

Efficient Capital Markets (ECM)

(Welch, Chapter 12)

Ivo Welch

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A Wide Excursion Chapter

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

Making Sense

- ▶ All reasonable financial models impose the beliefs that
 1. there is an absence of great bets, and
 2. 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 lack of arbitrage and lack of great bets tell us about sense
 - ▶ in the presence of PCM?
 - ▶ in the absence of PCM?

An Efficient Capital Market (ECM)

ECM = Efficient Capital Market

- ▶ (not a common abbreviation; just us)
- ▶ investments courses cover market efficiency (ME) in much more detail.

Definition

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

- ▶ Put differently, an ECM does not ignore information.
- ▶ You won't find much useful unused information

ECM Is About E(R)

- ▶ ECM is all about *asset price* today
 - ▶ equivalently, ECM is all about E(R) from today, because
 - ▶ higher price \Leftrightarrow lower expected return.
- ▶ ECM is not primarily about covariances, betas, variances, earnings, etc.
 - ▶ But to make ECM empirically meaningful, we will need 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!
 - ▶ incl some who do not know what they are talking about.

Causation?

- ▶ Again, economics dictates

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

because of market forces, but not necessarily the opposite,

$$\text{PCM} \nLeftarrow \text{ECM} .$$

- ▶ A market can be 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

1. 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: Specific Example

1. The market estimates ABC's expected value next year to be \$55/s, and other aspects, such as
 - ▶ ABC's cash flows,
 - ▶ ABC's market-betas,
 - ▶ ABC's covariances,
 - ▶ ABC's liquidity, etc.

Pricing Model (Target)

2. Some researcher-chosen pricing model relates characteristics to appropriate expected RoRs.
 - ▶ typically, pricing models identify the value-relevant characteristics. We may only need covariances or only liquidity or ...

Pricing Model: Specific Example

2. 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 CAPM $E(r)$ is 10%.

ECM Plus Model = Price

3. The market sets ABC's price today, so that the $E(r_i)$ is just as the (CAPM) model states.
 - ▶ The price of ABC today should be $\$55/1.1 = \$50/s$.
 - ▶ No pricing model, ECM is useless
 - ▶ No ECM, pricing model is useless

Consequence / Usefulness

- ▶ If the market has already used information,
- ▶ then you cannot use the same information to outperform the market.
- ▶ \Rightarrow There are no (easy) superior returns to be had based on already public information.

Are you concluding the market is inefficient?

- ▶ Say, after 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] Data can (realistically) falsify your belief.

[Religion] Data cannot (realistically) falsify your belief.

- ▶ Religion: do we live in a multiverse?
- ▶ Strong enough scientific priors = religion
- ▶ Market-efficiency: part religion, part science.
 - ▶ Not all religion, not all science.

ECM: Long vs Short View

- ▶ When is ECM a stronger concept?
 - ▶ When does it have more “bite”?
- ▶ Is ECM stronger over short intervals (a day), or
- ▶ Is ECM stronger 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?

- ▶ What is the correct market pricing model?

- ▶ What is the correct model of market pricing over 1 day?
- ▶ What is the correct model of market pricing over 10 years?

- ▶ What types of markets are more likely to be efficient?
- ▶ What types of markets are more likely to be inefficient?

Traditional Classifications

- ▶ Focuses on information availability:
- ▶ **Strong Form:**
 - ▶ Price reflects all public and private information.
 - ▶ You cannot outperform even with insider info.
 - ▶ Not absurd...if there are enough competing insiders

▶ **Semi-Strong Form:**

- ▶ Price reflects public, but not all private information.
- ▶ You cannot outperform 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 outperform analyzing other aspects, such as company fundamentals.

More 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.

▶ **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.

Prominent Problems

- ▶ Rare — prominent because they are so weird
- ▶ Equity Carveouts
 - ▶ some firms are worth less than their components
- ▶ Factor Anomalies
 - ▶ value vs. growth
 - ▶ momentum
- ▶ Bubbles (Tech in 1999?)
- ▶ Bitcoin, Crypto, NFTs
- ▶ Gamestop

Value Investing

- ▶ Graham and Dodd, Warren Buffett, Eugene Fama and Ken French
- ▶ “Boring stocks” with high B/M earned higher average rates of return than “growth stocks” with low B/M.
- ▶ Coincidence or Regularity?

- ▶ From 2015 to 2021:

	Ari	Sdv	Geo	Years Better
Value	10%	16%	9%	6
Growth	14%	21%	12%	11

- ▶ Maybe worked better in the past.
- ▶ **But** no longer *forward-looking* a strong regularity!

Momentum

- ▶ Buy stocks that
 - ▶ increased a lot in the last 12 months
 - ▶ after skipping the last month
 - ▶ and perhaps skipping January
- ▶ Go short the opposite
- ▶ Zero-investment portfolio

- ▶ For \$100 long and \$100 short, you earned \$1 a month.
 - ▶ Great!!
 - ▶ Well, only until about 2008-2009...
 - ▶ ... when you suddenly lost **\$100!**
 - ▶ and from 2015 to 2021, was about 0%
- ▶ Many momentum variations
 - ▶ some still positive, others negative.
 - ▶ happy academics and hedge funds?!

Why? What could have happened?

Bubbles?

- ▶ Everyone wants to get in on getting rich quick.
 - ▶ many stories of near-instant riches of neighbors
 - ▶ Musical chairs, Ponzi schemes
- ▶ Some researchers believe bubbles do not exist in public and/or competitive financial markets.
 - ▶ hard to prove existence.
 - ▶ but hard to take advantage of.
 - ▶ if \$100 makes no sense, could it not go to \$200?
 - ▶ shorting could wipe you out (in your attempt to profit)
 - ▶ academics call this “limits to arbitrage.”

- ▶ Cryptocurrencies, Bitcoin
 - ▶ better alternative currencies and financial systems exist: faster, trusted, traceable, gvrnmnt-accepted and endorsed.
 - ▶ BTC is difficult to short (if/when BTC dies, exchanges will themselves die and will not pay out shorting profits).

GameStop

- ▶ **Short Squeeze**
 - ▶ usually require coordination
- ▶ Suddenly, a collective decentralized “attack”
- ▶ participants lost small token amounts (— ok)
- ▶ enjoyed participation?!
 - ▶ out of spite?

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 but not Sufficient**
 - ▶ Is roulette an ECM?
 - ▶ Is bitcoin an ECM?
 - ▶ Is VFIAX an ECM?

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.
 - ▶ Example: known release date of drug trial results.
 - ▶ Example: pre vs. harvest time

Non-Finance Diversion: Causality

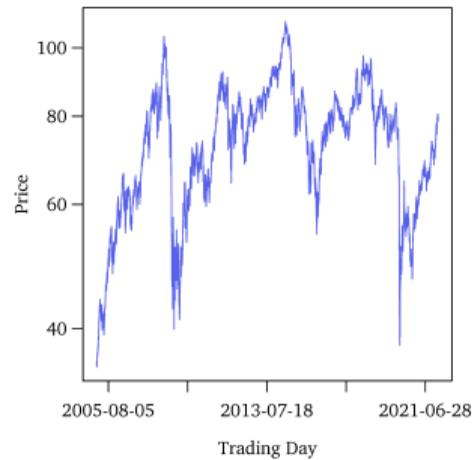
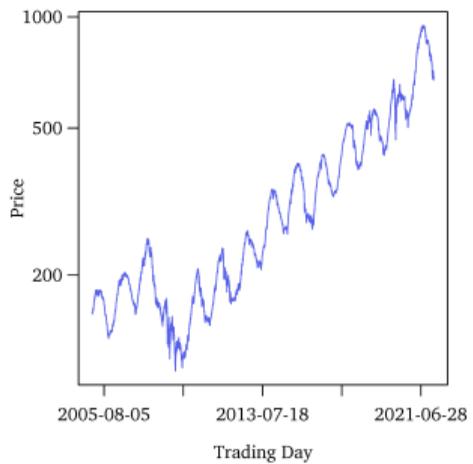
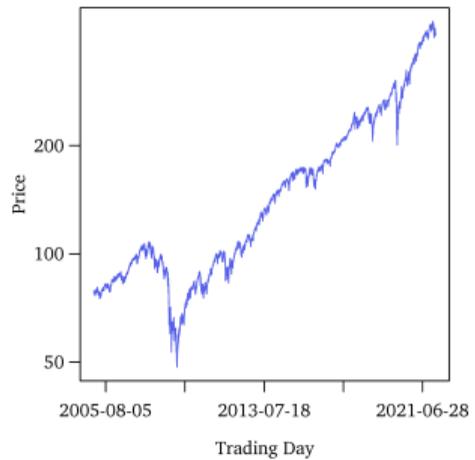
Perhaps most important subject ever!

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

Nobel Prizes in Economics 2021!

Technical Analysis

- ▶ **Technical Analysis** is “charting.”
- ▶ What sort of price/return patterns should not be observable?
 - ▶ Note: ex-post vs ex-ante!!!
- ▶ These “weak form” ECM tests were central to the creation of early modern finance.
- ▶ Tell me which of the following TS graphs are real.



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 VFIAX (index *level* of the S&P500) is a random walk?

Important AR1 Warning

- ▶ AR1 is “autoregressive order 1” process.
- ▶ You would think that a plain OLS TS regression should work, but unfortunately it does not.

$$P_t = a + b \times P_{t-1} + e$$

- ▶ The estimated b coefficient, *given a true random walk*, will sadly *not* likely be close to **1.0**, but lower (0.9?).
 - ▶ OLS does not work well if X's are related to past e's.
 - ▶ Be very careful with time-series regressions!

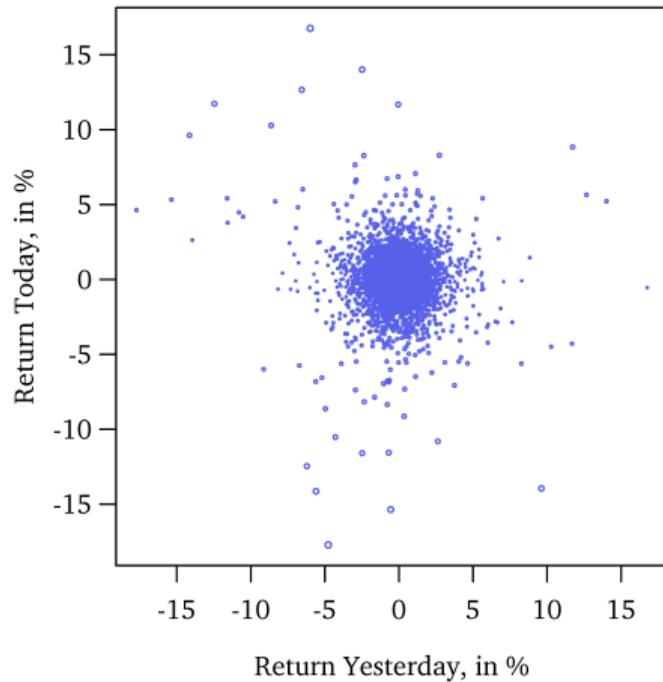
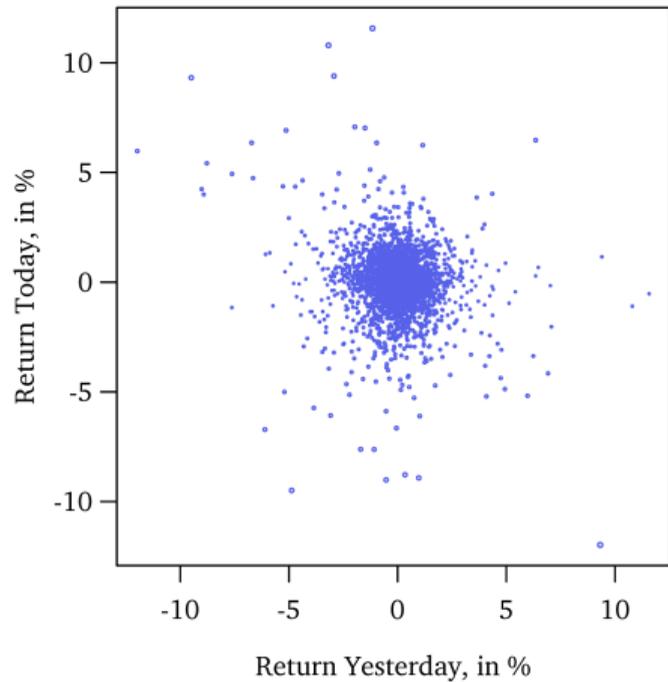
Advice: Differencing

- ▶ 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!

Caveat Random Walks and Time-Series Regressions

Rate of Return Predictions

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



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 has eroded all reasonable rents.
- ▶ Few funds manage to outperform. Fund performance seems serially uncorrelated and close to random.
 - ▶ past outperformers do not outperform later, either.

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...

Performance Inference

- ▶ The next few slides discuss inference based on short-term and long-term performance.
- ▶ This is a very, very practical problem.
- ▶ Please review Chapter~6 for means and Chapter~8 for variances.

Daily Stock Price Performance

- ▶ According to sane equilibrium models, on an average trading day, what can a reasonable $E(r)$ be for a typical stock or portfolio or index?

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?



The Expected T-Statistic of a Superstar

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

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

Investment Funds Startups

- ▶ How do (hedge/mutual) funds get started?

What To Expect — Fraction of Funds Beating Benchmark, 84-06

	Under Luck	Before Fees	After Fees
Small Funds	16%	21%	10%
Medium Funds	16%	17%	9%
Large Funds	16%	15%	8%

Before Hire and Fire, 94-03

- ▶ Pension funds fired advising funds:
 - ▶ Pre-Performance: -1.6% (duh!)
 - ▶ Post-Performance: 3.1%
- ▶ Pension funds fired advising funds:
 - ▶ Pre-Performance: 7.6% (duh!)
 - ▶ Post-Performance: 2.3%

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 who has made 5% per year above your benchmark five years in a row, what would you think of your capabilities?
- ▶ Would you go to B-school receptions and meet impressionable students?

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

- ▶ Are the following superior investment strategies?
 1. Double up every time you lose.
 2. Write options 15% out of the market.
- ▶ How will the performance of (surviving) managers look like?
- ▶ How will the performance of all managers look like?

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 impacted stocks to the release unexpected news?
 - ▶ Can it be slow?

- ▶ Event studies can determine value without having to forecast cash flows.
- ▶ Yet they also require isolation of expected/unexpected cash flows.

Sample ES Answerable Questions

- ▶ You can answer very convincingly such questions as:
 - ▶ Does paying dividends increase or decrease stock price? For what kinds of firms?
 - ▶ Did Trump's 2016 or Biden's 2020 election increase or decrease hospital stocks? Oil stocks? Mexican Peso?
 - ▶ Did the Deepwater Horizon increase or decrease the oil price?
 - ▶ Does ESG (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?

Application: OLS on a true RW

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

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

```
MC <- 10000 # 10,000 Monte-Carlo Draws
beta <- rep(NA,MC) # destination
for (mc in 1:MC) {
  x <- randwalk(50) ## draw a RW
  ## estimate now
  beta[mc] <- (coef(lm(x ~ lagseries(x))))[2])
}
print( summary(beta) )
##      Min. 1st Qu.  Median      Mean 3rd Qu.      Max.
## 0.322  0.854  0.913  0.896  0.956  1.086
```