Efficient Market Hypothesis

Random walk hypothesis

The **Random Walk Hypothesis** is a theory in finance that suggests that **stock prices follow a random path** and are therefore **unpredictable**. According to this hypothesis, **future price movements are independent of past movements**, and stock prices **reflect** all available **information at any given time**.

Imagine you're flipping a fair coin to decide whether a stock price will go up or down each day:

- **Heads**: The stock price goes up by $1.
- **Tails**: The stock price goes down by $1.

Process:

1. **Day 1**: Start with a stock price of $50.
2. **Flip Coin**: If it's heads, the stock price moves to $51. If tails, it moves to $49.
3. **Repeat**: Each day, flip the coin again and adjust the price accordingly.

Outcome: Over many days, the stock price will move randomly up and down, with no predictable trend or pattern. Each day's movement depends only on the coin flip, not on past prices. This illustrates the essence of the Random Walk Hypothesis: future price changes are independent of past price movements and follow a random path.

Introduction

It is an **investment theory** that states it is **impossible to "beat the market"** because **stock market efficiency** causes **existing shares to always incorporate and reflect all relevant information**.

According to the EMH, **stock always** trade at their **fair value** on stock exchanges, making it impossible for investors to either purchase undervalued stocks or sell stocks for inflated prices. As such, it should be **impossible to outperform the overall market** through expert stock selection or market timing, and that the only way an investor can possibly obtain the higher returns is by purchasing riskier investments.

An **efficient capital market** is one where prices of **securities quickly and accurately reflect all available information.**

This means that as soon as new information becomes available, it is immediately incorporated into the prices of securities, ensuring that the prices are always based on the most current and accurate information.

The Efficient Markets Hypothesis

The Efficient Markets Hypothesis (EMH) is made up of three progressively stronger forms:

- **Weak Form**
- **Semi-strong Form**
- **Strong Form**
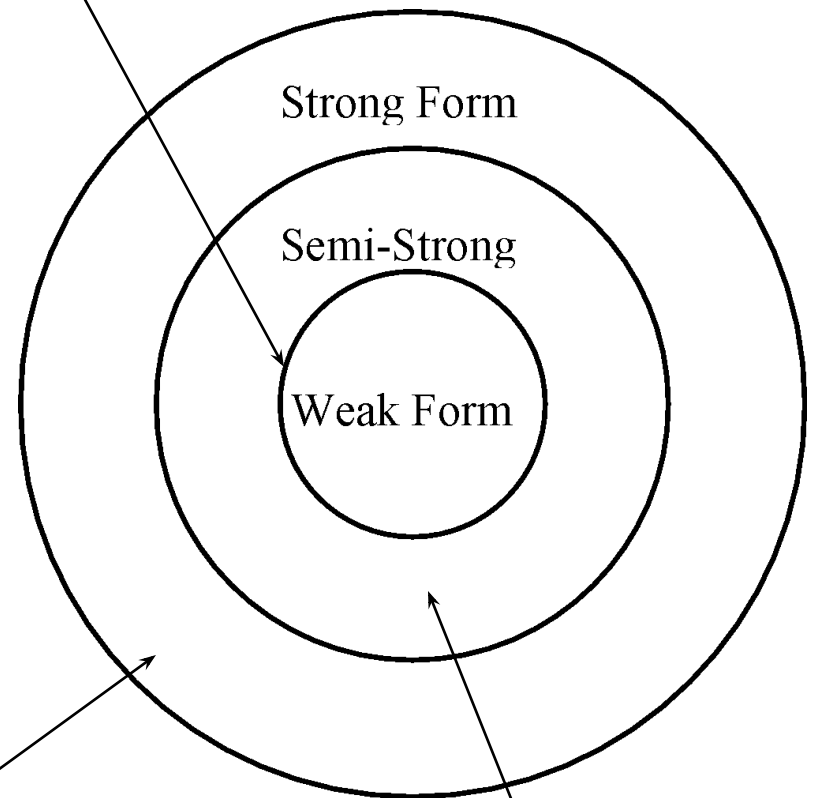
The EMH Graphically

In this diagram, the circles represent the amount of information that each form of the EMH includes.

Note that the weak form covers the least amount of information, and the strong form covers all information.

Also note that each successive form includes the previous ones.

All historical prices and returns

Strong Form

Semi-Strong

Weak Form

All information, public and private

All public information

The Weak Form

Weak Form Efficiency

Past data on stock price and volume — Reflects → Current price

Past data on stock price and volume — ✗ Cannot predict → Future price patterns

WallStreetMojo
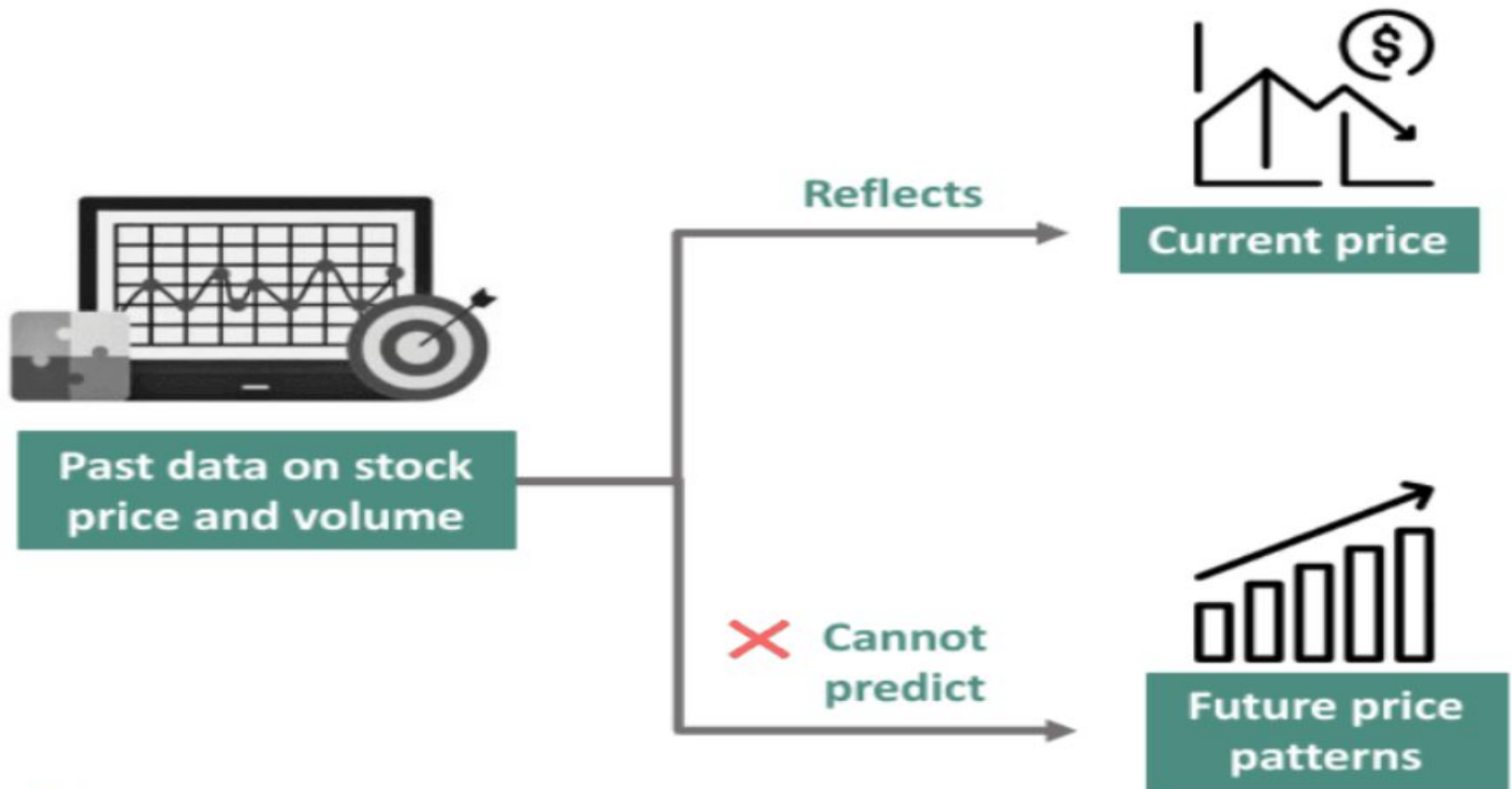
The Weak Form

- The weak form of the EMH says that **past prices, volume, and other market statistics** provide **no information** that can be used to **predict future prices**.
- Weak because **security prices** are the **most easily** available **piece of information.**
- **Technical analysis** is a method used by financial analysts to try to make profits by **studying past stock prices and trading volumes**. However, the idea behind **efficient market**s is that this kind of **analysis is not very usefu**l because **prices already reflect all available information.**
- In an efficient market, prices adjust rapidly and accurately when new information becomes available.
- **This form of the EMH, if correct, repudiates technical analysis**.

The Semi-strong Form

- The semi-strong form says that **prices fully reflect** all **publicly available information**(even those reported in the financial statements of the companies) and expectations about the future

- This suggests that **prices adjust very rapidly** as per new information, and that **old information cannot be used to earn superior returns.**

- The **assertion** behind semi-strong market efficiency is still that **one should not be able to profit using something that "everybody else knows"** (the information is public). Nevertheless, this assumption is far stronger than that of weak-form efficiency.

- The semi-strong form, if correct, **repudiates fundamental analysis.**

The Strong Form

- The strong form says that **prices** fully **reflect** all information, **whether publicly available or not.**

- Even the knowledge of material, non-public information (insider data) cannot be used to earn superior results.

   Example:

   Imagine a company is about to **release a new produc**t that will **significantly increase its profits**, but this **information isn't public yet**.

   In a strong form efficient market, even if you have **access to this insider information,** the **stock price has already adjusted** to reflect the anticipated impact of the new product. So, **you wouldn't be able to make extra profits from knowing this secret.**

The Strong Form

- The idea behind strong-form market efficiency is that the market can predict future developments accurately, so stock prices already include all information, even insider details.

- However, most research shows that markets aren't truly this efficient, and insider information can still give some people an advantage.

Summary of Tests of the EMH

- Weak form is supported, so technical analysis cannot consistently outperform the market.

- Semi-strong form is mostly supported , so fundamental analysis cannot consistently outperform the market.

- Strong form is generally not supported.

- Most people think the market is very efficient, but not perfect. This means it's hard to consistently make big profits using any method, especially after accounting for costs and risks.

Implications of Efficient Markets

<u>Technical Analysis</u> – Technical analysis uses past patterns of price and the volume of trading as the basis for predicting future prices.

Evidence suggests that **prices of securities are affected by news. Favourable news will push up the price** and **vice versa**.

Example:
Suppose Reliance Industries announces a major new investment in green energy. The positive news might cause its stock price to rise from ₹2,500 to ₹2,600 per share as investors are excited about future growth prospects. Conversely, if Reliance faces environmental violations and news of hefty fines is reported, its stock price might fall from ₹2,500 to ₹2,400 per share as investors react to the potential costs and negative impact on the company's reputation.

Implications of Efficient Markets

This means that relying on technical analysis (studying past price movements and patterns) might not be the best way to pick investments.
This is because it doesn't consider how news and external events, which can significantly impact security prices, might affect investment decisions.

__Fundamental Analysis__ –

Fundamental Analysis involves using market information(such as earnings , dividends , accounting ratios) to determine the intrinsic value of securities in order to identify those securities that are undervalued.

However semi strong form market efficiency suggests that fundamentals analysis cannot be used to outperform the market. In an efficient market, where all available information is already reflected in stock prices, spending time and money on equity research might not be worth it.

Example:

Imagine you're buying apples at a grocery store where all apples are priced based on their quality and freshness. If you spend time checking every apple to find one that's cheaper than its actual value, you're unlikely to find one. This is because the store's pricing already reflects the true value of each apple.

In this situation, spending extra time to look for a better deal (which is like doing research) probably won't save you money, because the prices are already fair. Thus, the effort and cost of looking for a better deal might not be worth it, as you're unlikely to find a better price.

Weak form of EMH test

Run Test

The **Run Test** (or **Runs Test**) is a statistical method used to determine whether a sequence of data points is randomly ordered or if there are patterns in the sequence.

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Weak form of Efficiency test has failed — **Low** ⇩ — Technical Analysis is applicable

Average ⇩ — Market has passed weak form of EMH. Technical Analysis is not applicable

High ⇩ — Technical Analysis is applicable

Weak form of Efficiency test has failed

Weak form of EMH test

Autocorrelation test

- **Get historical price data** for the stock.
- **Calculate daily returns** to see how much the price changes each day.
- **Test for autocorrelation** by checking if today's returns are influenced by previous days' returns.

If the correlations are close to zero, it suggests that past returns don't predict future returns. This supports the idea that the market is efficient (at least in the weak form).

If the correlations are significantly different from zero, it suggests that past returns might help predict future returns. This would mean the market is not fully efficient.

Weak form of EMH test

Filter test

Obtain Historical Data: Gather historical price data for the asset you want to test
Define the Filter Percentage: Choose a filter percentage (fff), such as 1%, 2%, etc.
This **filter percentage will be used to determine buy and sell signals.**

Generate Trading Signals

- **Initial Position:** Start with no position.
- **Buy Signal:** If the asset's price increases by fff% from its most recent low, buy the asset.
- **Sell Signal:** If the asset's price decreases by fff% from its most recent high, sell the asset.

Start trading & Calculate the returns from a buy-and-hold strategy over the same period.
Compare the performance of the f**ilter rule strategy to the buy-and-hold strategy.**
If the filter rule strategy's returns are **significantly higher,** it may indicate that the
market is not weak form efficient.
If the returns are not significantly different, it supports weak form efficiency.

EMPIRICAL TEST – SEMI-STRONG FORM EFFICIENCY

The semi-strong form of market efficiency tests whether stock prices fully and quickly reflect all publicly available information.

- **Purpose**: To see if share prices react to new information and if analysts can earn above-average returns using public data.
- **Types of Information**: Researchers have tested this form of market efficiency using different kinds of publicly available information, such as earnings announcements, economic news, and other public data.
- **Key Researchers**: Fama, Fisher, Jensen, and Roll developed much of the testing methods used for this analysis.

Residual analysis measures the **impact of new information on a stock** by comparing **actual returns to expected returns**.

- **Excess Return**: The difference between actual and expected returns. A **positive difference** means the stock earned more than expected.This could imply that the **market is not fully efficient**, particularly in the context of the semi-strong form of the Efficient Market Hypothesis (EMH)
- **Semi-Strong EMH**: If the excess **return is close to zero**, it suggests that the **stock price quickly and fully adjusts to new information**, supporting the semi-strong form of the Efficient Market Hypothesis.

Strong form EMH tests

1. Insider Trading Test

- **Concept**: Check if insiders (company executives, major shareholders) can earn abnormal returns based on their non-public, private information.
- **Test**: Compare the returns of trades made by insiders with those of regular investors. If insiders consistently make better returns due to their private information, it suggests the market is not strong form efficient.

2. Performance of Professional Money Managers Test

- **Concept**: Evaluate whether professional fund managers can consistently outperform the market using their access to detailed information and advanced analysis techniques.
- **Test**: Analyze the long-term performance of mutual funds or hedge funds. If professional managers do not consistently outperform the market after accounting for risk, it supports the idea that all information is already reflected in prices, indicating strong form efficiency.