EFFICIENT MARKETS

Chapter Outline

- Description of Efficient Capital Markets
- Different Types of Efficiency
- The Evidence
- The Behavior Challenge to Market Efficiency
- Empirical Challenges to Market Efficiency

Some idea that markets are informationally efficient. When something happens that should change a securities price that change is seen immediately in the market. This is the idea of efficient markets. Information is automatically updated into the prices of assets.

There are different levels of efficiency. These different levels refer to the type of information we are talking about. It could be PUBLIC information or PRIVATE information. What information is priced. We will look at the evidence and the test which are used to try and prove these ideas. We will think about the abnormalities, where things seem to go wrong. And we will come up with alternative explanations of what has happened. We will look at behavioral finance (a relatively new field of finance). Will think about empirical challenges. Have any of these tests been verified?

Why Do We Care?

- Many finance theories assume that capital markets are perfect
  - In addition to information efficiency and perfect competition, markets are also frictionless, e.g. no transaction costs or taxes.
- The CAPM
- Capital Structure Theories
- Option Pricing

CAPM for example, assume that markets are efficient. Without efficiency these theories will not work. Usually we assume something about inflation (?) efficiency, something about perfect competition, remove frictions, assume that there are no transaction costs or taxes are low to non-existent.

Where do we use these types of assumptions? The CAPM for one. We saw that. Capital Structure is another place, trying to explain how much debt and how much stock finance accomplishes operations with. That will usually assume some sort of efficiency, perfect markets. Option Pricing, the ability to use a Black Shells (?) price methodology will

assume that markets are perfect. If efficient is not true then all these theories will have to be revisited and think about how they should be reconstructed.

What Sort of Financing Decisions?

- Typical financing decisions include:
  - How much debt and equity to sell, when should it sell shares, when should it issue debt. Weather a market is efficient or not is going to change the answer to this question. We will see this in seasoned equity offers.
  - When (or if) to pay dividends
  - When to sell debt and equity

From a financial management point of view there are other issues. These are not the theoretical questions of the previous slide. From a financial managers point of view there are other implications if a market is not efficient (such as those in the above slide).

Should a company pay dividends or should the company simply buy back it's stock? The answers to these questions will be different depending on weather of not we believe the market is efficient.

How to Create Value through Financing

- Fool Investors
  - Empirical evidence suggests that it is hard to fool investors consistently.
- Reduce Costs or Increase Subsidies
  - Certain forms of financing have tax advantages or carry other subsidies.
- Create a New Security
  - Sometimes a firm can find a previously-unsatisfied clientele and issue new securities at favorable prices.
  - In the long-run, this value creation is relatively small, however.

Generally, creating a new security *may be* a positive NPV *for the innovator*, *the first time out.* But competition quickly removes the advantage.

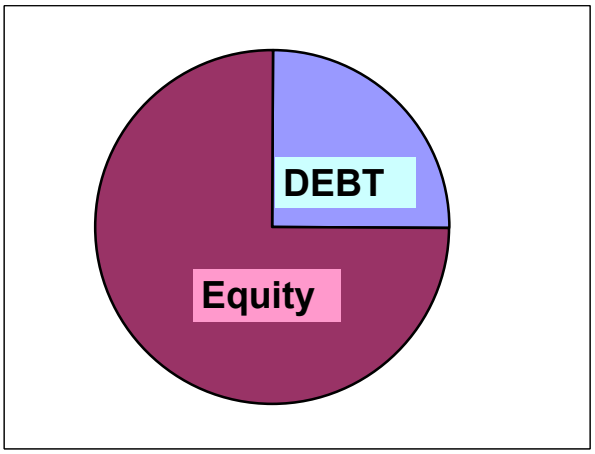
How to create value through decisions about stock and debt financing?

Try and fool investors. What do we mean? If I'm a CFO of a company and I know my stock is over priced I may be tempted to issue stock and not issue debt. Try and fool investors. I may be interested in issuing convertible debt, which is really a mixture of debt and stock, if I believe I can fool investors into miss-pricing that particular asset.

Generally, empirical evidence suggest that it is very hard to fool the market consistently. The market seems to see through these types of arrangements that managers try to use in order to create value, fool the markets, to rip off investors.

There are certain forms of financing that may have tax advantages (or subsidies). Certain types of debt that companies can issue that the government will finance interest on, will pay grants. This is certainly a realistic or good way of creating value through financing decisions. How much debt and equity should the company sell? How much should the company have on it's (?).

Financial assets are merely a way for a company to allocate profits, generate by it's real assets. If I have a company I can describe the company by a pie.



The value of the company can be split between debt and equity. Financial assets decide on how the value, the intrinsic value of the company, how it is split between debt holders and stock holders.

What is meant by how to create value through financing is the way that I can increase the overall value of the pie. That's what we are trying to do. The underlying assets have a certain value. Can I make a financing decision on what kind of debt to sell, what kind of equity to sell, and how much of each to sell? Can I do that and increase the overall size of the pie, increase the overall value of the business? **This is what is meant by creating value through financing**.

First Point: I try and fool investors. I try and construct securities that I believe investors are going to miss-price. I'm going to try and sell securities that are overvalued. Empirically, it appears that manages cannot do this. Investors see through this and they realize what the value of the business truly is.

Second Point: I might be able to increase the overall value if I can get some outside party to chip in. How? If I can reduce my taxes in some way, the government is in fact in some way subsidizing my business. I can increase the overall value by creating financing. Some types of financing the government will actually subsidize.

For example, if I'm a bank and I supply mortgages to certain segments of the market, the government will loam me funds at a cheap rate to do so. If I am financing mortgages to underprivileged people who cannot easily afford mortgages, the government will give me funds to do so (under certain policies). That is a subsidy and that would increase the overall value of the business. So it is possible to increase value this way.

CREATE A NEW SECURITY:

At one time convertible debt did not exist. The company that first thought up convertible debt was able to sell it at a premium simply for the reason that it was a security that was

not previously available. There was a demand for this security because it allowed additional diversification and added value to the market place. The value which was added by the issuance of this security to the market place was not intrinsic to the business, the value added was because of the structure of the security sold. This has the effect of increasing the overall value of the "pie" (graph above). Of course as soon as this product appeared there was immediate competition. Everyone wanted to sell it.

Convertible Debt: debt that the security holder can sell back to the company and receive stock in it's place. Could decide after a period of time to redeem the debt and get face value payback or exchange that payback for a certain number of shares. The price is fixed per the debt agreement, it can vary as the stock price goes up and down but there is a formula to tell you how it's calculated. The debt holder can decide to keep it as debt or convert it so there is extra value created. Does pay interest. Only convert if it was of value to the holder to do so. Creates value. As this financial product became more available it's value went down, but the first issuer would have seen the value of their overall business increase and have nothing to do with the real assets and the financial assets being fully responsible. Another example would be _____.

Description of Efficient Capital Markets

- An efficient capital market is one in which stock prices fully reflect available information.
  - Stock prices fully and accurately reflect publicly available information.
  - Once information becomes available, market participants analyze it.
  - Competition assures prices reflect information.

The price of the financial asset fully reflects available information. The public asses new information immediately and the stock price adjust immediately. Whatever the information the new price reflects it. There is no systematic lag. This is due to competition. If there were a lag people would learn to make a profit from it and the ability to make that profit off that systematic lag would be eroded. This is true for any type of traded financial asset. Even options.

Market efficiency is a funny thing: Markets are efficient precisely because there are lots of well-paid, well-financed, and smart security analysts who don't believe that the markets are efficient…and their actions make the market efficient!

Description of Efficient Capital Markets

- Why are price changes random?
  - Prices react to information
  - Flow of information is random
  - Therefore, price changes are random
- The EMH has implications for investors and firms.
  - If information is reflected in security prices quickly, knowing information when it is released does an investor no good.
  - Firms should expect to receive the fair value for securities that they sell.

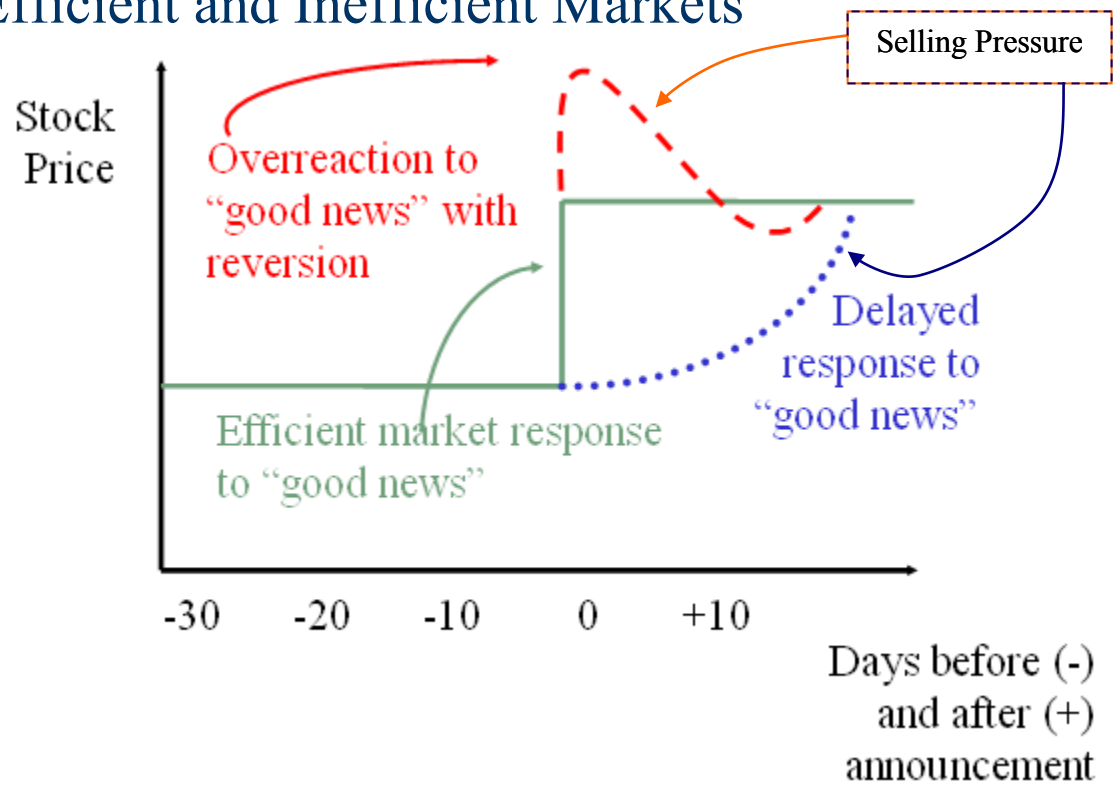
When you look at a series of stock prices for a particular stock there may be a drift upwards but the pattern is random. There is no discernable pattern in stock price changes. Why? Prices reflect information and will change based on new information received by the market. **THE FLOW OF INFORMATION IS RANDOM**. It's fairly obvious when a company is going to issue it's earnings report that it happens on a time table but it is not obvious weather the information contained in the release will be good or bad. **THE INFORMATION IS RANDOM**. Therefore price changes appear to be random. **The real issue is that information is received randomly**.

Implications of what efficient capital markets means. Cannot benefit from new news because the reaction in stock price is immediate.

1) Prices do not change because people buy and sell shares. Prices change because of information. Dealers/Market Makers/Specialist will change their bid-ask-prices to reflect information. It does not need an investor putting in an order to change the price.

2) **(IMPORTANT POINT)** Firms should expect to see fair value when they sell securities. If a company issues stock all information which is publicly available is included in that price. A company cannot say it's stock is under-priced based on available information. The market is fairly pricing the stock or bond based on information which is available. The only way that a firm can trick the market is if t issues stocks or bonds or some other capital transaction with insider knowledge. Example, if the company knows it is about to issue a terrible earnings release, selling stock then could trick the market. (This would be a dangerous practice, also legal implications).

Reaction of Stock Price to New Information in Efficient and Inefficient Markets



New information should be immediately reflected in a financial assets price. Green is the efficient market response to good news.

IMMEDIATE RESPONSE TO GOOD NEWS

If markets were not efficient we would see the overshot and undershoot cases.
In the overreaction case the market goes too far, gives too much value to an event. The market corrects itself in the following day. Now, why should this not happen is markets are efficient? What mechanism would remove this behavior out of the market place? Competition would remove the overshoot. If I can recognize this pattern I will take action to profit from it, but so will others in the market. It's not even necessary that the overshoot happen every time, just the majority is enough.

SHORT SELLING: I do not have to own a stock in order to sell that same stock. In this case I call a broker and issue a sell order on this stock. The broker will barrow the stock from someone else and sell it on my behalf. Sell something I don't own at high price, owe someone the stock, buy the stock back at a lower price, return the stock to the person it was barrowed from and keep the profit. CEO's try to put pressure on investment banks and brokers they do business with not to lend their stock to short sellers. But it's a had sell because the brokers can make money doing so.

So if I know the overshoot case is happening the majority of the time I would sell short, wait the appropriate number of days, buy the stock back and make a profit (I would have sold "short" at the higher price).

What will happen? There's going to be selling pressure. Billions of dollars are spent looking for such events. Others will join in the scheme to profit from the pattern. The abnormality will be priced out of the market, the effect will be eroded each time the cycle occurs, soon it will be gone.

The selling pressure will ring the overshoot out of the market. When the overshoot is gone there is no longer any selling pressure. Therefore there has to be investors on the look out for these types of things to make sure these types of things do not exist. Counterintuitive.

DELAYED RESPONSE TO GOOD NEWS

Some event happens, it's good news, it takes a while to accumulate the information. The price goes up slowly. Should not happen because it can be priced out of the market. How can it be priced out? If you can see this happens the majority of the time for this type of event, then you would put in your buy order immediately because you would know on average in the following days the stock price would go up. It may not go up for every event but as long as it goes up more often then it goes down the scheme will make money. What will happen? Buying pressure will raise the price of the stock on the first day and continue each time the vent happens until the effect is priced out of the market.

These examples illustrate two ways that the market can be inefficient.

Different Types of Efficiency

- Weak Form
  - Security prices reflect all information found in past (historical) prices and trading volume. It's anything that I can see from a stock chart. Weak form efficiency tells me that that information (historical price & volume) is priced into the assets price. This is saying **"I cannot profit by looking up prior stock prices"**. I will not be able to see any patterns. Cannot make claims like "the stock price has gone up for the last 5 days, therefore it must fall". If we could say this it would mean the markets were not weak form efficient.
- Semi-Strong Form
  - Security prices reflect all publicly available information. Examples include press releases, analysis' write ups, articles, industry reports, anything publically available is immediately reflected in a stocks price. Notice that this data set, semi-strong, includes the weak form data set.

- Strong Form
  - Security prices reflect all information—public and private. All information everywhere, private or not, is available to everyone instantly. It is immediately reflected in the stock price.

This is all to do with the information set that we believe is reflected in the assets price.

Now, which form of efficiency is really true? Clearly not the strong form, the mechanism does not exist. Is it weak or semi-strong? Remember, semi includes weak.

Weak Form Market Efficiency

- Security prices reflect all information found in past prices and volume.
- If the weak form of market efficiency holds, then technical analysis is of no value.
  - Technical Analysis - using prices and volume information to predict future prices. This would not work, they should have no job! They look at stock price charts and they come up with ways of accessing weather the price is going to rise or fall. Trying to predict the future based on stock prices of the past. In fact there are people being paid a LOT of money to do this. Yet if weak form holds they should not be able to profit from this type of analysis.

Weak form efficiency says this analysis should be no better then reading tea leafs.

Stock prices following a random walk is not the same thing as stock prices having random returns.

Weak Form Market Efficiency

- Often weak-form efficiency is represented algebraically as

$$\mathbf{P_t = P_{t-1} + Expected\ return + random\ error_t}$$

This equation is saying the stock price today (P_t) is equal to the stock price yesterday (P_{t-1}, starting point) plus expected return calculated using CAPM for instance plus the random error (random error$_t$).

Price today = Starting point + Predicted return + random error (truly random)

The random error component is truly random, not correlated with past prices. Ex, suppose the stock price has gone up for the last 3 months, there is no reason to believe that this random error is going to be negative bcause the price increase has been positive for the last 10 days. Knowing anything about the sequence of the prices in the past tells you nothing about the random error on a particular day. Ruely random! It follows a random walk. **The random term represents new information arriving, new information is random and therefore the "random" term is random.**

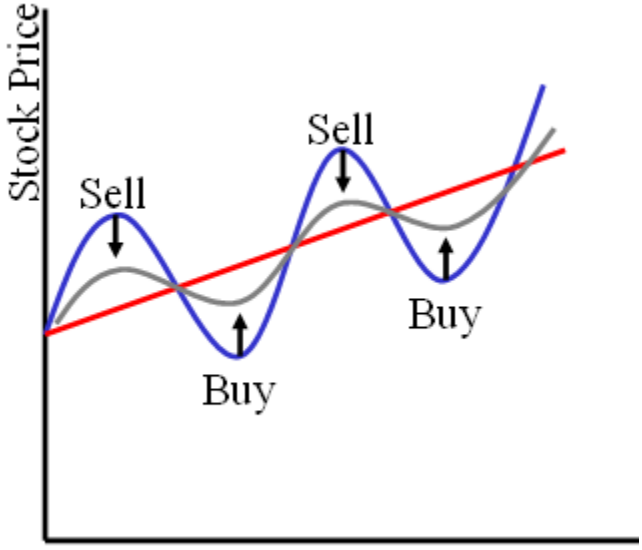
- Since stock prices only respond to new information, which by definition arrives randomly, stock prices are said to follow a **random walk**.
  - Expected price is positive over time
  - Positive trend and random about the trend

The random element represents new information arriving. New information is random and therefore this term is random. No new information is generated based on historical prices. The random element is uncorrelated with price information.

Positive drift (expected term?), stock price goes up an average of 10% per year based on it's beta. But there is a random walk around the drift.

Why Technical Analysis Fails

- Investor behavior tends to eliminate any profit opportunity associated with stock price patterns.
- If it were possible to make big money simply by finding "the pattern" in the stock price movements, everyone would do it and the profits would be competed away.



ChannelStocks.com is a company which searches for these types of patterns, they provide you the names of stocks which seem to be trading in a channel (above pattern). Investor buys low and sells high. ChannelStocks.com argues that the stocks they find do this predictably. This is exactly what **Technical Analysis** does. It's more sophisticated and the patterns are more extreme but this is it in a nutshell. Looks for trend and tells you when to buy and sell. Why must it fail? Everyone in the world can see these patterns, there will be an overload of sell orders at the top, and many buy orders at the bottom. If there are extra buy orders the price of the stock increases, if there are extra sell orders the price comes down. Patterns like this can happen at random, it will actually exist in the market, it most likely takes several months (10) for the pattern to develop and become apparent, but when it does it's over, it will immediately be priced out of the market by buying and selling until there is no discernable pattern.. These are called **back testing strategies**.

Have to consider how transaction costs effect the reaction to these patterns. May not be worth pursuing. Although large hedge funds may be able to devise a way.

If there were no technical analysis would this condition exist? Maybe the patterns would come back and then someone would reinvent technical analysis and make money off of the patterns which would cause them to disappear.

Semi-Strong Form Market Efficiency

- Security Prices reflect all publicly available information.
- Publicly available information includes:
  - Historical price and volume information
  - Published accounting statements. Can't profit from looking at financial records (10Q's and 10K's) if markets are semi-strong efficient.
  - Information found in annual reports. (8K's, officer stock selling reports, industry reports, FED reports)

All publicly available information is priced into the stock (or otherwise traded security).

- Fundamental Analysis - using economic and accounting information to predict stock prices.

Here you are trying to say something is over or under valued by analyzing past information. Should not work is markets are semi-strong efficient. These analysis should not be able to make excess profits.

This includes mutual funds. We usually assume that mutual fund managers do not use insider information, make their decisions based on publicly available info only. If this is the case then Mutual Fund Managers should not be able to beat (outperform) the market.

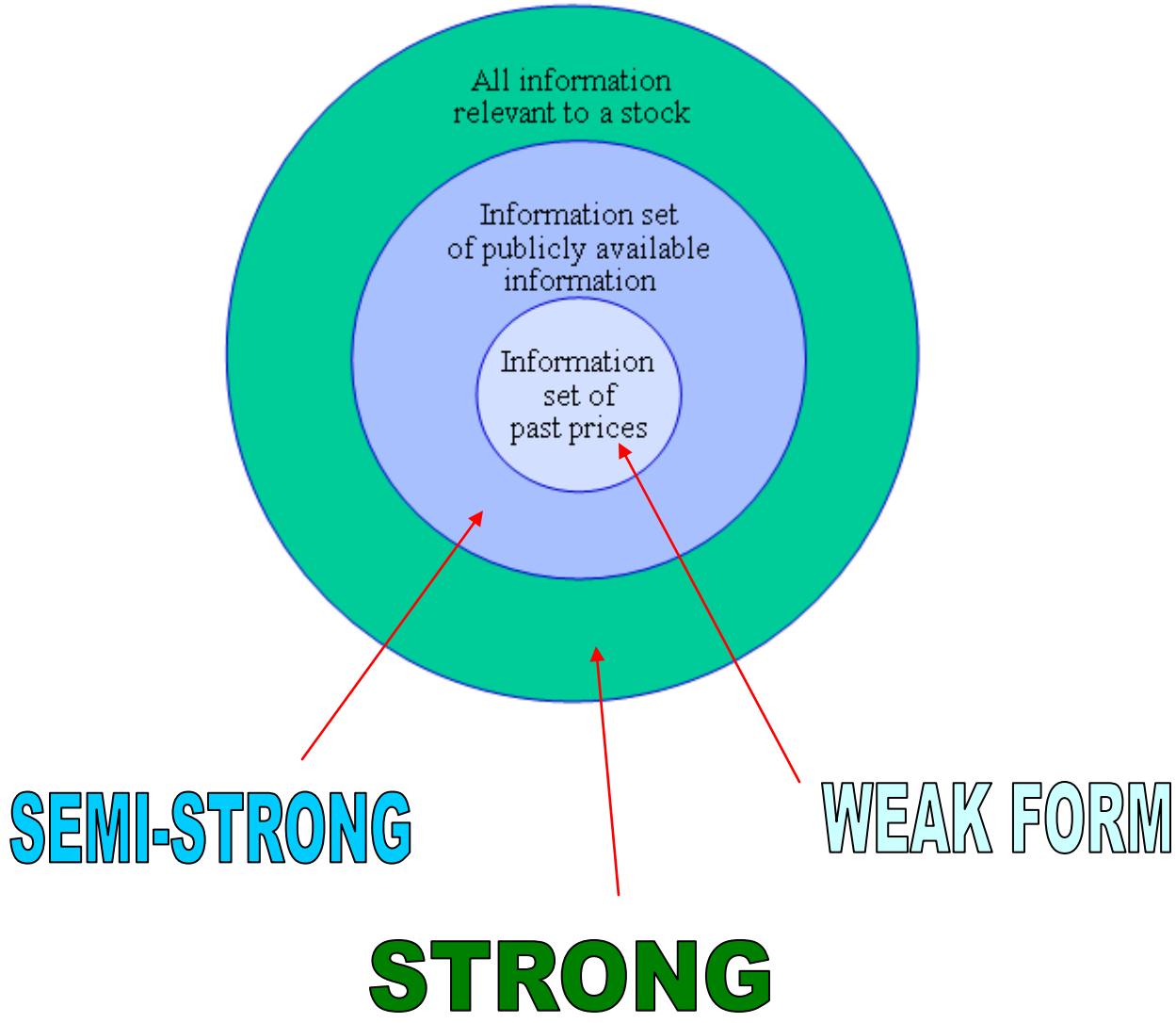
Janas Funds is a classic example. They would pick stocks and create portfolios of very few stocks. They would go to the businesses they were investing in and survey, try to asses this way. There was a scandal a few years ago that almost caused them to go bust.

Strong Form Market Efficiency

- Security Prices reflect all information—public and private.
- Strong form efficiency incorporates weak and semi-strong form efficiency.
- Strong form efficiency says that anything pertinent to the stock and known to at least one investor (PERSON) is already incorporated into the security's price.

ANY INFORMATION KNOWN BY ANYONE IS REFLECTED IN THE STOCK.

Relationship among Three Different Information Sets



Some Common Misconceptions

- Much of the criticism of the EMH has been based on a misunderstanding of the hypothesis says and does not say.

There are some misconceptions about what efficiency actually means.
The first is listed below…

What the EMH Does and Does NOT Say

- **Investors can throw darts to select stocks.**
  - This is almost, but not quite, true.
  - An investor must still decide how risky a portfolio he wants based on risk aversion and the level of expected return **(DIVERSIFICATION)**.

There is a reason for this myth. The Wall Street Journal use to have a something called "the dart board analysis". On the front page of section C each Monday they would announce the results or four professional managers AND a randomly selected portfolio selected by throwing darts at a list of available stocks. The majority of the time the randomly selected stocks would out perform the professionally managed portfolio.

Is this true? Can you do as well as a professional manager? If markets are efficient this would seem to make sense. If market prices reflect all available information then there is no point in my studying stock reports or analysis reports. No point in research and background work. If all information is included then I may as well just pick my stocks randomly. This is actually almost true.

If I am going to select stocks randomly I still want to make sure that I am adequately diversified. It may be possible that a random selection of stocks may end up being all high tech stocks say. In that case I would not be adequately diversified. There is a role for a professional manager in making sure that my selection is well diversified.

Can a professional manager tell me which stocks are going to out perform? NO! Not if markets are efficient. But they can tell me how to diversify.

What the EMH Does and Does NOT Say

- **Stock prices are completely random or uncaused.**
  - Prices reflect information.
  - The price CHANGE is driven by new information, which by definition arrives randomly.
  - Therefore, financial managers cannot "**time**" stock and bond sales.

This is NOT what the hypothesis says. Prices reflect information. There is nothing random about stock prices, they reflect information. What is random is the information.

This is true to a degree. One of the papers assigned to read said that academic researchers can only explain stock prices changes for about 30% (informational based), the rest just seems to be completely random noise. Question is, are the researchers just missing information which is available or is there really truly a random element?

If that's the case, prices are random to some degree. (Must bear this in mind.)

We also know that financial managers cannot time stock and bond sales. Given all available public information, **financial managers shouldn't be able to time the market unless they have private information**.

The Evidence

- The record on the EMH is extensive, and in large measure it is reassuring to advocates of the efficiency of markets.
- Studies fall into three broad categories:
  1) Are changes in stock prices random? Are there profitable "trading rules"?

These usually come down to test of the random error term in the random walk equation. Look at the random error each day (or week or month) and try and find some consistent pattern in that random term based on some prior price or volume history. Can I make a prediction.

If a company does well in a particular month is it more likely to do badly in the next month? If a company out performs in one year is it likely to under perform in the next year? Can I pick winners based on last years losers? Can I pick losers based on last years winners?

If I could do so the markets would not be weak form efficient. I should be able to test for this because I should be able to see weather there is any link between that random term and some other prior price equation (inflation?). That's what these tests do, at their most extreme all they try and do is say is there any serial correlation in that random error term? Can yesterdays random error term tell me anything about todays? Is there a basis upward? Downwards? **Is there any systematic pattern in the random error term?**

Almost 99.999% of these test will show the markets to be weak form efficient. There are abnormalities.

2) Event studies: does the market quickly and accurately respond to new information?

Event study is another type of test. These are often tests of semi-strong efficiency. Not always but often. What an event study does is pick a particular event such as a company announcing that it is going to cut it's dividend, company announces it is going to sell stock, announces it is going to acquire another company, announces it s going to upgrade it computer system, any event. What researchers do is look at these events, get info from every company that has had that event during a period, and try and see if there is any inefficiency in the markets pricing of the information of that event.

Can come up with some interesting results (below).

What level of EMH should we follow, which one is true? Is it Weak, Semi-Strong, or Strong? **What level of information is included in asset prices?** There have been numerous thousands of studies on EMH. Most of them suggest that the markets are efficient to some degree.

3) The record of professionally managed investment firms.

Simple idea, if there's any value to information then professional investors should be the ones who profit from that information. Look up mutual fund managers. Are there groups of mutual fund managers who are consistently outperforming the market? Are there consistently good mutual fund managers? This is a useful test of semi-strong efficiency.

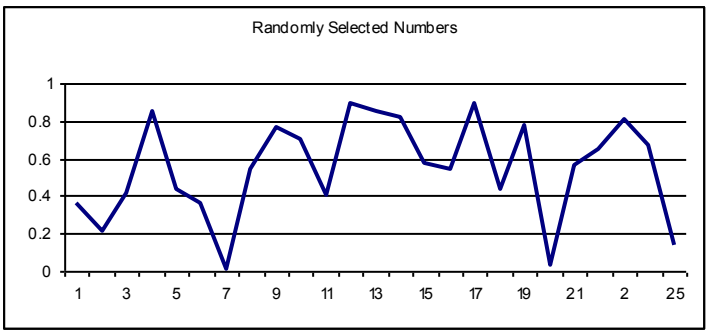
Are Changes in Stock Prices Random?

- Can we really tell?
  - Many psychologists and statisticians believe that most people want to see patterns even when faced with pure randomness.
  - People claiming to see patterns in stock price movements are probably seeing optical illusions.
- A matter of degree
  - Even if we can spot patterns, we need to have returns that beat our transactions costs.
- Random stock price changes support weak-form efficiency.

People tend to see patterns in random data, simply because they want to. Often people will think they see a pattern and find out that it disappears when they try to profit from it.

There are also cases where patterns do occur but the transaction costs are too great to profit from them. Returns must exceed transaction costs.

If stock prices really are random it supports weak form efficiency. Looking at enough sequences of data we will be able to convince ourselves a pattern appears every so often.



This makes services like channelstocks.com an attractive idea. You'll be able to find 20 stocks that show that pattern, but is it really a pattern or just some random chance event?

With different patterns, you may believe that you can predict the next value in the series—even though you *know* it is random. These random appearances of patterns does not mean there is a mechanism for making a profit.

Event Studies: How Tests Are Structured

- **Event Studies are one type of test of the SEMI-STRONG form of market efficiency.**
  - This form of the EMH implies that prices should reflect all publicly available information.
- To test this, event studies examine prices and returns over time—particularly around the arrival of new information.
- Test for evidence of under reaction, overreaction, early reaction, delayed reaction around the event.

Pick a particular event. Gather companies whom have had that type of event. Group them together, see what happens overall. Does there seem to be any tendency in their stock prices that would suggest the markets weren't efficient on the strong form level?

Testing to see weather all publicly available information is priced. Will look at how stock or bond prices change over time. Collect data so many days before and so many days after time 0 (time of the announcement). Look at the returns days before and days after, looking for any patterns which suggest the markets are not efficient. Is there any systematic over or under reaction? Is there any delayed or early reaction? All of these things would suggest that markets were not semi-strong efficient. Remember, we want to see an immediate reflection of the information in the stock price and no tendency afterwards to come back to some level or to increase to some level. Should be immediate. Should start with a random walk, information release, immediate jump or fall, and random walk again. This would indicate that the markets are semi-strong efficient.

- Returns are adjusted to determine if they are *abnormal* by taking into account what the rest of the market did that day.

There is a technical issue to setting up an event test, we have to analyze the random return, the unknown return. How do we know that on a particular day the market didn't crash and that's why the stock price fell? We have to analysis the **UNUSUAL** or **ABMORMAL** return. How ??? Many ways…

How Tests Are Structured (cont.)

- The ***Abnormal Return*** on a given stock for a particular day can be calculated by subtracting the market's return on the same day (R_M) from the actual return (R) on the stock for that day:

$$AR = R - R_M$$

ONE METHOD

We take the return of the market as a whole, the S&P500 for example, on a particular day. And we take our return of our stock on that particular day. Subtract one from the other to get the excess return over the market. Trying to remove overall market effects and systematic market risk. Want to analysis what happened on a company level.

- The abnormal return can be calculated using the Market Model approach:

$$AR = R - (\alpha + \beta R_M)$$

(Expected – Actual)

ANOTHER METHOD

Can also use CAPM. We are almost assuming that the stock has a beta of 1 here. But if we use the CAPM approach do we use the beta of the stock or do we say "on any particular day, what would the return have been if CAPM was exactly followed?" If the market went up 10% what should the return on that stock have been? This gibes us a predicted return. Alpha is the risk-free rate (?). This is one of the purposes of the CAPM, to test event studies. It gives you an expected return, what you believe to have happened, and you compare it to the actual leaving the unexplained bit. Must be careful there isn't any systematic basis. Maybe companies do particular events when the market does a certain thing. Therefore we want to remove systematic market moves out of our returns. We just want the company specific return.

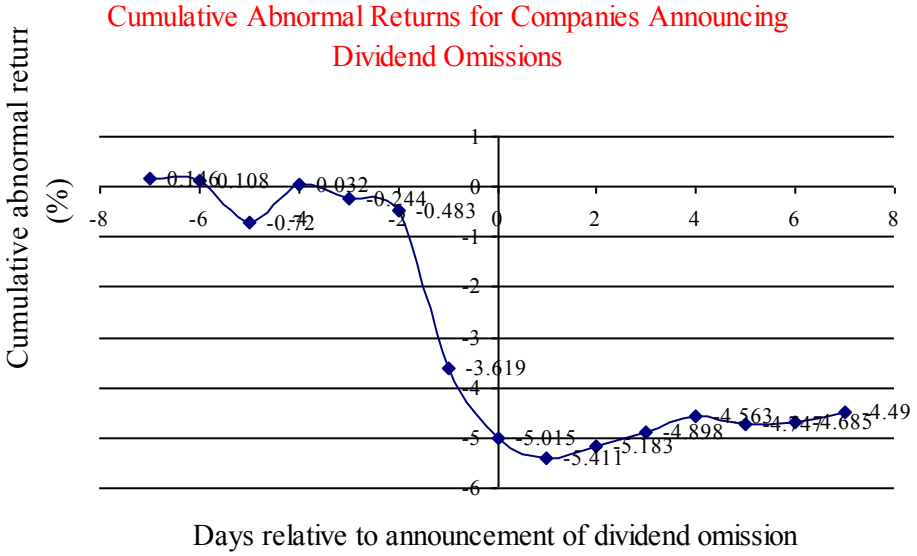
But there are even more ways to study an event …

A THIRD METHOD

In some event studies we would select the stock that we want to analysis and select another stock in the same industry, with the same capital structure, same market size (another very similar company). We would use this other company's performance as a proxy for what the stock we are studying should have done. Compare the actual return of the stock being examined to that of the proxy stock. This doesn't even assume that there is any price involved.

Could even compare it to an indexed fund of a certain sector but in this case we must be very careful that the portfolio we create does not have one of the events we are studying in it. Trying to get to the company specific part of the return.

Event Studies: Dividend Omissions



This is a classic study of dividend omissions. Looked at companies where there was an announcement that a dividend payout would be missed. This irritates investors, they had been expecting a $/share announcement. Company kept the money that quarter to reinvest or something else. Companies who cut their dividends usually see there stock plunge.

This study accumulated data of companies who had cut their dividend over a long period of time (like companies that had done this over ten years). Looked at stock price change relevant to a time zero (before and after). If markets were efficient the average drop in stock price due to the missed dividend should be about 5%. If you do it over a lot of companies the above is what you should see on average. Ideally we would see a step drop of 5% on the announcement day (time 0). The price of the stock did drop approx. 5% but it seems that the market overreacted a little bit. Seems that initially the stock fell by more than it should then came back to the 5% level. **May be some inefficiency on a**

semi-strong level. Must consider that we may not be able to profit from this undershoot effect because the transaction costs would be just too much.

The strategy to take advantage of the undershoot would be to buy the stock one day after the announcement and wait a few days for the price to increase (but it doesn't really go up by that much).

The more interesting thing is what is happening the day(s) before the announcement. Stock price seems to plunge the day before. Does this imply that the markets are semi-strong efficient? This effect is caused by insider trading. But it could actually be related to seepage of the announcement, maybe it got released the day before time 0. May be just a measurement problem. But the authors have probably done a pretty good job of getting this effect out of the results. This tends to suggest that private information is leaking into the system. **So this effect even supports not only semi-strong but strong efficiency!** It does seem that private information does creep into the market. Markets certainly are not strong efficient but they are on the strong side of semi-strong.

We could run this type of event study for various events and we will often see the same effects. Event examples: dividend increase and decrease, earning announcements, mergers, capital spending, new issues of stock. The majority of these studies usually prove that markets are semi-strong efficient with a leaking effect of information before the official announcement. Generally these studies do support semi-strong.

- Over the years, event study methodology has been applied to a large number of events including:
  - Dividend increases and decreases
  - Earnings announcements
  - Mergers
  - Capital Spending
  - New Issues of Stock
- The studies generally support the view that the market is semistrong-from efficient.
- In fact, the studies suggest that markets may even have some foresight into the future—in other words, news tends to leak out in advance of public announcements.

Issues in Examining the Results

- Magnitude Issue
- Selection Bias Issue
- Lucky Event Issue
- Possible Model Misspecification

Magnitude Issue: Sometimes some event studies will suggest that markets are not semi-strong efficient. Occasionally in some of these thousands of studies we see this but does this necessarily mean the markets are not semi-strong efficient? Must look at magnitude issues. Example is the undershoot inefficiency we saw above. Could the market have removed that inefficiency by transactions taking place? May be too small to profit from so is it really saying anything about market efficiency?

Selection Bias: If you look at enough event studies just by chance you are going to find one that seems to break semi-strong efficiency. If you ran the same test in 10 years time it may not give you the same answer. Statistical tests come with levels of confidence. It is possible that I can run an event study which seems to suggest something but it is really only statistical chance. This is called selection bias.

Lucky Event Issue: Basically academics trying to find some event which supports something extraordinary and looking hard enough until they find what they seek.

Possible Model Misspecification: Must have some way of calculating abnormal returns (company specific). It may happen that the company I'm looking at, because it's undergoing this event, changes it's risk characteristics. A company goes public for the first time, if I try to find a matching pair, another company that is already public, then they are intrinsically different, ones public, ones going public. So there may be a problem with trying to find company specific returns. The model may not be accurate. The event may change the return profile in some way. For example, a company who has to issue stock may be running into financial difficulties which in turn cause the price of the stock to fall. If I match this company with other companies who do not issue stock there will be an intrinsic difference between the two companies. Stock issue is just a proxy for that (?), therefore I'm not specifying true company specific returns. This issue is always present.

MOST EVENT STUDIES SEEM TO BACK UP SEMI-STRONG EFFICIENCY.

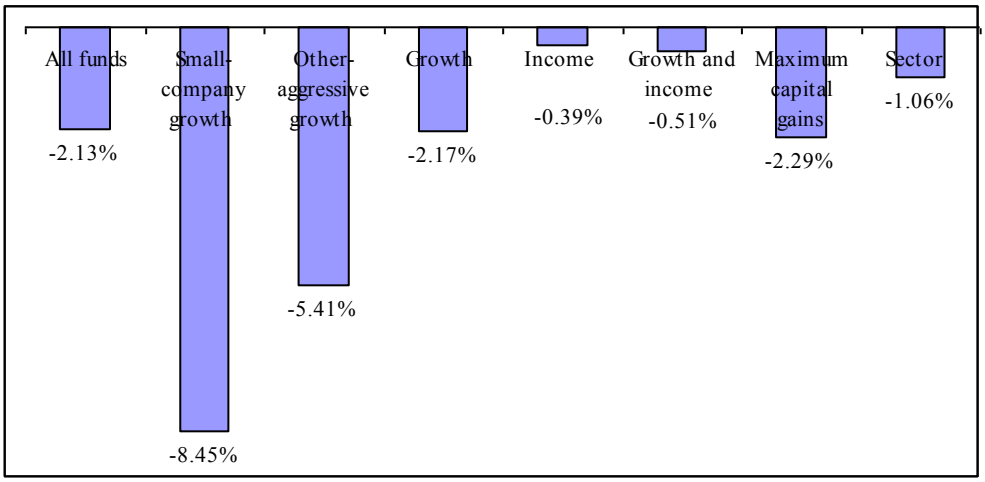
The Record of Mutual Funds

- If the market is semi-strong-form efficient, then no matter what publicly available information mutual-fund managers rely on to pick stocks, their average returns should be the same as those of the average investor in the market as a whole.

There should not be a hot-hand investor. People look at mutual fund managers. Compare efficiency by comparing returns of professionally managed funds against some sort of index to see if they have beaten the market. If I want to see weather they are beating the market I have to specify what type of return I was expecting. If a mutual fund invests in very high risk sectors of the market, then they need to be judged by a different index then a mutual fund that invest in a broad index of blue chip companies. Must specify what my expected return should be.

- We can test efficiency by comparing the performance of professionally managed mutual funds with the performance of a market index.

The Record of Mutual Funds



This is a classic study of mutual fund managers. They are grouped according to how well they compare to the market overall. You may find a manager who performs well for 5, 10, or 15 years but overall they don't seem to be outperforming the market. In fact they seem to under-perform. Why under? If what we have been saying is true we would expect them to, on average, do just as well as the market. The reason is mainly transaction costs. Consider small company growth stocks above, transaction costs are

likely to be higher. In fact the -8.45% will basically be transaction costs. Remember, we are comparing them to a static portfolio, a portfolio that does not change on a very consistent basis.

There was a study done about 6 years ago at U. California. A couple of researchers were given the records of Charles Swabb's investors with the names removed. They want to see if any private investors consistently outperformed the market. Found that they could not outperform the market and the ones who did worst are the ones who transacted more. They underperformed by the level of their transaction costs. The most successful individual investors were the ones who did not churn their individual portfolios. Kept their stocks for the long run and on average preformed as well as the market.

Also found in the study that women were better investors than men for the simple reason that women did not buy and sell as much.

So professional managers compared to individual investors seem to suggest that the markets are semi-strong efficient. There does not seem to be any systematic way of beating the market from using publicly available information. Of course there may be standouts, lucky people or people doing something special.

The Record of Mutual Funds

- **Even if the market is efficient a role exists for portfolio management:**
  - **Appropriate risk level**, diversification purposes. Very important!
  - **Tax considerations**, can make tax efficient decisions for investors although some make very tax inefficient decisions for investors.

A good mutual funds manager can improve the returns to investors by taking these kinds of things into account. But what they cannot do is consistently beat the market by picking stocks!

Tests for **Strong Form** of the EMH

- One group of studies of strong-form market efficiency investigates insider trading.
- A number of studies support the view that insider trading is abnormally profitable.
- **Thus, strong-form efficiency <u>does not</u> seem to be substantiated by the evidence**.

If markets were strong form efficient then an insider should make no profits. If markets are strong form efficient that means that as soon as the insider receives the information the stock price reflects that information (everyone finds out at same time, immediate price reaction). Yet it is seen that insiders do make profits off the markets, abnormally profitable. There are studies which suggest that insider trading is quite a profitable activity, this indicates that markets are not strong form efficient.

SO STRONG FORM EFFICIENCY DOES NOT SEEM TO EXIST IN THE MARKET.

Although a lot of event studies seem to suggest that markets are a little bit stronger than semi-strong. Insider information does seem to leak into stock prices.

Views Contrary to Market Efficiency

- **Stock Market Crash of 1987**
  - The market dropped between 20 percent and 25 percent **WORLDWIDE** on a Monday following a weekend during which little surprising information was released.

No person or study has ever been able to come up with a reason why the whole world woke up one days and decided their stocks were 25% overpriced. If the markets are efficient they a should incorporate information. Yet here is an example where no one can find the "information" which lead to this devastating event. This is the example people always bring up when they are trying to say that markets cannot be efficient.

One of the reading handouts says that news and information only seem to account for about 30% of stock price changes. Where is the other 70% or information?

❑ Temporal Anomalies

* Turn of the year, —month, —week.

Certain months of the year historically see higher stock price returns compared to the remained of the year. January is one. Maybe something to do with tax year? Some people say certain days of the week usually see higher returns. Tens to suggest there is something else going on, markets are not truly efficient. How could one month having a higher return be efficient? The information is not relevant. This is another mark against efficient markets.

❑ Speculative Bubbles

* Sometimes a crowd of investors can behave as a single squirrel.

The authoritative and entertaining book about speculative bubbles is "Extraordinary Popular Delusion and the Madness of Crowds" by John Mackay

People also argue that there is no informational reason, other than other investors are buying the stock, to suggest why a certain stock or asset class should run up in price above what appears to be it's fundamental value. How are markets efficient if bubbles can happen?

The Behavioral Challenge to Market Efficiency

❑ Rationality, are investors RATIONAL?

* People are not always rational:
* Many investors fail to **diversify**, trade too much, and seem to try to maximize taxes by selling winners and holding losers.

This is an alternative way of looking at things. This may be a way of explaining where these anomalies come from. Must be careful though because if investors are not rational then we've got a problem with a lot of the theoretical models constructed and used to describe finance.

Do people make decisions which are not rationally based? Behavioral researchers would say that people are not always rational. We know that many investors fail to diversify, this is not rational behavior. There are good reasons to be diversified yet people don't do it.

People tend to own stocks of local companies (town, state, country). Is that rational? Maybe, maybe not. People trend to trade too much. Many studies show that investors are more profitable if they buy and hold. Yet some people buy and sell consistently. Not rational!

People like to sell their winners and hold on to their losers because they hate to feel like they have made a mistake. This maximizes the amount of taxes paid as well as transaction costs! This also goes against the idea of efficient markets.

The Behavioral Challenge to Market Efficiency

- Independent Deviations from Rationality
  - Psychologists argue that people deviate from rationality in predictable ways:
    - **Representativeness**: drawing conclusions from too little data
      - This can lead to bubbles in security prices
    - **Conservativism**: people are too slow in adjusting their beliefs to new information.
      - Security Prices seem to respond too slowly to earnings surprises.

Psychologists are saying you can do tests on people and make predictions about what they will do in certain situations.

Classic Examples of Irrational Behavior:
Drawing conclusions from too little data. Such as people believing that because a stock has gone up 3 months it will continue.
Tend to just focus on the near term and forget about the long term. The result is that this can lead to bubbles in stock prices. People only looking at the short term can run up a stock.
People are too slow to adjust their moves given new information. Ex, a company cuts it's earnings, I do not incorporate into my value of the stock for a while. Maintain old believes.

- Attention / Memory / Ease of Processing
- Narrow Framing / Mental Accounting
  - Dividend vs. Capital Gains
- Misunderstanding of Randomness / Clustering Illusion
  - Mutual fund manager performance chasing
- Belief Updating
- Self Deception / Hindsight Bias

Some people believe people are not rational because they have a problem processing data. Rationality requires that I be able to take on all information. It may simply be impossible to do that. People may be physically incapable of rationality.

People tend to compartmentalize problems in their head. For example, they will hold two portfolios, one for child's education and the other is for retirement. I may be able to make a better investment decision if I consider both of those portfolios together, may be

able to structure and diversify better. People don't seem to be able to do that. They can deal with one thing or the other thing but they don't seem to be able to bring the two together very easily.

Dividends versus capital gains. Investors will hold mutual funds that promise dividend payments and other mutual funds that promise growth. They may be better off if they combined and consider the better allocation of their assets. But they only seem to be able to think of one problem at a time. This may lead to appearances of irrationality.

Misunderstanding of randomness. They see patterns that are not there. May believe they can profit from them. May follow a fund manager who was successful one year, but that success may have been random chance.

Self Deception and Hindsight Bias. People tend to believe that they are the ones who made good choices and the bad choices they made were random luck or other peoples faults. This can lead to irrational decisions.

The Behavioral Challenge to Market Efficiency

- Arbitrage
  - Suppose that your superior, rational, analysis shows that company ABC is overpriced.
  - Arbitrage would suggest that you should short the shares.
  - After the rest of the investors come to their senses, you make money because you were smart enough to "sell high and buy low".

If people are irrational, if speculative bubbles happen, if asset prices are not where they should be given available prices, if earning surprises are not quickly incorporated into asset prices. If all of these things happen than shouldn't arbitrage be able to make excess profits in those types of situations?

Strictly speaking, **arbitrage** is a certain profit with zero investment. I buy then sell, my net investment is zero but I lock into an absolute certain profit. If smart investors can see people making these mistakes on a consistent basis, then these smart people should be able to make almost certain profits with very little risk. That is the argument.

Classic example is internet and technology stocks tend to sell off during the summer. The argument being that people are just irrational toward this stock. Smart investor should be able to make a profit off of this behavior. If I believe it's overpriced I should be able to short the shares. When the market prices come back up I sell and should be able to make a profit.

The Behavioral Challenge to Market Efficiency

- **If the world is full on many rational and irrational investors then their should be a steady flow of funds from irrational to rational.**
  - But what about the smaller, less well known corners of the market.
- But what if the rest of the investment community doesn't come to their senses in time for you to cover your short position?
  - This makes arbitrage risky.

But this generally does not happen. Consider the insiders, people who are forced to hold a stock. Maybe that is the very reason the are making a profit, because they cannot be irrational, are not allowed to make irrational decisions. Again, in general there is no flow of funds from the stupid investor to the smart investor. However there may be small corners of the market which are less well understood where it is possible that people are being consistently beaten. It is possible. Also, even if I believe I am rational and everyone else is irrational, by the time the market comes to it's senses and equilibrium is reestablished, I could have gone bust. If I believe a stock or sector or industry is overpriced and I short that security, if it carries on being overpriced in the next year, the bubble I though was about to burst carries on growing for another year, I may go bust before the market comes to it's senses.

So arbitrage does not guarantee that I will make a profit. People may all come to there senses in a short enough period of time before the arbitrage can beat them.

Empirical Challenges to Market Efficiency (anomalies)

- Limits to Arbitrage
  - **"Markets can stay irrational longer than you can stay solvent."** John Maynard Keynes
- Buying and selling from (unknown) irrational investors can also be considered as information (volume)
  - Even rational investors opinions may contain this irrational influence
- Two economists are walking along a corridor…

When buying and selling from irrational investors it's impossible to tell weather this is noisy, bad information, or weather it's good information. **So sometimes stock prices can reflect information from irrational sources.** Information does not have to make sense, it just has to be adequately priced. If people are making mistakes, even that irrational information should be accurately reflected in stock prices.

Empirical Challenges to Market Efficiency (anomalies)

- Earnings Surprises
  - Stock prices adjust slowly to earnings announcements.
  - Behavioralists claim that investors exhibit conservatism.

Empirical Challenges to Market Efficiency (anomalies)

- Size
  - Small cap stocks seem to outperform large cap stocks.
- Value versus Growth
  - High book-value-to-stock-price stocks and/or high P/E stocks outperform growth stocks. Makes no sense why they should but they seem to. May be to do with irrationality. May be to do with investors behavior.

- **Size**: Studies have shown that small firms (measured by market capitalization) earn higher returns than large firms after adjusting for systematic risk. One controversy on this finding is whether the correct asset-pricing model was used to adjust for systematic risk.

- **Value versus Growth**: This is the latest battleground for the EMH. Several studies show that public information (e.g. book value and PE ratio) can be used to select stocks that produce abnormal return. These findings are inconsistent with the semi-strong form EMH. However, other studies find that these findings are results of biases in the data and not true evidence against EMH. The verdict on this topic is still not in.

Empirical Challenges to Market Efficiency (anomalies)

- **Crashes**
  - On October 19, 1987 the stock market dropped between 20 and 25 percent on a Monday following a weekend during which little surprising news was released. Could have been irrational behavior.
  - A drop of this magnitude for no apparent reason is inconsistent with market efficiency.
- **Bubbles**
  - Consider the tech stock bubble of the late 1990s. Suggest irrational behavior, people only looking at short term.

Reviewing the Differences

- Financial Economists have sorted themselves into three camps:

1. Market efficiency (we just don't understand how to price)
2. Behavioral finance (irrational investors, reconsider financial models)
3. Those that admit that they don't know (by far largest group)

- This is perhaps the most contentious area in the field.

RECAP

Implications Of Market Efficiency

- Because information is reflected in security prices quickly, investors should only expect to obtain a normal rate of return.
  - Awareness of information when it is released does an investor little good. The price adjusts before the investor has time to act on it.
  - Investments in financial securities are zero NPV projects.
    - Investors can expect to earn a fair return consistent with the risk of the security and companies can expect to receive a fair price when it issues securities.

If I believe the CAPM and I have a beta model, if I believe that a stock should generate a 12% return given it's risk, then on average that is what I should expect to see. Markets being efficient does not mean that I earn 0 return, it only means that I earn a fair return given the risks.

If I want to calculate the NPV of a project I calculate the present value of the future cash flows measured at the required rate of return. I compare that to the price today. If markets are efficient that sum gives me zero, the price today is the present value of the future cash flows. All financial projects are zero NPV projects. Means

that on average I should only earn a return which is adequate to compensate me for the risk. No excess returns.

Implications if markets are semi-strong efficient

- Firms should expect to receive the fair value for securities that they sell. All public information should be incorporated in the prices. Private information is another matter.
  - Fair means that the price they receive for the securities they issue is the present value.

If a CEO tells the board the company is not going to issue stock because it is undervalued it is a misleading statement. The market should be fairly pricing the stock.

  - Thus, valuable financing opportunities that arise from fooling investors are unavailable in efficient markets.

For example, an accounting change from LIFO to FIFO, as long as it's properly announced, should not cause a jump in stock price. That accounting change does not change the value of the business. Should not be able to fool investors that way.

Implications

- The EMH has three implications for corporate managers:
  - The price of a company's stock cannot be affected by a change in accounting.
  - Financial managers cannot "time" issues of stocks and bonds using publicly available information. Cannot sell stock when it's overpriced. Cannot issue debt when the market is under-pricing debt (because the market is setting a fair price if EMH is true).
  - A firm can sell as many shares of stocks or bonds as it desires without depressing prices. As long as the return that is generated on those new financial assets is the same as the return on the existing stock. If I can earn a 12% return, if I can sell stock and invest it at 12%, then there should be no impact on the stocks price.
- **There is conflicting empirical evidence on all three points.**

Why Doesn't Everybody Believe the EMH?

- There are optical illusions, mirages, and apparent patterns in charts of stock market returns.
- The truth is less interesting.
- There is some evidence against market efficiency:
  - Seasonality
  - Small versus Large stocks
  - Value versus growth stocks
- The tests of market efficiency are weak.

Summary and Conclusions

- An efficient market incorporates information in security prices.
- There are three forms of the EMH:
  - Weak-Form EMH
    - Security prices reflect past price data.
  - Semistrong-Form EMH
    - Security prices reflect publicly available information.
  - Strong-Form EMH
    - Security prices reflect all information.
- There is abundant evidence for the first two forms of the EMH.