

Artificial Intelligence (AI) for Investments



Lesson 9: Theory of Efficient Capital Markets



Introduction

In this lesson, we will cover the following topics:

- NPV computation for financing decision
- Differences between investment and financing decisions
- What is an efficient market
- Theory of market efficiency
- The evidence against market efficiency
- Investor psychology and behavioral finance
- Key implications of market efficiency
- Summary and concluding remarks

NPV Computation for Financing Decision

Net Present Value (NPV) : Computation for Financing Decision

- It is helpful to separate investment and financing decisions
 - There are certain similarities between these decisions
 - The decisions to purchase a machine tool and to sell a bond each involves the valuation of a risky asset
 - In both cases, we end up computing the net present value
 - As part of its policy of encouraging small businesses, the government offers to lend your firm \$100,000 for 10 years at 3%. This means that the firm is liable for interest payments of \$3,000 in each of the years, 1 through 10 years, and responsible for repaying the \$100,000 in the final year

NPV Computation for Financing Decision

- Should you accept this offer?
 - We can compute the NPV of the loan agreement in the usual way
 - $NPV = \text{amount borrowed} - \text{present value of interest payments} - \text{present value of loan repayment}$
 - $NPV = +100,000 - \sum_{t=1}^{10} \frac{3000}{(1+r)^t} - \frac{100000}{(1+r)^{10}}$
 - The only missing variable is r , the opportunity cost of capital
 - You need that to value the liability created by the loan



NPV Computation for Financing Decision

- The government's loan to you is a financial asset
 - We can compute the NPV of the loan agreement in the usual way
 - A piece of paper representing your promise to pay \$3,000 per year plus the final repayment of \$100,000
 - It would sell for the present value of those cash flows discounted at r
 - The only missing variable is r , the opportunity cost of capital
 - What interest rate would my firm need to pay to borrow money directly from the capital markets rather than from the government?

NPV Computation for Financing Decision

- Suppose that this rate is 10%
 - $NPV = +100,000 - \sum_{t=1}^{10} \frac{3000}{(1.10)^t} - \frac{100000}{(1.10)^{10}}$
 - $NPV = +100,000 - 56,988 = +\$43,012$
 - NPV calculations tell you just how much that opportunity is worth (\$43,012)
 - You don't need any arithmetic to tell you that borrowing at 3% is a good deal when the fair rate is 10%

Differences Between Investment and Financing Decisions



Differences Between Investment and Financing Decisions

- Investment decisions and financing decisions differ from each other in contrasting ways
 - Financing decisions do not have the same degree of finality as investment decisions
 - It's harder to make money through smart financing strategies
 - Financial markets are more competitive than product markets
 - It is more difficult to find positive-NPV financing strategies than positive-NPV investment strategies

Differences Between Investment and Financing Decisions

- Capital investment decisions do not face competitive markets
 - Markets for financing are highly competitive
 - Numerous smart investors supply financing
 - Money flows across different financial markets in a seamless manner
 - Thus, it is expected that financing instruments would be fairly priced

What Is an Efficient Market

What Is an Efficient Market

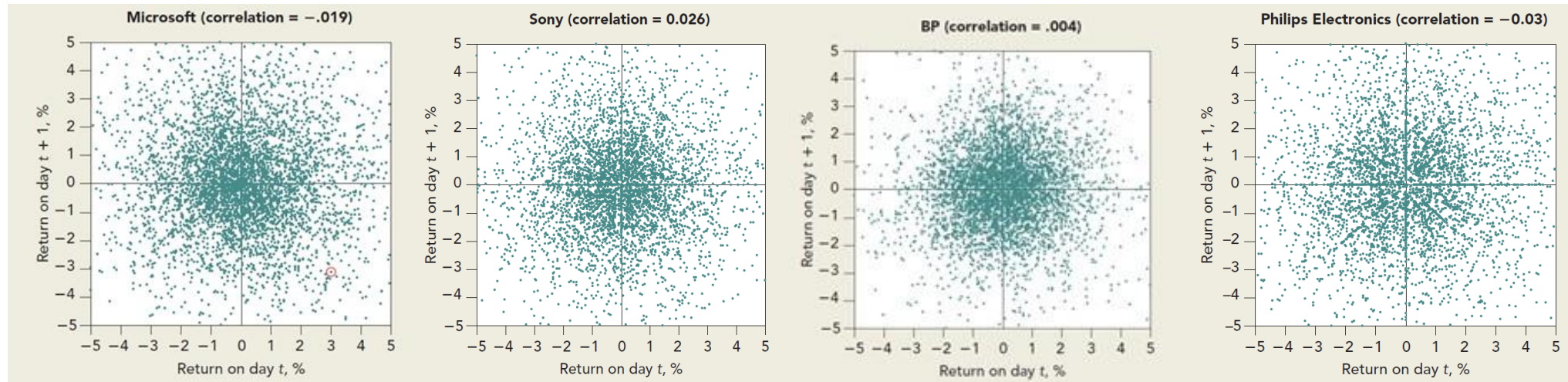
- Security prices seem to follow a random walk
 - A process is a random walk process if the successive changes are independent
 - Consider a simple example of a coin-toss game
 - If it comes up heads, you win 3% of your investment; if it is tails, you lose 2.5%
 - The odds each week are the same, regardless of the value at the start of the week or of the pattern of heads and tails in the previous weeks

What Is an Efficient Market

- As per the random walk model, the price changes are independent of one another
 - One can compute correlation coefficients between price changes at each of the successive days
 - If prices persist, then one can expect to find some correlation across price changes
 - No correlation if there is purely a random walk-in price changes

What Is an Efficient Market

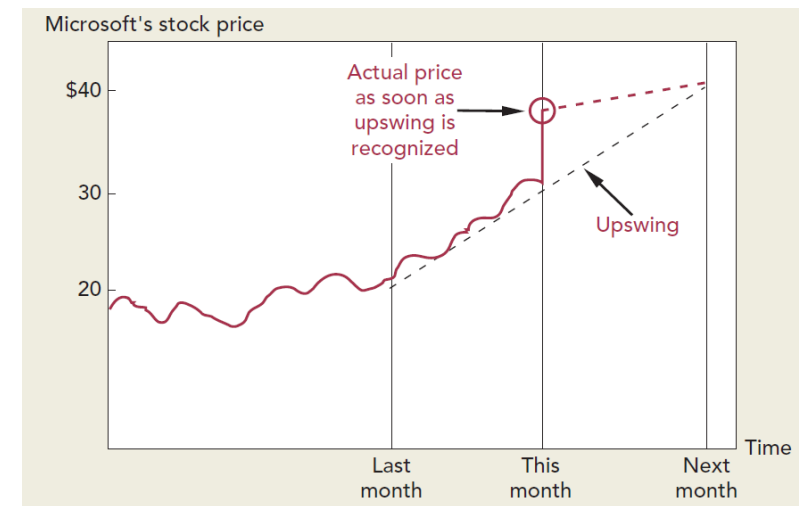
- Consider the following four correlation examples



- For example, the correlation between successive price changes in Microsoft was -0.019
- For Philips, this correlation was also negative at -0.030
- However, for BP and Sony, the correlations were positive at +0.004 and +0.026

What Is an Efficient Market

- The Fig. shown here provides an example of such a predictable cycle
 - An upswing in Microsoft's stock price started last month when the price was \$20, and it is expected to carry the price to \$40 next month
 - Since Microsoft stock is a bargain at \$30, investors will rush to buy
 - As soon as a cycle becomes apparent to investors, they immediately eliminate it by their trading



Theory of Market Efficiency



Theory of Market Efficiency

- Prices in competitive markets must follow a random walk
 - If past price changes could be used to predict future price changes, investors could make easy profits
 - All the information in past prices will be reflected in today's stock price, not tomorrow's
 - No one earns consistently superior returns in competitive markets
 - Thus, collecting more information may not help

Theory of Market Efficiency

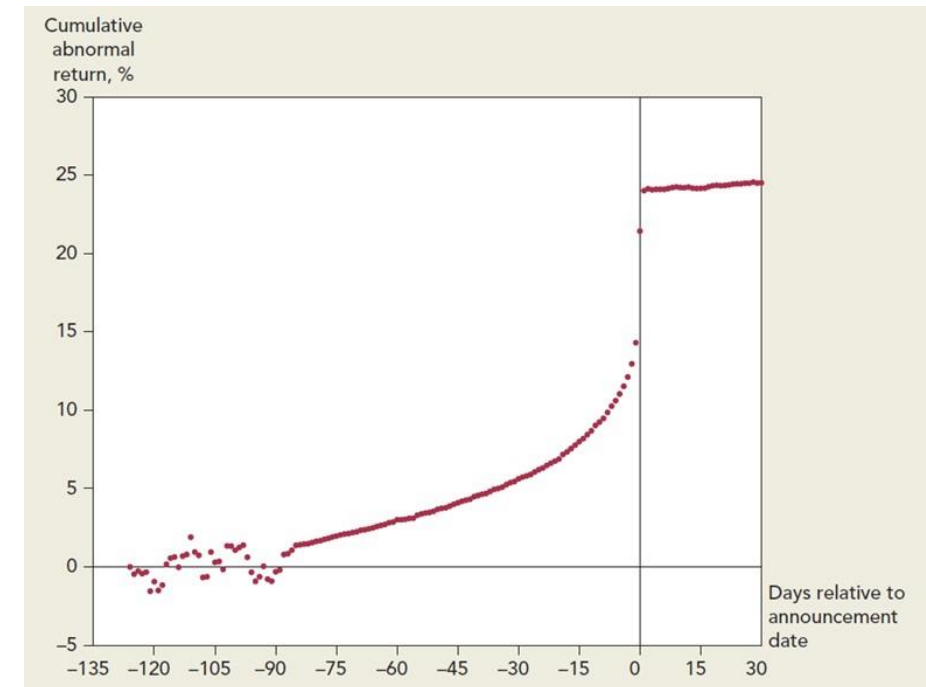
- Economists define three levels of market efficiency
 - **Weak market efficiency:** prices reflect the information contained in the record of past prices
 - **Semi-strong form of efficiency:** prices reflect all the public information
 - **Strong form of efficiency:** prices reflect all the available information, including historical prices, public information, and private information
 - In a strong form efficient market, investment managers cannot consistently beat the market

Theory of Market Efficiency

- How to test different forms of efficiencies
 - **Weak market efficiency:** researchers examine the profitability of various technical trading rules employing historical price information
 - **Semi-strong form of efficiency:** researchers examine how fast public information (such as dividend announcements) is incorporate into prices
 - To analyze the semi-strong form of the efficient-market hypothesis, researchers measure how rapidly security prices respond to different items of news, such as earnings or dividend announcements, news of a takeover, or macroeconomic information

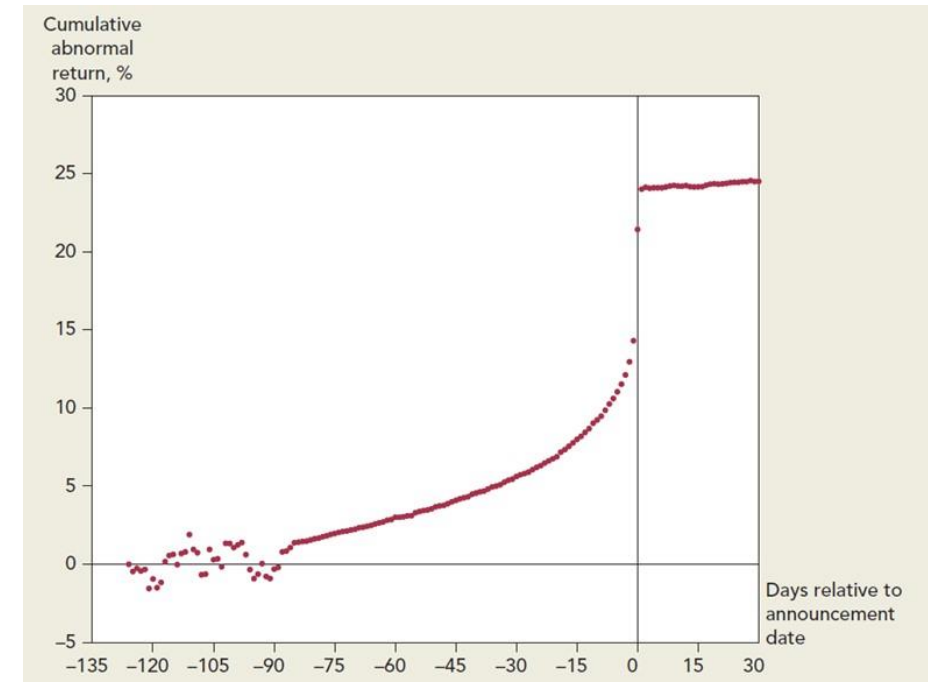
Theory of Market Efficiency

- Consider an example of news that a company being a target of acquisition coming into public
- The graph shows the abnormal returns on the firms that are target take-overs
- The prices of the target stocks jump up on the announcement day, but from then on, there are no unusual price movements
- The announcement of the takeover attempt seems to be fully reflected in the stock price on the announcement day



Theory of Market Efficiency

- The graph shows the abnormal returns on the firms that are target takeovers
- The acquiring firms usually must pay a substantial takeover premium to get the deal done
- Stock prices drift up before date zero, as investors gradually realize that a takeover may be coming
- Within the day, the new stock prices reflect (at least on average) the magnitude of the takeover premium



Theory of Market Efficiency

- **Strong form of efficiency:** tests of the strong form of the hypothesis have examined the recommendations of professional security analysts
- Researchers examine whether mutual funds and pension funds can outperform the market
- Evidence suggests that professionally managed funds fail to recoup the costs of management
- It appears that in some years they do well and not so well in others
- It would be difficult to believe that some managers possess superior abilities to others

Theory of Market Efficiency

- The evidence of efficient markets has convinced many professional and individual investors to give up the pursuit of superior performance
- The implication is less focus on active management as more and more people follow passive investment strategies by investing in market indices over long horizons
- However, if everybody invests in index funds, then nobody will collect new information
- An efficient market needs some smart investors who gather information and attempt to profit from it
- There must be some profits available to allow the costs of information to be recouped

The Evidence Against Market Efficiency

The Evidence Against Market Efficiency

- Research suggests that there are indeed anomalies that can be exploited and contradict the notion of market efficiency
 - What exactly is an anomaly?
 - In an efficient market, it is not possible to find expected returns greater (or less) than the risk-adjusted opportunity cost of capital
 - $P = \sum_{t=1}^{\infty} \frac{C_t}{(1+r)^t}$; future cash flows (C_t) and the opportunity cost of capital (r)
 - If price equals fundamental value, the expected rate of return is the opportunity cost of capital, no more and no less

The Evidence Against Market Efficiency

- The principle tells us that you can't identify a superior return unless you know what the normal expected return is
 - We need an asset pricing model to determine the relationship between the risk and expected returns
 - The most used asset pricing model is the CAPM
 - Several CAPM violations have been found in the literature
 - This includes the abnormally high returns on the stocks of small firms vis-à-vis large firms
 - Investors may demand higher returns for bearing the risk associated with small stocks

The Evidence Against Market Efficiency

- If these anomalies offer easy pickings, you expect to find a number of investors eager to take advantage of them
 - However, this seems to be surprisingly difficult for investors to get rich by picking these
 - Some of the calendar anomalies include day of the week effect
 - Long-term investors are usually less concerned with these short-term mispricing
 - They are more interested in long-lasting inefficiencies such as the earnings announcement puzzle and new issue puzzle

The Evidence Against Market Efficiency

- Another interesting phenomenon is bubbles and market efficiency
 - Bubbles: prices can no longer be justified with fundamentals
 - Valuation of stocks from scratch through methods such as dividend growth model is extremely difficult
 - Easier to estimate tomorrow's price relative to today's price
 - When investors lose confidence in prices, prices become inefficient and volatile
 - Most of the tests of market efficiency are concerned with relative prices and focus on whether there are easy profits to be made

The Evidence Against Market Efficiency

- It may be impossible to prove that market levels are, or are not, consistent with fundamentals
 - Now and again investors seem to be caught up in a speculative frenzy, and asset prices are inflated much beyond fundamentals
 - Bubbles can result when prices rise rapidly, and more and more investors join the game on the assumption that prices will continue to rise
 - Lots of money is lost when these bubbles burst

Investor Psychology and Behavioral Finance



Investor Psychology and Behavioral Finance

- Often, prices depart from fundamental values
 - This may be so because people are not rational all the times
 - This manifests in their attitude toward risk: people are particularly loath to incur losses
 - **Prospect theory:** investors are more averse to losing than their affinity toward gain
 - **Beliefs about probabilities:** investors often make errors in assessing the probability of uncertain events
 - They place higher weights on more recent events



Investor Psychology and Behavioral Finance

- Also, investors are slow in updating their beliefs in the presence of new evidence
- Most investors are systematically biased due to overconfidence and consider themselves better-than-average stock pickers
- Such biases help in anomalies and bubbles
- Limits to arbitrage: these are limits to which smart investors can carry out arbitrage and drive prices toward efficient values
- Arbitrage is an investment strategy aimed to generate guaranteed superior returns without any risk
- However, these are not as risk-free as the theory might suggest

Investor Psychology and Behavioral Finance

- For example, trading costs can be significant, and some trades are difficult to execute
- To sell a stock short, you borrow shares from another investor's portfolio, sell them, and then wait hopefully until the price falls and you can repurchase the stock back for less than you sold it for
- If you're wrong and the stock price increases, then sooner or later, you will be forced to repurchase the stock at a higher price (therefore at a loss) to return the borrowed shares to the lender
- In addition, there are costs and fees to be paid, and in some cases, you will not be able to find shares to borrow

Key Implications of Market Efficiency

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- The efficient-market hypothesis emphasizes that arbitrage will rapidly eliminate any profit opportunities and drive market prices back to fair value
 - Lesson 1: Markets Have No Memory: the weak form of the efficient-market hypothesis states that the sequence of past price changes contains no information about future changes
 - Lesson 2: Trust Market Prices: in an efficient market, you can trust prices, for they impound all available information about the value of each security
 - Lesson 3: Read the Entrails: if the market is efficient, prices impound all available information; and therefore, can tell us a lot about future worldview of that stock

Key Implications of Market Efficiency

- The efficient-market hypothesis emphasizes that arbitrage will rapidly eliminate any profit opportunities and drive market prices back to fair value
 - Lesson 4: There Are No Financial Illusions: investors are only concerned with the firm's cash flows and the portion of those cash flows to which they are entitled
 - Lesson 5: The Do-It-Yourself Alternative: in an efficient market, investors will not pay others for what they can do equally well themselves
 - Lesson 6: Seen One Stock, Seen Them All: investors don't buy a stock for its unique qualities; they buy it because it offers the prospect of a fair return for its risk. This means that stocks are like perfect substitutes for each other

Key Implications of Market Efficiency

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Summary and Concluding remarks

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- Competition between investors will tend to produce an efficient market
- In such a market, prices will rapidly impound any new information, and it will be difficult to make consistently superior returns
- The efficient-market hypothesis comes in three different flavors: weak form, semi-strong form, and strong form
- Limits to arbitrage can explain why asset prices may get out of line with fundamental values
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Thanks!

