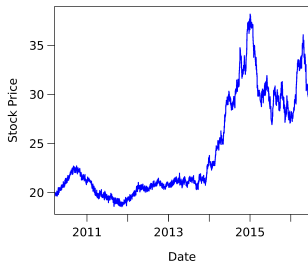


Figure 1: Stock Price Pattern 1

Graph: Realistic TS II?

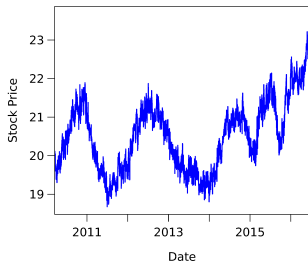


Figure 2: Stock Price Pattern 2

Graph: Realistic TS III?

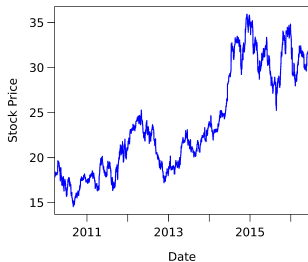


Figure 3: Stock Price Pattern 3

Graph: Realistic TS IV?

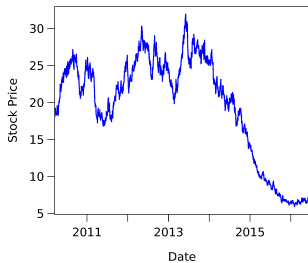


Figure 4: Stock Price Pattern

Testing For Random Walks

How would you test on empirical data whether you are dealing with a random walk?

Say, how would you test whether the index level of an S&P500 is a random walk?

Important AR1 Warning

You would think that a plain OLS TS regression should work, but unfortunately it does not.

The estimated coefficient, given a true random walk, is *not* **1.0**, but less (say, **0.9**).

- ▶ This is because OLS does not work well if X's are related to past epsilon's.
- ▶ Be very careful with time-series regressions!

Advice: Differencing

As with spurious X-Y relations, differencing is one way of addressing the problem.

But you need to learn a lot more before you can tackle this problem competently.

For now, at least be aware of it!

RoR Predictions

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

Graph: IXIC

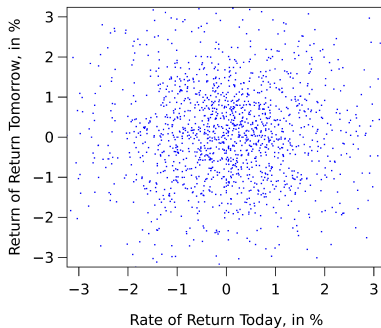


Figure 5: dailyrose

Graph: INTC

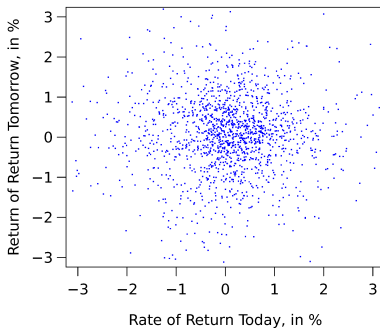


Figure 6: daily rose

Empirical Evidence, 1st-Order

U.S. financial markets, especially for large liquid securities (stocks, certain bonds), are practically like ECM with respect to public information.

It is very difficult to get rich easily.

Competition erodes rents.

Few funds manage to outperform. Fund performance seems serially uncorrelated and close to random.

Empirical Evidence, 2nd-Order

There may be some “anomalies” that seem to offer a tiny bit more than what seems reasonable.

The two main equities-related anomalies were. . .

Superior Technical Analysis: Momentum?

Momentum (at least a specific form thereof).

Buy stocks that did well -12 to -2 months ago.

Omit last month. Do not run in January.

A zero-investment portfolio earned about 1% per month on average

... BUT ...

Momentum has a lot of risk, too.

We learned this in the 2008 financial crisis.

The momentum portfolio (\$1 long, \$1 short) did not earn about 1 cent per month, but lost more than \$1 in a few months!

Superior Fundamental Analysis: Value over Growth?

“Boring” value firms performed better than “glamorous” growth stocks.

Often measured by BV/MV.

Easy to implement with quantitative data.

This is the “Buffett Strategy” (and AQR’s and many others).

... BUT ...

The superior performance of *value* seems to have disappeared about 15 years ago

- ▶ PS: There are about 3-10 other fundamental value stock regularities, too.
- ▶ Usually quite convincing *backward*-looking,
- ▶ but who trusts them *forward*-looking?

Performance Inference

The next few slides discuss inference based on short-term and long-term performance.

A very practical problem.

Please review Chapter~6 for means and Chapter~8 for variances.

Daily Stock Price Performance

According to sane equilibrium models, what can the $E(r)$ of a stock / portfolio / index be on an average trading day?

Typical Stock Price Moves

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

Effect of Time on Risk

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

“Required” T-statistic

What kind of T-statistic gives you confidence that the underlying mean performance is not just noise (zero)?

The “Edge” of Superstars

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



Figure 7: superman

The Expected T of a 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?

Investment Funds Startups

How do (hedge/mutual) funds get started?

Funds Outperforming Market?

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

Funds Outperforming Market?

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

Large Investment Funds

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

Beating the Market?

If you can beat the market, who would you tell your actual strategy?

Berkshire-Hathaway?

Is Berkshire-Hathaway a good investment today?

Buffett Rents

Rents are *excess profits* (monopoly rents).

Who would get the rents from Buffett's abilities?

Investment Manager Ego

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?

Contingent Comp as Solution?

What do you think of performance-based compensation?

- ▶ You have to pay me only if I give you profitable stock picks?

Will this not remedy the problem of ignorant managers not wanting to get into the business?

Almost-Sure Recipe

Is the following a superior investment strategy?

- ▶ Double up every time you lose?
- ▶ Write options 15% out of the market.

Performance

Can you increase performance (Sharpe ratio? Alpha?) by hiding or throwing away returns?

ECM and RW Empirical Evidence

What is the empirical evidence for ECM?

Event Studies

What is the response of affected stocks to the release of unexpected news?

- ▶ Can it be slow?

Event studies can determine value without having to forecast CFs.

But they also require isolation of expected/unexpected CFs.

Sample ES Answerable Questions I

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

- ▶ Does paying dividends increase or decrease stock price? For what kinds of firms?
- ▶ Did Trump's 2016 election increase or decrease hospital stocks? Oil stocks?
- ▶ Did Trump's 2016 election increase or decrease Mexican Pesos?

Sample ES Answerable Questions II

- ▶ Did the Deepwater Horizon increase or decrease the oil price?
- ▶ Does socially responsible divestment hurt divested stocks? Or divesting managers?

Corporate Consequences of ECM

- ▶ You can learn from your own market value.
- ▶ You can learn from your competitors' values.
- ▶ You can learn from other values.

Corporate Consequences of PCM

More PCM Oriented:

- ▶ You cannot add value by doing things that investors can do (or undo), such as splits, dividends, etc.
- ▶ You cannot make money by trying to time interest rates or gambling on commodities.

Undervalued Shares?

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

Is this even reasonable possible?

Overvalued Shares?

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

App: OLS on true AR1 I

▶ ▶ `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
```

App: OLS on true AR1 II

```
▶ ▶ for (mc in 1:MC) {  
    x <- randwalk(50)  ## draw  
    beta[mc] <- (coef(lm(x ~ iaw$lagseries(x)  
  
    summary(beta)
```