

Market Efficiency

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What is “rational” behavior?

- Individuals take actions that optimize given preferences and beliefs (information)
- Beliefs are formed using Bayes Rule
 - You form a “prior” probability for an event based on past data
 - You observe new data on the event
 - You update you prior with the data to form a “posterior” probability in a consistent manner (Bayes Rule)
- Game theory adds assumptions about:
 - coordination among players
 - information structure
 - “equilibrium” concept (“Nash”)

How “behavioralists” try to modify “rational”

- Uses research from psychology
- Experiments indicate individuals exhibit inherent biases
 - overconfidence
 - unable to compute
 - inconsistencies in preferences
- Questions the Bayesian belief formation
 - But: What is a workable alternative?

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Behavioral models are in their infancy

- Behavioral models are still way too complex
 - Unclear what the prediction is (e.g. long-run)
 - *Someone* must be “rational” for others to be “irrational – but who?
- Fundamental problem:
 - Need standard preference structure to be able to aggregate individual demands to get market prices
 - Behavioral models have not resolved this issue

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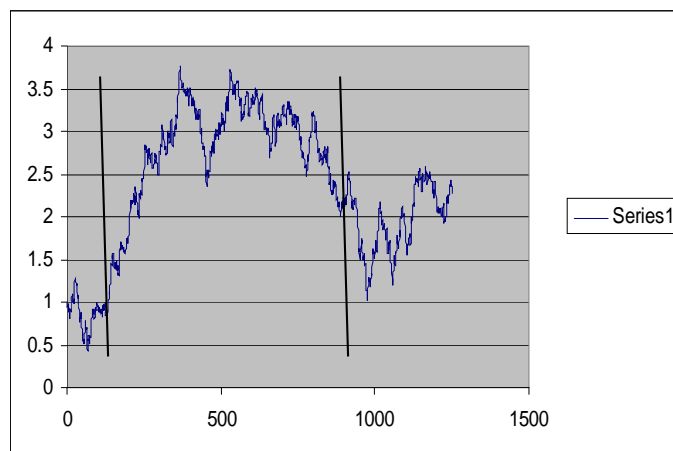
Horse race between behavioral and rational explanations

- Macroeconomics: Market “bubbles” and “crashes”
 - Perfect fit ex post – but zero predictive power ex ante
- Cross-section of expected stock returns
 - Profitable trading strategies?
- Managerial decisions that decrease stock price
 - Rational information-based stories
 - Agency stories
 - Behavioral stories – but with poor governance
 - Overconfident CEOs?
- What measure of mispricing?
 - Tendency to use M/B (but controversial)

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Analyze this! (?)



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Prices tend to follow a “random walk”

- Suppose stock prices fully reflect all publicly available information Φ
- Then, by definition, a stock’s price will change only in response to new information
- Since new information arrives randomly (or it wouldn’t be new), successive stock price changes must also be random:

$$p_t - p_{t-1} = \alpha + \varepsilon, \text{ where } E(\varepsilon) = 0$$

where α is the stock’s expected price movement given risk

- So, today’s price plus α is your best forecast of tomorrow’s price
- Every price change tend to be “permanent” as opposed to “temporary”

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Stock market mean reversion?

- Prices mean revert if they follow a process like the following:

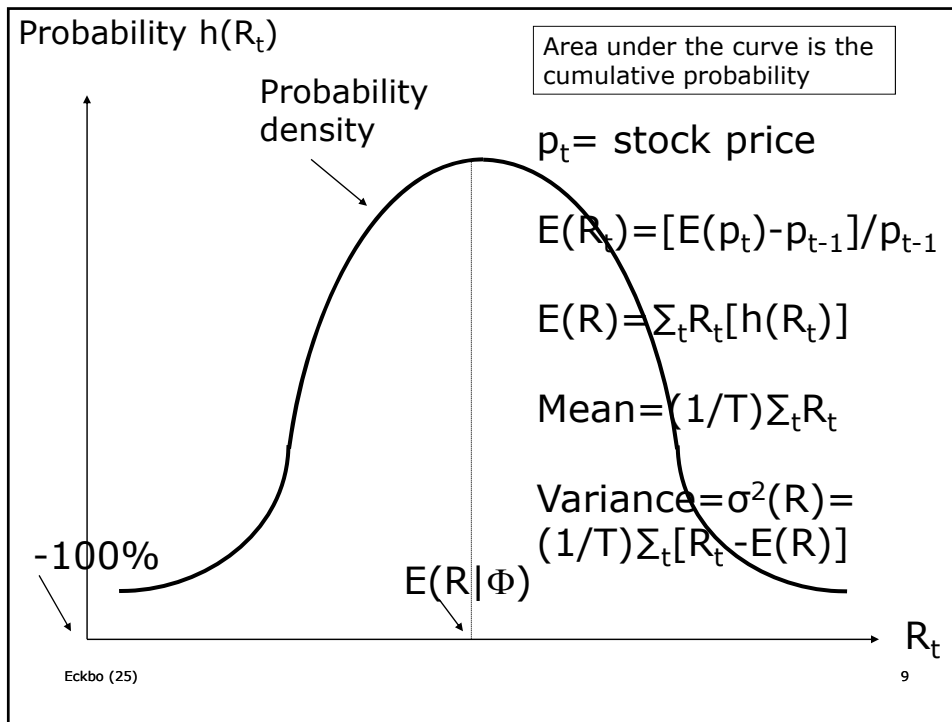
$$p_t = \alpha + \phi p_{t-1} + u_t$$

where $\phi < 1$ ($\phi = 1$ if random walk)

- Mean reversion means that a price change is temporarily “too high” or “too low”, and the price will therefore gradually revert to its “normal” level
- In contrast, in a random walk, every price change is permanent
- There is some evidence of stock market mean reversion over 2-3 yrs, but it’s too small to exploit using trading rules

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Efficiency and competition

- Buying and selling pressure among rational investors eliminates any systematic deviation between expected and required (realized) return, given investor's opportunity cost of capital
- $AR = R - E(R|\Phi)$
 - R = the required (realized) rate of return given the true pricing model
 - $E(R)$ = the market's expected return given the information set Φ
- Market efficiency implies that $E(AR|\Phi) = 0$

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Price-sensitivity to new information

- Bonds
 - Contractual payments well defined
 - Priority of payments enforceable in court
 - Bond prices are relatively insensitive to new information
- Stocks
 - A residual claim, and the firm has no contractual obligation to pay dividends, nor to undertake an investment policy that ensures a positive capital gain
 - Stock prices are relatively sensitive to new information about fundamentals
 - "Growth stocks" most sensitive

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"Growth" vs. "Value" stocks

Today's market value of the firm (Market)
= market value of assets in place (Book)
+ market value of "growth options" (Growth)

$$M = B + G$$
$$M/B = 1 + G/B$$

- "Growth stock": M/B is high
 - "Value stock": M/B is low
- What does it mean if $M/B < 1$?

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“Market efficiency” statements

- “Rational expectations”
- “Unbiased expectations”
- “Prices reflect all available information”
- “Trading strategies based on publicly available information have zero value”
- “Law of one price holds”
- “New, publicly available information is quickly incorporated into prices”

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“Tests” of Market Efficiency

- Tests use various forms of side-bets
- The success of these side-bets are almost always measured in the form of abnormal return:

$$AR = R - E(R|\Phi)$$

where R is the realized return on the bet and $E(R)$ is the market's expected return given the information set Φ

- Again, market efficiency implies that $E(AR|\Phi)=0$

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The joint hypothesis problem: we don't know $E(R|\Phi)$

- $E(R|\Phi)$ is the expectation of the marginal investor in the market
 - Any test of market efficiency must start by assuming a certain value for $E(R|\Phi)$
 - If we assume the wrong value, the tests will appear to reject market efficiency even when the market is efficient (joint test problem)
 - Thus, the efficient market hypothesis is not directly testable

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So, is the EM concept empty?

- No, we can say a great deal about how difficult it is to generate valuable trading strategies
- The less valuable these bets, the more likely it is that the market "functions well" and that market prices provide valuable information about optimal resource allocation (high $E(R)$ attracts capital)
- We can also say a great deal about how fast new information is incorporated into stock prices, which is another indication of how competitive the stock market is

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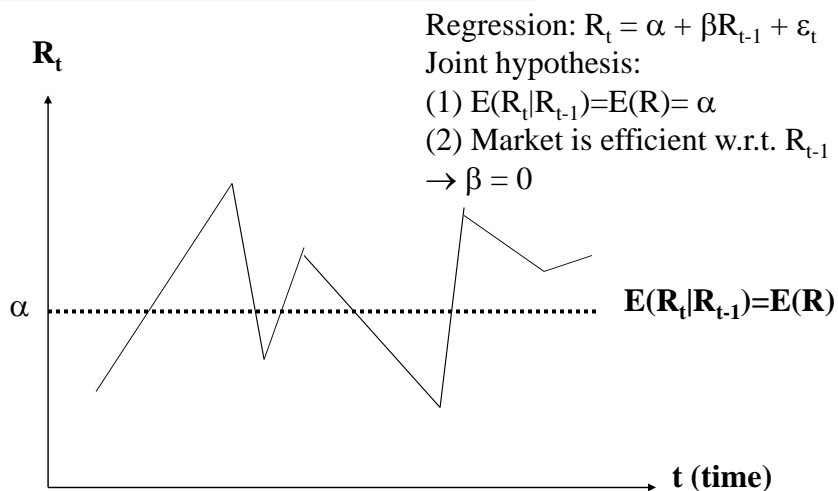
$\Phi =$ past return history R_{t-1}

- This is also called “weak form tests”
- Can you beat the market’s expected return simply by using information in the past history of returns $E(R_t|R_{t-1})$?
- That is: is technical analysis valuable?
- To find the answer, try so-called filter rules
- A filter rule goes like this: “If the stock price goes up by $Y\%$ following a previous low, then buy. If it drops by $Y\%$ following a previous high, then sell.”

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Fig. 1: Weak form (filter rule) tests of EM



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Seasonalities

- With zero storage costs, there should be no significant predictable return patterns (seasonalities)
 - Why?
- The following are within transaction cost bounds:
 - “weekend effect”
 - “turn-of-the-year and January effect”

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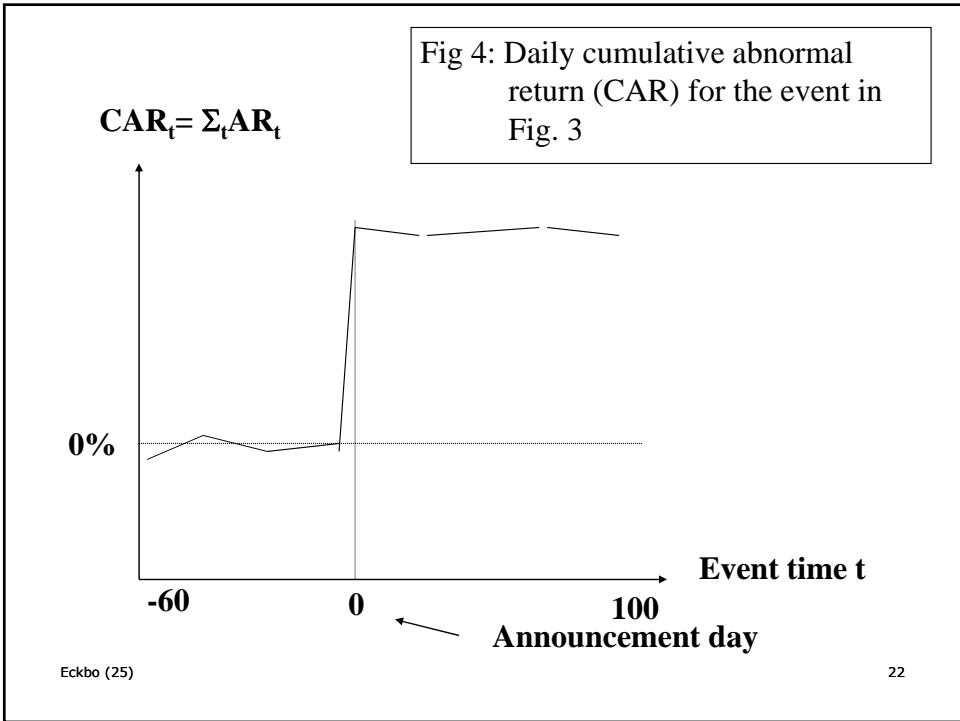
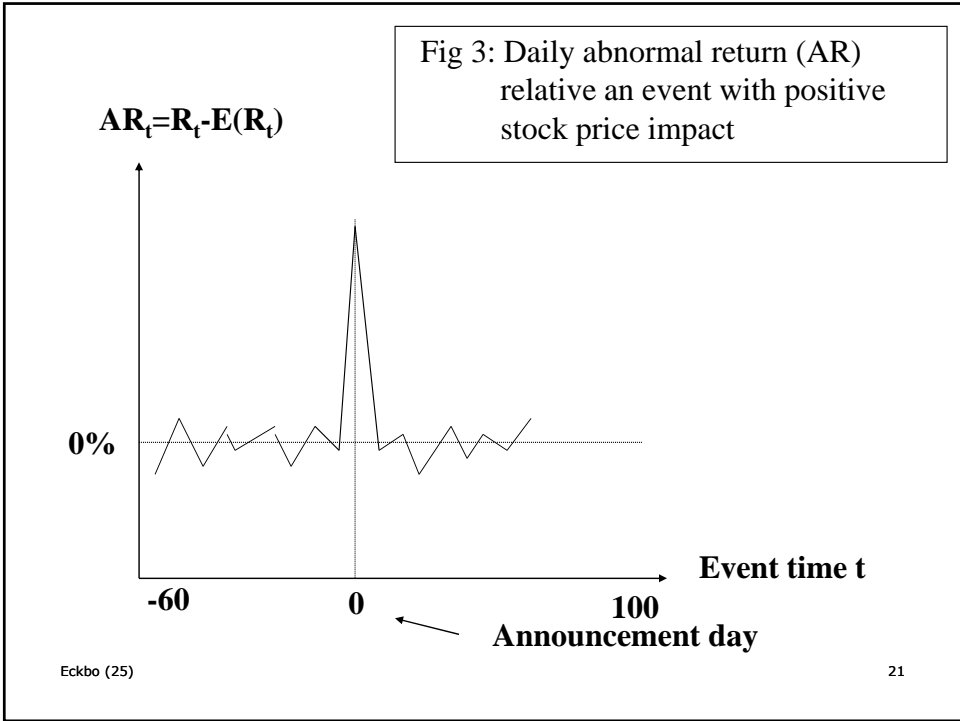
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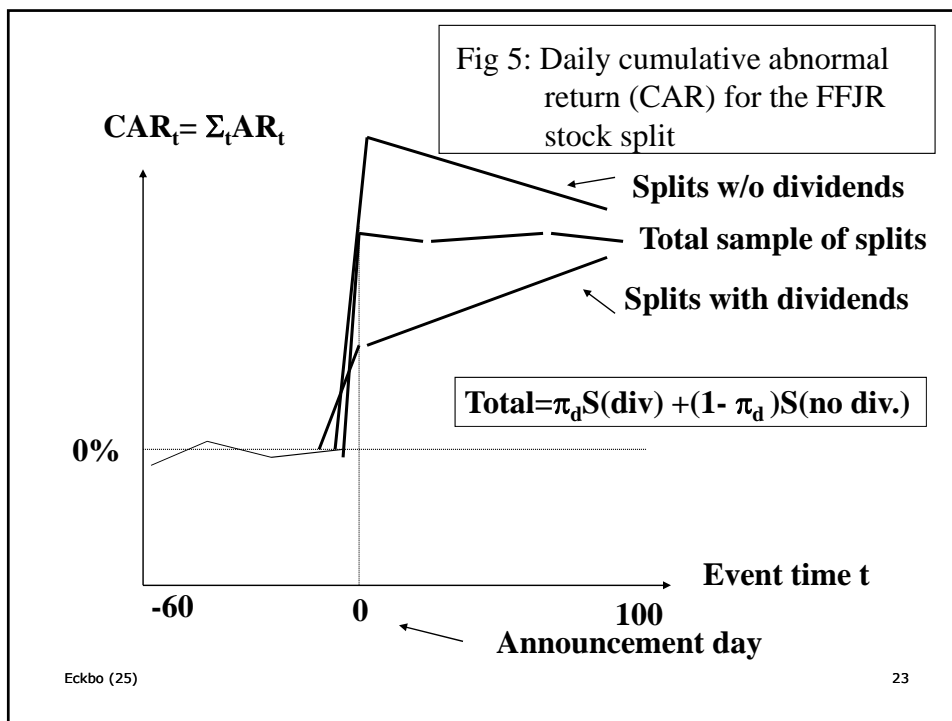
Φ = some public news event

- This is also called “semi-strong tests”
- Pick some firm-specific (voluntary) news event (e.g., merger announcement, earnings announcement, stock issue, etc.) and test whether the information is incorporated quickly and in an unbiased fashion into stock prices
- The first such event study was by Fama-Fisher-Jensen-Roll on stock splits (1969)

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$\Phi =$ “all” information

- Referred to as “strong form tests”
 - Focuses typically on insider trading (will return to this under section on portfolio performance measurement)
- Strong form efficient markets a virtual impossibility if information is costly
 - There would be no incentive to spend resources collecting information. If no information is collected, it cannot be reflected in prices
- The fundamental question is: “What is the optimal amount of market inefficiency”

The efficient amount of inefficiency

- There should be enough wrong prices that, on average, the *efficient* information producers are compensated for producing information.
 - Large portfolio managers can spread their information costs over a larger portfolio.
 - Floor traders and specialists have more timely information and lower transactions costs.
 - Insiders have an advantage because they have more timely and accurate information.