Intro to Econometrics

Objectives:

- Students will be able to demonstrate a basic understanding of econometrics
- Students will be able to explain why econometrics is important to business analysis and other disciplines

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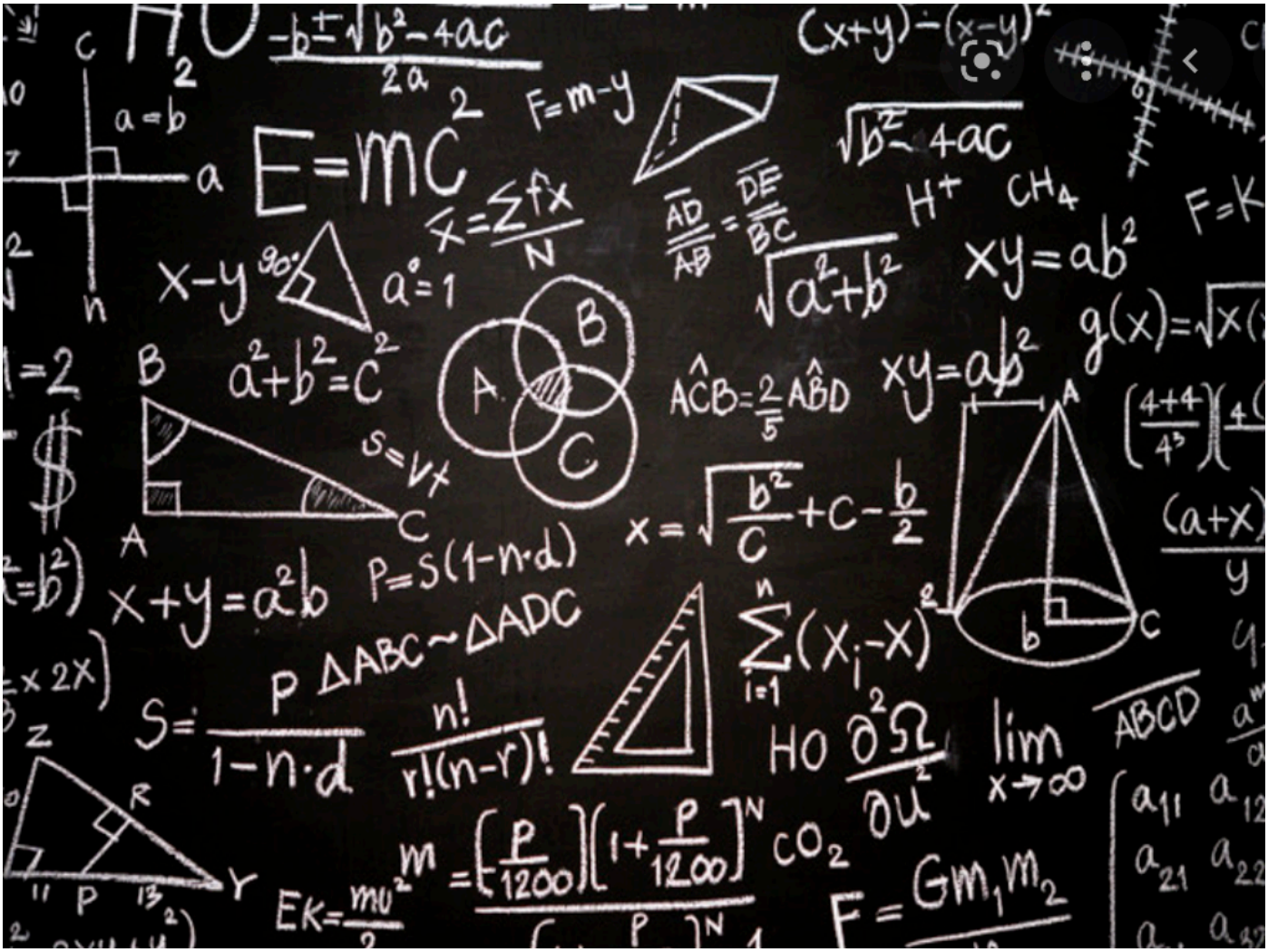
For economic measurement, econometrics is essential. Econometrics is significant, however, extends far beyond the field of economics. Econometrics is a set of research methods used in accounting, finance, marketing, and management, among other business disciplines. It is utilized by social scientists, particularly historians, political scientists, and sociologists. Econometrics is used in a variety of disciplines, including forestry and agricultural economics. Because economics is the cornerstone of business analysis and the fundamental social science, there is a wide range of interest in econometrics. As a result, economists' study techniques, which include the subject of econometrics, are beneficial to a wide range of people.



In the education of economists, econometrics is very important. You are learning to "think like an economist" as an economics student. Economic concepts like opportunity cost, scarcity, and comparative advantage are being taught to you. You're dealing with supply and demand economic models, macroeconomic behavior, and international commerce. You will get a greater understanding of the world in which we live as a result of this course; you will learn how markets function and how government policies impact the marketplace.

If economics is your major or minor subject of study, you'll have a lot of options after graduation. If you want to work in the business sector, you must be able to answer the question, "What can you do for me?" ‘‘I can think like an economist," said students in a typical economics class. While we may think such a statement is strong, it isn't particularly detailed, and it may not

satisfy an employer who doesn't understand economics.

The issue is that there is a disconnect between what you learnt in economics class and what economists really do. Only a small percentage of economists make a career solely by researching economic theory, and those who do are often hired by universities. Most economists, whether they work in industry or for the government, or teach in universities, participate in some form of empirical economic analysis. They utilize economic data to assess economic connections, test economic hypotheses, and forecast economic consequences.

We need to describe the nature of econometrics at this point. It all starts with a hypothesis about how significant variables are connected to one another from your field of study—whether it's accounting, sociology, or economics. The mathematical notion of a function is used in economics to describe our beliefs about connections between economic variables. To express a connection between income and consumption, for example, we may write

CONSUMPTION = f(INCOME)

This states that the amount of consumption is a function of income, f().

The demand for a certain commodity, such as the Hyundai Accent, may be stated as follows:

Qd = f (P, Ps, Pc, INC)

which says that the quantity of Hyundai Accents demanded, Qd, is a function f (P, Ps, Pc, INC) of the price of Hyundai Accents P, the price of cars that are substitutes Ps, the price of items that are complements Pc (like gasoline), and the level of income INC.

This equation is a common economic model that defines how we view the interrelationships between economic variables. This sort of economic model directs our economic analysis. Knowing that particular economic variables are connected, or even the direction of the relationship, is insufficient for most economic decision or choice issues. Furthermore, we must comprehend the magnitudes involved. That is, we must be able to determine the magnitude of a change in one variable's impact on another.

The Econometric Model

Objectives:

- Students will be able to define what an econometric model is
- Students will be able to explain the variables involved with an econometric model

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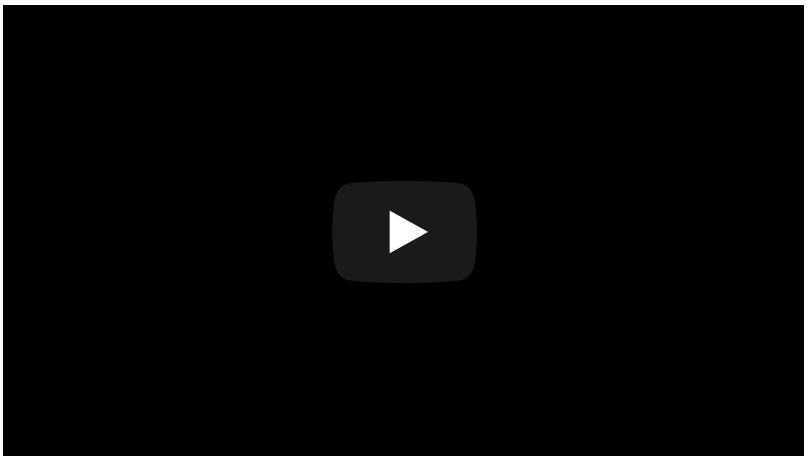


What exactly is an **econometric model**, and where did it originate? We must first recognize that economic relationships are not accurate in an econometric model. Economic theory does not pretend to be able to forecast the person or firm's unique conduct, but rather explains the average or systematic behavior of many individuals or companies. We realize that the actual number of Hyundais sold is the sum of this systematic element plus a random and unexpected component *e*, which we will term a random error, while examining vehicle sales. As a result, an econometric model of Hyundai Accent sales is developed.

Qd = f (P, Ps, Pc, INC) + e

The random error *e* represents the inherent unpredictability in economic activity and accounts for numerous factors that impact sales that we have ignored from our simplified model.

We must additionally state something about the shape of the algebraic relationship among our economic variables to complete the econometric model definition. For example, quantity demanded was portrayed as a linear function of price in your first economics classes. We apply that assumption to the other variables as well, giving the demand relationship a systematic component.

f (P, Ps, Pc, INC) = β1 + β2P + β3Ps + β4Pc + β5INC + e

The corresponding econometric model is

Qd = β1 + β2P + β3Ps + β4Pc + β5INC + e

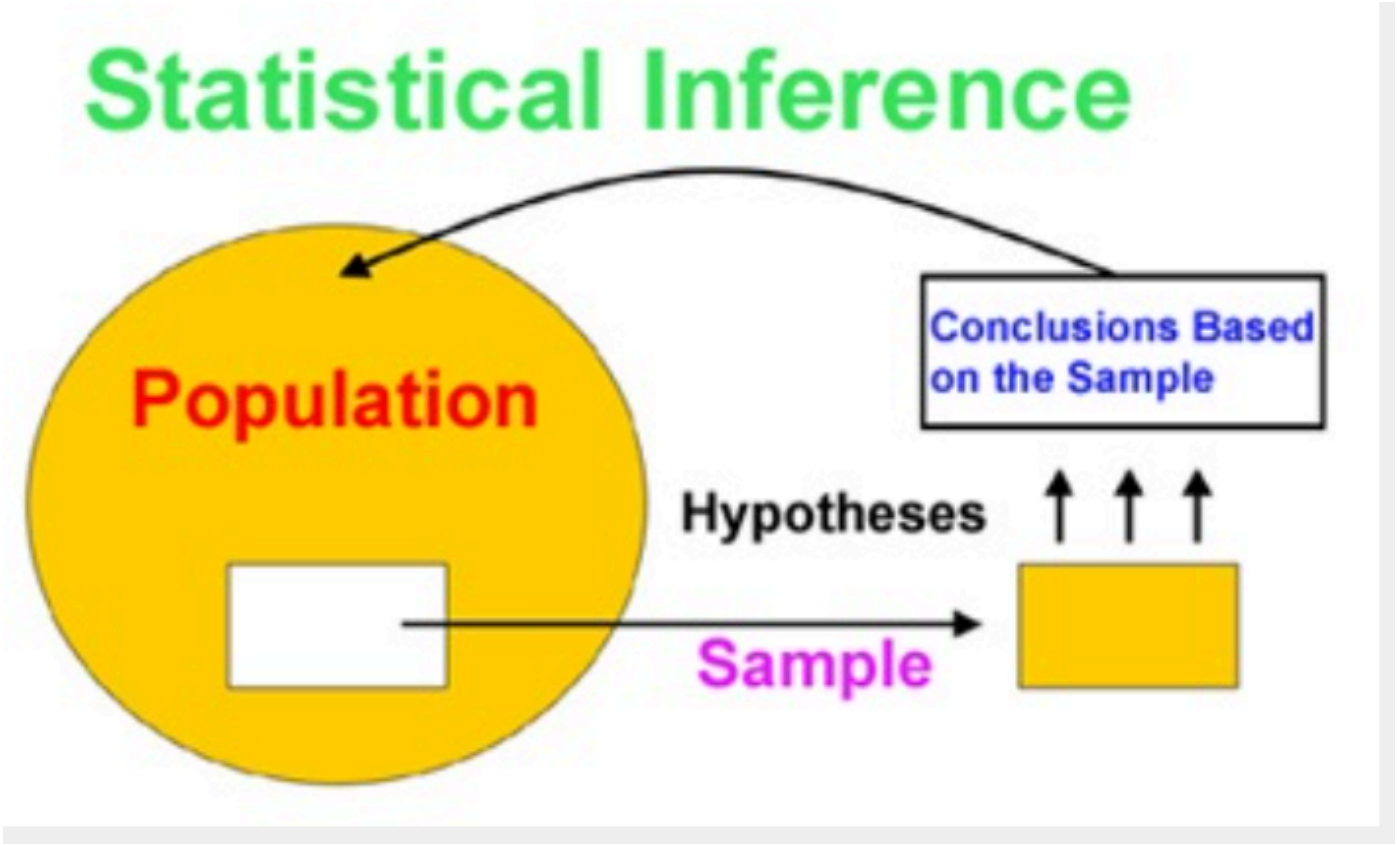
The coefficients β1, β2, ..., β5 are unknown model parameters that we estimate using economic data and an econometric method. The functional form represents a hypothesis regarding the variables' connection. One issue in every given situation is determining a functional form that is consistent with economic theory and facts.

There is a systematic portion and an unobservable random component in every econometric model, whether it be a demand equation, a supply equation, or a production function. The systematic element is the part we get from economic theory, and it contains a functional form assumption. The random component is a ‘‘noise" component that obfuscates our comprehension of the connection between variables and is represented by the random variable *e*.

For statistical inference, we employ the econometric model as a foundation. We draw conclusions about the actual world using an economic model and a sample of data, and we learn something in the process. Statistical inference may be done in a variety of methods.

- Using econometric techniques to estimate economic characteristics such as elasticities.
- Predicting economic results for the next 10 years, such as enrollment at two-year institutions in the United States.
- Putting economic ideas to the test, such as whether newspaper advertisements are more effective than shop displays in generating sales.

All of these elements of statistical inference are covered by econometrics.


Statistical Inference
Population
Conclusions Based on the Sample
Hypotheses
Sample

The Roots of all Data

Objectives:

- Students will be able to differentiate between experimental data and non-experimental data

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We need data in order to make statistical inferences. What is the source of data? What kinds of real-world processes produce data? Economists and other social scientists operate in a complicated environment where data on variables is "observed" rather than "experimented" with. The work of learning about economic factors becomes much more complex as a result.

Experimental Data

Conducting or observing the outcome of an experiment is one approach to obtain knowledge about the unknown parameters of economic interactions. Controlled experiments are common in the physical sciences and agriculture. The values of important control variables are set by scientists, who then observe the results. We might plant comparable plots of land with a certain wheat type, then adjust the quantities of fertilizer and insecticide used to each plot, noting the bushels of wheat produced on each plot at the conclusion of the growing season. The experiment is repeated on N plots of land, yielding a sample of N observations. Controlled trials like these are uncommon in the business and social sciences. The values of the explanatory variables may be set at particular values in repeated trials of the experiment, which is a crucial feature of experimental data.

One business example comes from marketing research. Suppose we are interested in the monthly sales of a particular item at a grocery store. As an item is sold it is passed over a scanning unit to record the price and the amount that will appear on your bill. But at the same time, a data record is created, and at every point in time the price of the item and the prices of all its competitors are known. The prices and shopping environment are controlled by store management, so this ‘‘experiment’’ can be repeated a number of days or weeks using the same values of the ‘‘control’’ variables.

Non-Experimental Data

Survey data is an example of non-experimental data. The Louisiana State University Public Policy Research Lab (www.survey.lsu.edu/) conducts telephone and postal surveys for customers. Numbers are chosen at random and phoned in a telephone survey. Question responses are recorded and evaluated. Data on all variables is gathered concurrently in this context, and the results are neither fixed nor repeated. These are non-experimental data.

National governments conduct these kinds of surveys on a large basis. The U.S. Bureau of the Census, for example, conducts a monthly survey of roughly 50,000 homes called the Current Population Survey (CPS). For more than 50 years, the survey has been performed. "CPS statistics are utilized by government officials and lawmakers as vital indicators of our nation's economic position, as well as for planning and assessing numerous government initiatives," according to the CPS website. The press, students, intellectuals, and the general public all utilize them."

Economic Data Types

Objectives:

- Students will be able to differentiate between the various types of data

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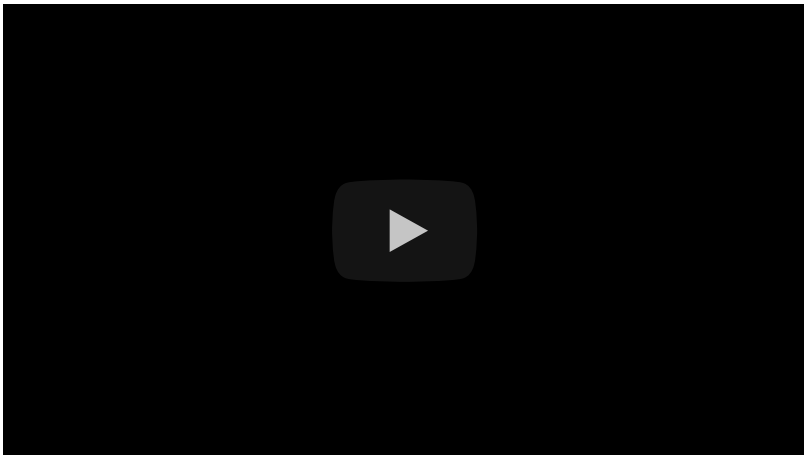
Economic information is available in a number of ‘‘flavors." Each is described and illustrated in this section. Be careful of the many data properties in each case, such as the following:

- Data may be gathered at several aggregate levels:
  - micro—information gathered on people, families, and businesses as economic decision-making units.
  - macro—information derived through aggregating or pooling data from people, households, or businesses at the local, state, or national level.
- Data may also be used to depict a flow or a stock:
  - flow—measures of a result through time, such as gasoline use in the fourth quarter of 2010.
  - stock—an outcome assessed at a certain moment in time, such as the amount of crude oil stored by Exxon in its United States storage tanks on November 1, 2010, or the asset worth of Wells Fargo Bank on July 1, 2009.
- Quantitative and qualitative data are both acceptable:
  - quantitative—numerical outcomes, such as prices or income, or some modification of them, such as real prices or per capita income.
  - qualitative—the results of a ‘‘either-or" scenario. A consumer, for example, may have made or not made a purchase of a specific item, or a person may be married or not.

Time Series Data

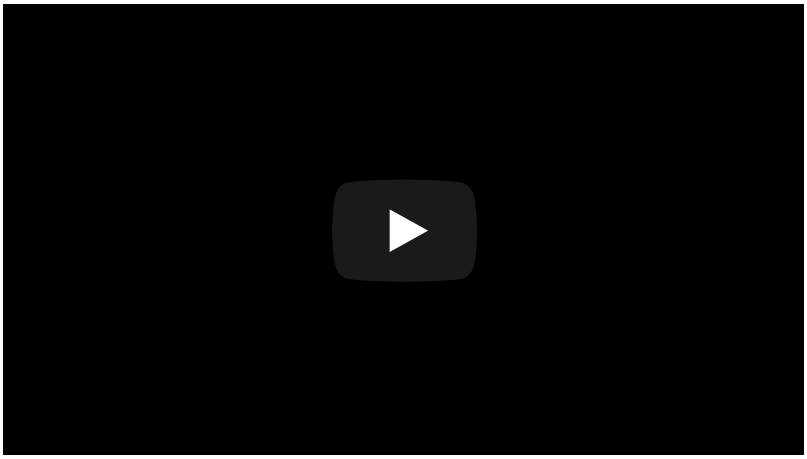


A time-series is a collection of data collected over a period of time. The annual price of wheat in the United States, for example, and the daily price of General Electric stock shares are two examples. Macroeconomic data is often published weekly, quarterly, or annually. Financial information, such as stock prices, can be recorded on a daily or even hourly basis. The main aspect of time-series data is that it records the same economic quantity at regular intervals.

The following table, for example, show the yearly real gross domestic product (GDP). We have the recorded value for each year. The data is annual, or annually, and has been ‘‘deflated” to billions of actual 2018 USD.

Year	Annual GDP (Billions of Real 2018 Dollars)
2012	11347.2
2013	11553.0
2014	11840.7
2015	12263.8
2016	12638.4
2017	12976.2
2018	13254.1
2019	13312.2
2020	13974.7

Panel (or Longitudinal) Data



In a given time period, a cross-section of data is collected across sample units. Income by county in California in 2019, for example, or high school graduation rates by state in 2018. Individual entities, such as businesses, people, families, governments, or nations, make up the “sample units.” The Current Population Survey, for example, publishes monthly findings of personal interviews on topics such as employment, unemployment, wages, educational attainment, and income.

Individual micro-units are seen and followed over time in a ‘‘panel” of data, also known as ‘‘longitudinal” data. The Panel Study of Income Dynamics (PSID), for example, presents itself as a "nationally representative longitudinal study of approximately 9000 US households." The PSID has been collecting data on economic, health, and social behavior of the same families and individuals since 1969." Other national panels exist, and many are listed at www.rfe.org under ‘‘Resources for Economists."

The fundamental feature of panel data is that we track each micro-unit, in this case a farm, across time. The amount of rice produced, the area planted, labor input, and fertilizer consumption are all listed here. A balanced panel has the same amount of time period observations for each micro-unit, which is the case here. The number of time series observations is usually modest in comparison to the number of micro-units, although this is not always the case. For some or all of the years 1950–2019, the Penn World Table offers purchasing power parity and national income accounts translated to international prices for 183 nations.

The following table shows data from three companies as an example. The data is based on yearly observations of these companies from 2015 to 2020.

Simple Linear Regression Model

Objectives:

- Students will be able to define what a linear regression model is
- Students will be able to describe the variables involved in a simple linear regression model
- Students will be able to provide the assumptions for a simple linear regression model
- Students will be able to explain how the error term impacts the simple linear regression model

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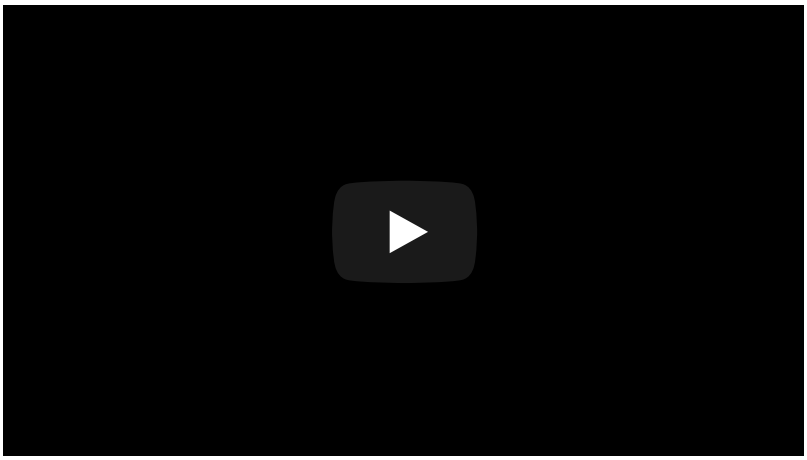


We will use a simple, yet important, economic example to develop the concepts of regression models. Assume we want to investigate the link between household income and food expenditures. Consider the "experiment" of picking households at random from a population. Households in a certain city, state, province, or nation may make up the population. Assume for the time being that we are only interested in households with a weekly income of $1,000. In this experiment, we randomly pick and interview a number of homes from this population. “How much did you spend per person on food last week?” we inquire.

Economic theory implies that average weekly per person household expenditure on food, represented mathematically by the conditional mean

E(y|x) = μy|x, is dependent on household income x in our food expenditure example. When we examine households with varying levels of income, we may anticipate the average food spending to vary.

To study the link between spending and income, we must first construct an economic model, followed by an econometric model, which will serve as the foundation for a quantitative or empirical economic analysis. Most economics textbooks show "consumption" or "expenditure" functions linking consumption to income as linear connections. The following depicts the mathematical formulation of our household food expenditure economic model.

$E(y|x) = \mu_{y|x} = \beta_1 + \beta_2 x$

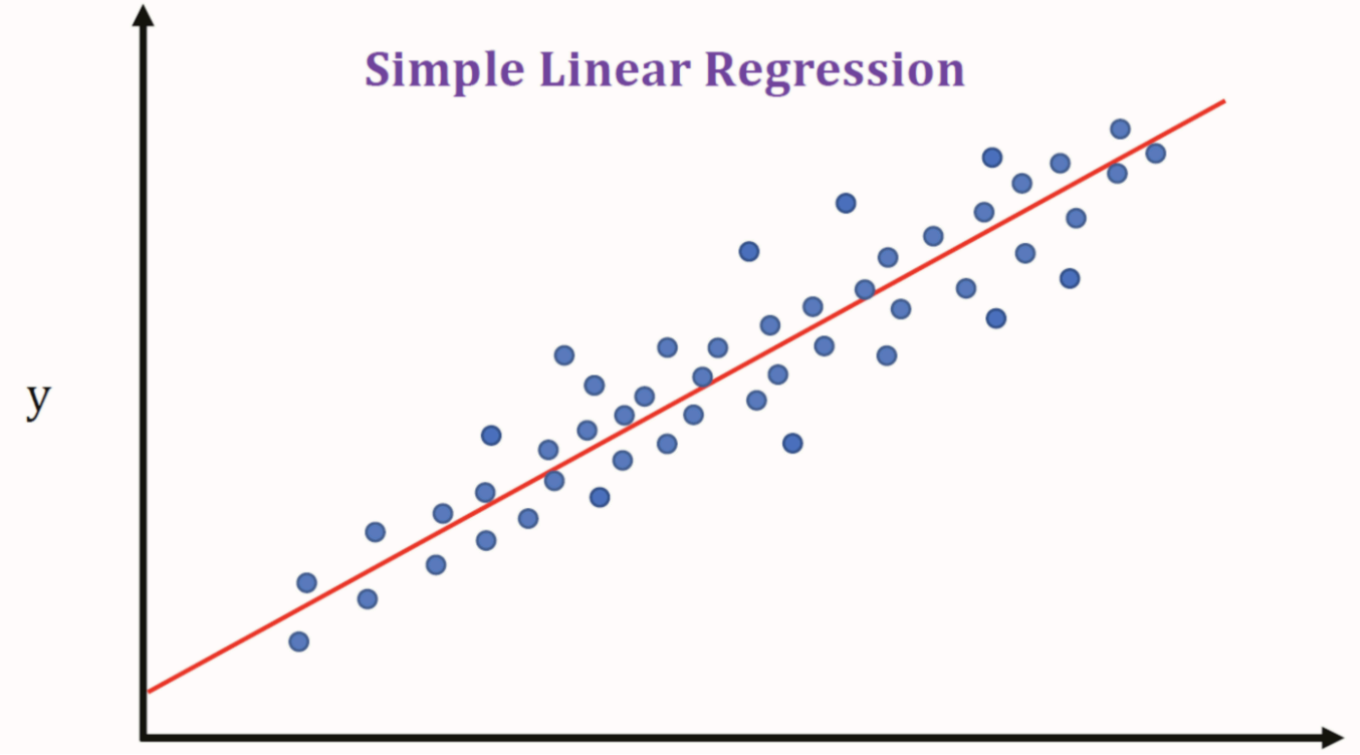
A basic regression function is the conditional mean E(y|x). It is termed simple regression not because it's simple, but because the right-hand side of the equation only has one explanatory variable. The intercept and slope of the regression function are the unknown regression parameters β1 and β2, respectively.

The intercept β1 reflects the mean per person weekly household expenditure on food by a household with no weekly income, x=$0, in our food expenditure example. If income is expressed in dollars, the slope β2 reflects the change in E(y|x) when weekly income is increased by $1. It is also known as the marginal willingness to spend on food.

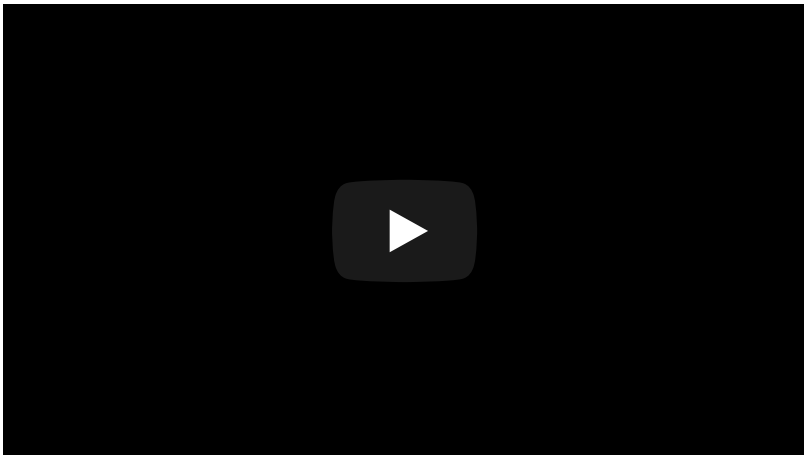
The link between weekly household income (x) and predicted household food spending, E(y|x), is summarized in this economic model. The model's parameters, β1 and β2, are termed population parameters because they assist describe economic behavior in the population under consideration. To use data, we must first define an economic model that specifies how family income and expenditure data are collected and leads the econometric study.

Assumptions of the Simple Linear Regression Model

- The linear regression function returns the mean value of y for each value of x.
- The values of y are dispersed around their mean value for each value of x, using probability distributions with the same variance. The y sample values are entirely uncorrelated and have zero covariance, indicating that there is no linear relationship between them. This assumption can be strengthened by assuming that all of the y values are statistically independent.
- x is not a random variable; it must take at least two different values.
- For any value of x, the values of y are normally distributed about their mean.



The error term



The assumptions of the simple linear regression model are best described in terms of y, which is the dependent variable in the regression model in general. For statistical reasons, however, it is more helpful to define the assumptions in a different way. Any observation on the dependent variable y may be divided into two parts: a systematic component and a random component, according to regression analysis. $E(y|x) = \beta1 + \beta2x$ is the systematic component of y, which is not random because it represents a mathematical expectation. The difference between y and its conditional mean value E(y|x) represents the random component of y. This is known as a random error term, and its definition is as follows:

$e = y - E(y|x) = y - \beta1 - \beta2x$

If we rearrange it we obtain the simple linear regression model

$y = \beta_1 + \beta_2 x + e$

The random error term e and a component that fluctuates consistently with the independent variable x explain the dependent variable y.

Both the random error e and the dependent variable y are random variables, and the characteristics of one may be deduced from the properties of the other, as we've shown. However, there is one notable distinction between them: y is ‘‘observable," whereas e is ‘‘unobservable." If we knew the regression parameters β1 and β2, we could compute $e = y - (\beta_1 + \beta_2 x)$ for every value of y. We may divide y into fixed and random components using the regression function $E(y) = \beta_1 + \beta_2 x$. However, β1 and β2 are never known, thus calculating e is impossible.

What is the meaning of the error word e? All factors affecting y other than x are represented by the random error e. Individual observations y deviate from the mean value $E(y) = \beta_1 + \beta_2 x$ due to these variables. What variables might cause a discrepancy between household spending per person y and its mean, E(y) in the food expenditure example?

- In this model, income serves as the sole explanatory variable. Other economic factors that influence food spending are "collected" in the error term. Because we aim to incorporate all of the key and relevant explanatory variables in any economic model, the error term e serves as a ‘‘storage bin" for unobservable and/or irrelevant factors impacting family food expenditures. As a result, it introduces noise that obscures the x-y connection.
- Because the linear functional form we imagined may only be an approximation to reality, the error term e captures any approximation mistake.
- Any components of random behavior that may be present in each person are captured by the error term. Knowing all of the factors that impact a family's food spending may not be enough to accurately anticipate spending. Human conduct that is unpredictable is also

included in e.

We need a method, or formula, to estimate b1 and b2, which informs us how to utilize the sample observations. There are a variety of rules to choose from, but the one we'll choose is based on the least squares idea. The sum of the squares of the vertical distances from each point to the line should be as minimal as feasible to match a line to the data values, according to this concept. To avoid huge positive distances from being negated by big negative distances, the distances are squared. This rule is arbitrary, but it works well, because it's just another way of describing a line that passes through the centre of the data.

More on linear regression: https://www.mit.edu/~6.s085/notes/lecture3.pdf

Multiple Linear Regression Model

Objectives:

- Students will be able to describe the components of a multiple linear regression model
- Students will be able to provide the assumptions applied when creating an econometric model from a multiple linear regression model and its error term

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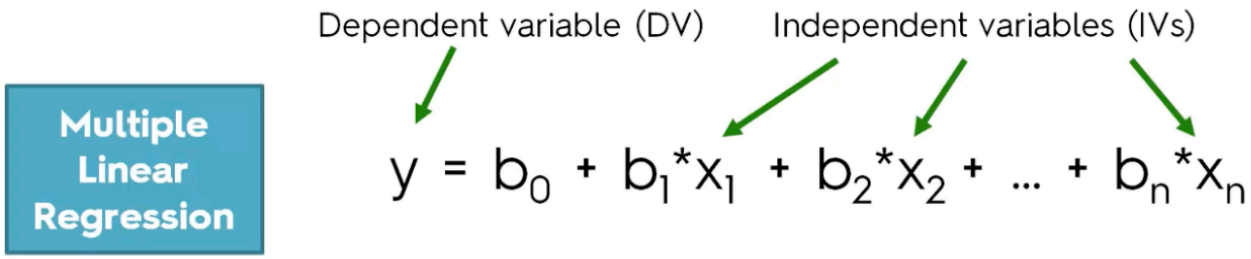
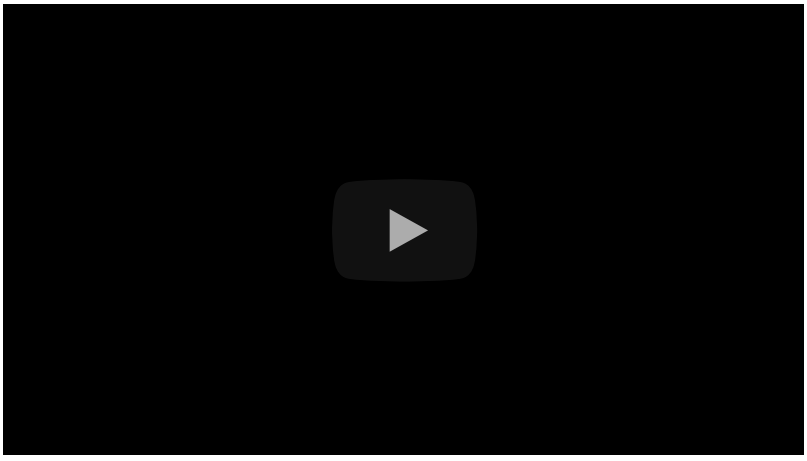
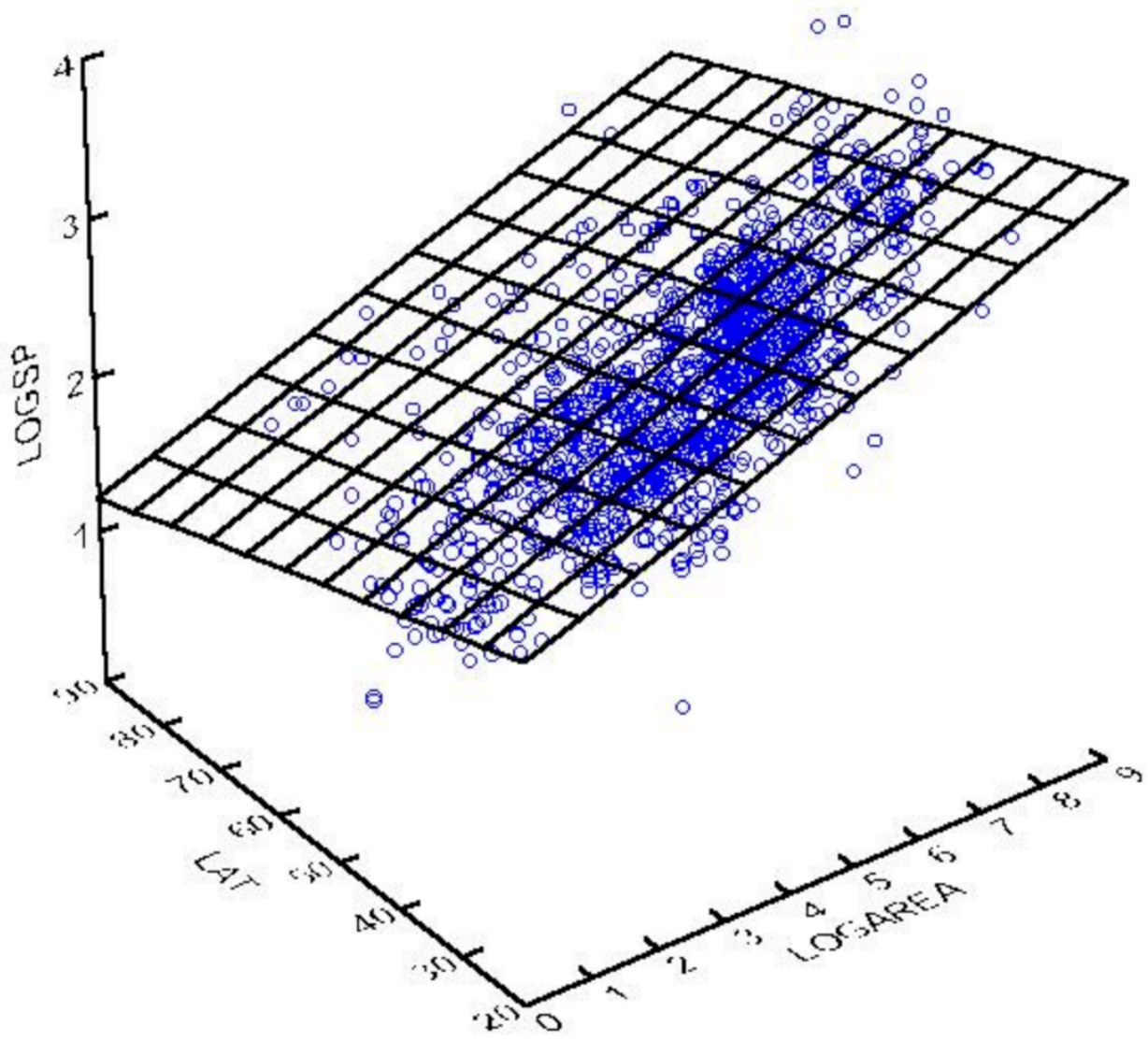




We'll create a business plan for a hamburger chain called Big Andy's Burger Barn. Big Andy's management makes important decisions such as pricing strategy for various items and how much to spend on advertising. Big Andy's Burger Barn sets different prices and spends different amounts on advertising in different cities to test the influence of alternative price structures and varied levels of advertising spending. How sales income

fluctuates when advertising spend changes is of great importance to management. Is there a link between increased advertising spending and increased sales? Is the rise in sales adequate to warrant the higher advertising spend if that is the case? Pricing strategy is also of importance to management. Will lowering prices result in a rise or fall in sales revenue? Sales income will decline if a price reduction results to only a modest increase in quantity sold; sales revenue will rise if the price reduction leads to a big increase in quantity sold. This financial data is necessary for successful management.



Multiple Regression Model

The first stage is to create an economic model that includes one or more

explanatory factors that affect sales revenue. We first hypothesized that sales income is proportional to both pricing and advertising spend. The financial model is

SALES = β1 + β2PRICE + β3ADVERT

where SALES represents monthly sales revenue in a given city, PRICE represents price in that city, and ADVERT is monthly advertising expenditure in that city. Both SALES and ADVERT are measured in terms of thousands of dollars. We concentrate on smaller cities with comparable populations because sales in larger cities will tend to be higher than sales in smaller ones.

β1, β2, and β3 illustrate how sales (SALES) are influenced by pricing (PRICE) and advertising (ADVERTISING) (ADVERT). The value of the dependent variable when each of the independent, explanatory variables is zero is known as the intercept parameter β1. However, in many situations, there is no obvious economic meaning for this characteristic. It is not possible to create a condition in which PRICE = ADVERT = 0 in this circumstance. We usually include an intercept in the model, even if it has no obvious economic interpretation, unless there are exceptional conditions. If you don't include it, you'll end up with a model that doesn't fit the data well and doesn't forecast properly. The model's other parameters quantify the change in the dependent variable's value in response to a unit change in an explanatory variable, with all other variables kept constant. β2 can have a positive or negative sign. If a price rise results in an increase in sales revenue, then $\beta 2 > 0$, indicating that demand for the chain's products is price inelastic. A price-elastic demand, on the other hand, occurs when an increase in price results in a decrease in revenue, in which case $\beta 2 < 0$. As a result, knowing the sign of β2 offers information about demand price elasticity. The magnitude of β2 refers to the amount of income that changes as a result of a price adjustment. The β3 parameter indicates how sales income changes in response to changes in advertising spending. The sign of β3 is expected to

be good. That is, we anticipate an increase in advertising spending to result in an increase in sales income, unless the advertising is objectionable. With $\beta 3 < 1$, a $1,000 increase in advertising spend will result in a revenue gain of less than $1,000. It will be larger if $\beta 3 > 1$. As a result, understanding $\beta 3$ is critical in terms of the chain's advertising policy.

We add a random error component, e = SALES - E(SALES), to account for the discrepancy between observed sales revenue and the expected value of sales revenue. Other than pricing and advertising revenue, this random error reflects all variables that cause sales income to deviate from its expected value. These influences might include the weather, rival activity, and changes in burger-buying behavior between cities, among others. The model is obtained by including the error term.

SALES = E(SALES) + e = $\beta 1 + \beta 2$PRICE + $\beta 3$ADVERT + e

The addition of the error term and probability distribution assumptions transforms the economic model into an econometric model. The econometric model provides a framework for creating and evaluating estimators of unknown parameters, as well as a more accurate description of the connection between the variables.

Assumptions regarding the probability distribution of the random mistakes e must be made to complete the econometric model. We propose assumptions for e that are comparable to those for the basic regression

model. These are

- A probability distribution with a zero mean exists for each random mistake. Some mistakes will be positive, while others will be negative; they will average out to zero over a large number of observations.
- Each random mistake has a σ2 variance probability distribution. The variance σ2 is an unknown quantity that measures the statistical model's uncertainty. It is the same for each observation, thus there is no difference in model uncertainty across observations, and it is unrelated to any economic variable. Homoskedastic errors are those that have this characteristic.
- There is no correlation between the two random mistakes relating to any two distinct observations. The magnitude of one observation's mistake has no influence on the magnitude of another observation's error. As a result, any two mistakes are unrelated.
- We'll also suppose that the random mistakes e have normal probability distributions on occasion.

We make two assumptions about the explanatory factors in addition to the previous assumptions about the error term (and hence about the dependent variable). The explanatory factors are not random variables, for starters. As a result, we're presuming that we already know the values of the explanatory variables before we see the values of the dependent variable. The second premise is that none of the explanatory variables are precise linear functions of the others. This is the same as presuming there are no duplicated variables.

Analysis: Technical, Fundamental & Sentiment

Objectives:

- Students will be able to differentiate the differences amongst technical analysis, fundamental analysis and sentiment analysis.
- Students will be able to describe the technical indicators associated with the technical analysis.
- Students will be able to discuss the importance of the LOB (limit order book).
- Students will be able to explain what tools are used for functional analysis.
- Students will be able to explain how sentiment analysis is used for predicting stock prices.

Technical Analysis

Technical analysis is a tool, or method, used to predict the probable future price movement of a security – such as a stock or currency pair – based on market data.

The theory behind the validity of technical analysis is the notion that the collective actions – buying and selling – of all the participants in the market accurately reflect all relevant information pertaining to a traded security, and therefore, continually assign a fair market value to the security.

Technical traders believe that current or past price action in the market is the most reliable indicator of future price action.

Technical analysis is not only used by technical traders. Many fundamental traders use fundamental analysis to determine whether to buy into a market,

but having made that decision, then use technical analysis to pinpoint good, low-risk buy entry price levels.

Technical traders analyze price charts to attempt to predict price movement. The two primary variables for technical analysis are the time frames considered and the particular technical indicators that a trader chooses to utilize.

The technical analysis time frames shown on charts range from one-minute to monthly, or even yearly, time spans. Popular time frames that technical analysts most frequently examine include:

- 5-minute chart
- 15-minute chart
- Hourly chart
- 4-hour chart
- Daily chart

The time frame a trader selects to study is typically determined by that individual trader's personal trading style. Intra-day traders, traders who open and close trading positions within a single trading day, favor analyzing price movement on shorter time frame charts, such as the 5-minute or 15-minute charts. Long-term traders who hold market positions overnight and for long periods of time are more inclined to analyze markets using hourly, 4-hour, daily, or even weekly charts.

Price movement that occurs within a 15-minute time span may be very significant for an intra-day trader who is looking for an opportunity to realize a profit from price fluctuations occurring during one trading day. However, that same price movement viewed on a daily or weekly chart may not be particularly significant or indicative for long-term trading purposes.

It's simple to illustrate this by viewing the same price action on different time frame charts. The following daily chart for silver shows price trading within

the same range, from roughly $16 to $18.50, that it's been in for the past several months. A long-term silver investor might be inclined to look to buy silver based on the fact that the price is fairly near the low of that range.

However, the same price action viewed on an hourly chart (below) shows a steady downtrend that has accelerated somewhat just within the past several hours. A silver investor interested only in making an intra-day trade would likely shy away from buying the precious metal based on the hourly chart price action.

Technical Indicators - Moving Averages

In addition to studying candlestick formations, technical traders can draw from a virtually endless supply of technical indicators to assist them in making trading decisions.

Moving averages are probably the single most widely-used technical indicator. Many trading strategies utilize one or more moving averages. A simple moving average trading strategy might be something like, “Buy as long as price remains above the 50-period exponential moving average (EMA); Sell as long as price remains below the 50 EMA”.

Moving average crossovers are another frequently employed technical indicator. A crossover trading strategy might be to buy when the 10-period moving average crosses above the 50-period moving average.

The higher a moving average number is, the more significant price movement in relation to it is considered. For example, price crossing above or below a 100- or 200-period moving average is usually considered much more significant than price moving above or below a 5-period moving average.

Technical Indicators - Pivots and Fibonacci Numbers

Daily pivot point indicators, which usually also identify several support and resistance levels in addition to the pivot point, are used by many traders to identify price levels for entering or closing out trades. Pivot point levels often mark significant support or resistance levels or the levels where trading is contained within a range. If trading soars (or plummets) through the daily pivot and all the associated support or resistance levels, this is interpreted by many traders as “breakout” trading that will shift market prices substantially higher or lower, in the direction of the breakout.

Daily pivot points and their corresponding support and resistance levels are calculated using the previous trading day’s high, low, opening and closing prices. I’d show you the calculation, but there’s really no need, as pivot point levels are widely published each trading day and there are pivot point indicators you can just load on a chart that do the calculations for you and reveal pivot levels. Most pivot point indicators show the daily pivot point along with three support levels below the pivot point and three price

resistance levels above it.

Technical Indicators - Momentum Indicators

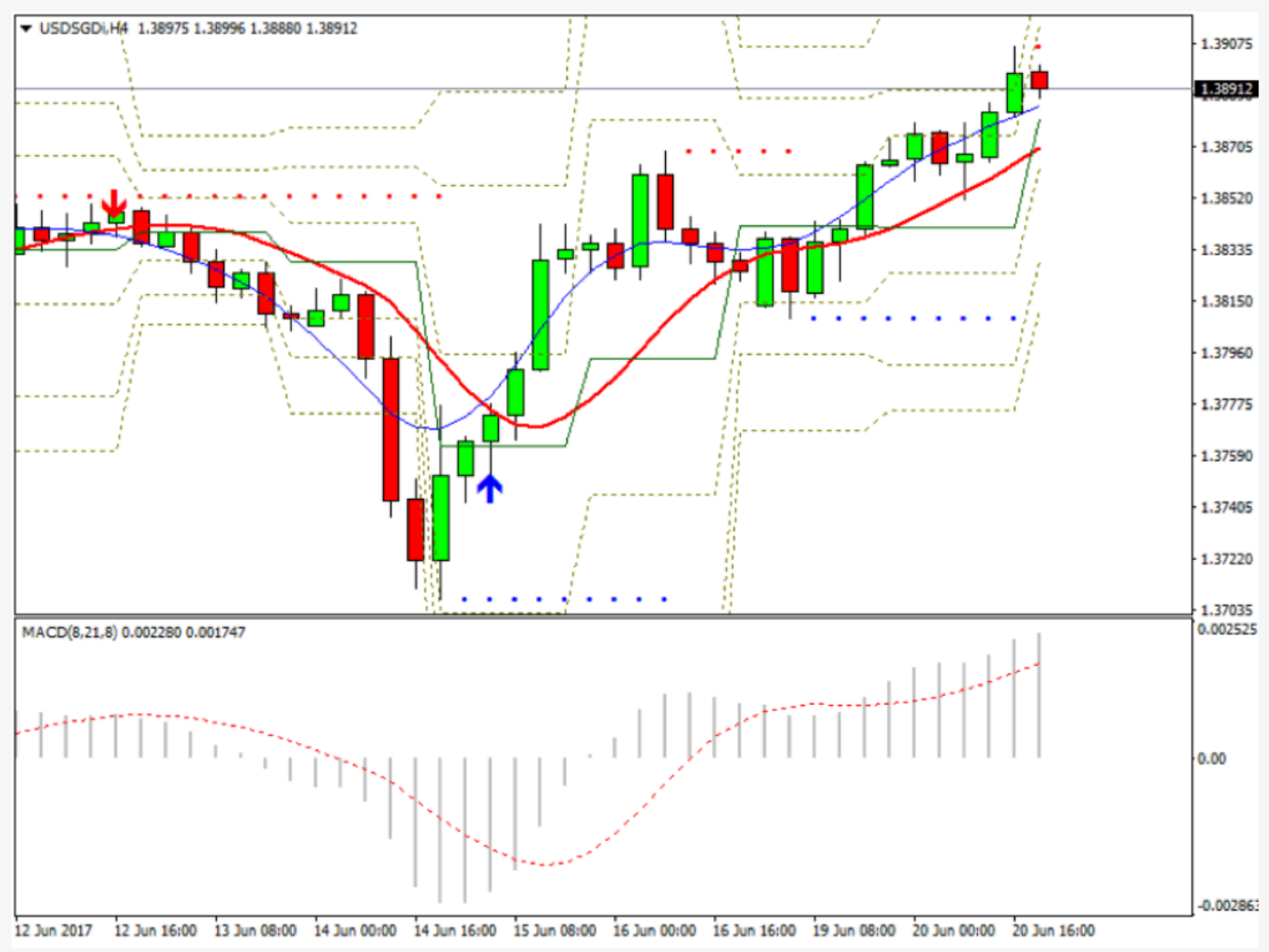
Moving averages and most other technical indicators are primarily focused on determining likely market direction, up or down.

There is another class of technical indicators, however, whose main purpose is not so much to determine market *direction* as to determine market *strength*. These indicators include such popular tools as the Stochastic Oscillator, the Relative Strength Index (RSI), the Moving Average Convergence-Divergence (MACD) indicator, and the Average Directional Movement Index (ADX).

By measuring the strength of price movement, momentum indicators help investors determine whether current price movement more likely represents relatively insignificant, range-bound trading or an actual, significant trend. Because momentum indicators measure trend strength, they can serve as early warning signals that a trend is coming to an end. For example, if a security has been trading in a strong, sustained uptrend for several months, but then one or more momentum indicators signals the trend steadily losing strength, it may be time to think about taking profits.

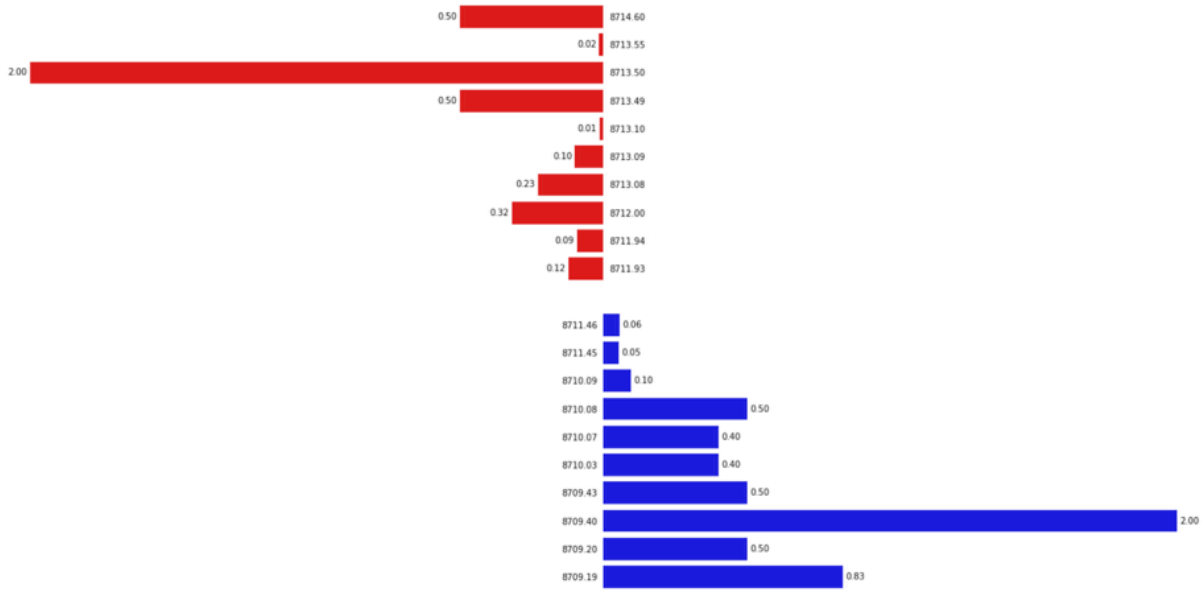
The 4-hour chart of USD/SGD below illustrates the value of a momentum indicator. The MACD indicator appears in a separate window below the main chart window. The sharp upturn in the MACD beginning around June 14th indicates that the corresponding upsurge in price is a strong, trending move rather than just a temporary correction. When price begins to retrace downward somewhat on the 16th, the MACD shows weaker price action, indicating that the downward movement in price does not have much strength behind it. Soon after that, a strong uptrend resumes. In this instance, the MACD would have helped provide reassurance to a buyer of the market that (A) the turn to the upside was a significant price move and (B) that the uptrend was likely to resume after price dipped slightly on the

16th.



Because momentum indicators generally only signal strong or weak price movement, but not trend direction, they are often combined with other technical analysis indicators as part of an overall trading strategy.

Limit Order Book (LOB)



A limit order book is a record of outstanding limit orders maintained by the security specialist who works at the exchange. A limit order is a type of order to buy or sell a security at a specific price or better. A buy limit order is an order to buy at a preset price or lower while a sell limit order is an order to sell a security at a pre-specified price or higher.

When a limit order for a security is entered, it is kept on record by the security specialist. As buy and sell limit orders for the security are given, the specialist keeps a record of all these orders in the order book. The specialist executes the orders at or better than the given limit price when the market moves to the pre-specified price.

The specialist running the limit order book has the responsibility to guarantee that the top priority order is executed before other orders in the book, and before other orders at an equal or worse price held or submitted by other traders on the floor, such as floor brokers and market makers.

The specialist earns a profit from the spread between the difference in prices between the bid and ask orders on their book as they execute the orders. With the advancements in trading system technologies, the process has shifted from a manual process to one that is largely automated.

In 2000, the Securities and Exchange Commission (SEC) began to create a centralized limit order book that keeps track of limit orders on exchanges electronically.1 This electronic order tracking system automatically matches for the execution of the best possible pair of orders in the system. The best pair is made up of the highest bid, and the lowest ask orders. The bid is the price the specialist or exchange will sell a security or the price at which an investor can buy the security. The ask or offer is the price at which the specialist or exchange will buy a security or the price at which the investor can sell the security.

When a limit order is entered into a trading system and fielded by either a specialist working the book or an electronic database of orders, it will stay on the books until it can be matched with a suitable trade and executed. Buy limit orders are placed with an upper price threshold. The investor would say "I don't want to pay more than $X for this share." Sell limit orders are placed with a lower price threshold. The investor would say "I don't want to sell this share for less than $X."

For a more detailed description click on limit order book.

Thinkorswim by TD Ameritrade

An electronic trading platform used to trade financial assets. It is geared for self-directed stock, options and futures traders which was previously offered by ThinkorSwim Group, Inc and was purchased by TD Ameritrade in 2009.

It provides services for self-directed option traders and institutional users who invest in equities, exchange-traded funds, futures, mutual funds and bonds.

Thinkorswim provides financial literacy services for self-directed investors including trading tools and analytics. It offers a range of investor education products in a variety of interactive delivery formats, including instructor-led synchronous and asynchronous online courses, in-person workshops, one-

on-one and one-to-many online coaching programs and telephone, live-chat and email support. Thinkorswim is used in conjunction with trades of equity securities, fixed income, index products, options, futures, other derivatives and foreign exchange. The Thinkorswim software is provided free for account holders of TD Ameritrade and trades via the TD Ameritrade platform are free.

JPM eFX DNA "Deep Neural Network for Algo Execution"

J.P. Morgan is taking technology to a new level in the foreign exchange market, applying machine learning to provide competitive pricing and optimize execution in what is already one of the most liquid and automated asset classes alongside equities. The Deep Neural Network for Algo Execution (DNA) is J.P. Morgan's latest tool to enhance its FX algorithms and uses a machine learning framework to bundle certain existing algos into one streamlined execution strategy.

“DNA is an optimization feature that leverages simulated data from various types of market conditions to select the best order placement and execution style designed to minimize market impact," said Chi Nzelu, head of Macro eCommerce at J.P. Morgan. “It then uses reinforcement learning – a subset of machine learning – to assess the performance of individual order placement choices."

Read more...

Oscillators

An oscillator is a technical analysis tool that constructs high and low bands between two extreme values, and then builds a trend indicator that fluctuates within these bounds. Traders use the trend indicator to discover short-term overbought or oversold conditions. When the value of the oscillator approaches the upper extreme value, technical analysts interpret that information to mean that the asset is overbought, and as it approaches the lower extreme, technicians consider the asset to be oversold.

The Relative Strength Index is arguably the most popular technical indicator when it comes to trading. But being popular doesn't always make you right or easy. David Jones knows this and is here to give a helping hand to those just starting their journey in the world of the markets, as well as those who've had a bit more experience.

Order Flow

Order flow defines the amount of orders waiting to be executed at a certain price level.

While the price is rising upward in a very strong rally, we know for certain that it will eventually stop somewhere. The rally up happens because there are simply more traders willing to buy than traders that are willing to sell. This creates an imbalance between buyers and sellers, whereas there are more buyers demanding the supply, therefore price shifts upwards. Eventually, the buyer momentum will end and the price will be driven up to a level where there are more sellers than buyers. This new imbalance created by more sellers than buyers will push price downwards.

This simple scenario is what happens in the markets on the macro and micro levels. This is the essence of what makes price move range or reverse.

When you look at a chart of a moving price and interpret this to the forces balance placed on different price levels.

Take a deeper look at Order Flow and VPIN here.

Tools for a Fundamental Analysis

Cross-Sectional Analysis

Cross-sectional analysis is a type of analysis where an investor, analyst or portfolio manager compares a particular company to its industry peers. Cross-sectional analysis may focus on a single company for head-to-head analysis with its biggest competitors or it may approach it from an industry-wide lens to identify companies with a particular strength.

Cross-sectional analysis is often deployed in an attempt to assess performance and investment opportunities using data points that are beyond the usual balance sheet numbers.

When conducting a cross-sectional analysis, the analyst uses comparative metrics to identify the valuation, debt-load, future outlook and/or operational efficiency of a target company. This allows the analyst to evaluate the target company's efficiency in these areas, and to make the best investment choice among a group of competitors within the industry as a whole.

Analysts implement a cross-sectional analysis to identify special characteristics within a group of comparable organizations, rather than to establish relationships. Often cross-sectional analysis will emphasize a particular area, such as a company's war chest, to expose hidden areas of strength and weakness in the sector. This type of analysis is based on information-gathering and seeks to understand the "what" instead of the "why." Cross-sectional analysis allows a researcher to form assumptions, and then test their hypothesis using research methods.

AQR - How It Places Bets Against Beta

AQR, a large hedge fund founded by famed investor Cliff Asness, uses a strategy of statistical arbitrage by taking a short position in stocks with high beta and a long position in stocks with a low beta. This strategy is known as a bet against beta. The theory is based on alleged inefficiencies with

the capital asset pricing model, or CAPM, due to large funds being constrained in the type of leverage they can utilize and the risk they can take.1 Beta is a statistical measure of the risk of an individual stock or portfolio against the market as a whole. The phrase bet against beta was coined from a few economics papers written by the creators of the strategy.

Beta is a measure of the risk that cannot be reduced by diversification. A beta of one means a stock or portfolio moves exactly in step with the larger market. A beta greater than one indicates an asset with higher volatility tends to move up and down with the market. A beta of less than one indicates an asset less volatile than the market or a higher volatility asset not correlated with the larger market. A negative beta shows an asset moves inversely to the overall market. Some derivatives such as put options have consistently negative betas.

CAPM is a model that calculates the expected return on an asset or portfolio. The formula determines the expected return as the prevailing risk-free rate plus the return of the market minus the risk-free rate times the beta of the stock. The security market line, or SML, is a result of CAPM. It shows an expected rate of return as a function of non-diversifiable risk. The SML is a straight line that shows the risk-return tradeoff for an asset. The slope of the SML is equal to the market risk premium. The market risk premium is the difference between the expected return on a market portfolio and the risk-free rate.

The basic bet against beta strategy is to find assets with higher betas and take a short position in them. At the same time, a leveraged long position is taken in assets with lower betas. The idea is the higher beta assets are overpriced and the lower beta assets are underpriced. The theory posits the prices of the stocks eventually come back into line with each other. This is essentially a statistical arbitrage strategy with the prices of the assets coming back to the median price versus risk. This median is defined as the SML.

A main tenet of CAPM is all reasonable investors invest their money in a portfolio with the highest expected excess return per unit of risk. The expected excess return per unit of risk is known as the Sharpe ratio. The investor can then leverage or reduce this leverage based on his individual risk preferences. However, many large mutual funds and individual investors are constrained in the amount of leverage they can use. As a result, they have a tendency to overweight their portfolios toward higher beta assets to improve returns.

This tilting toward higher beta stocks indicates these assets require lower risk-adjusted returns versus lower beta assets. Essentially, some experts believe the slope of the SML line is too flat for the U.S. market versus CAPM.1 This allegedly creates a pricing anomaly in the market in which some attempt to profit. Some economic papers doing historical backtesting have shown superior Sharpe ratios versus the market as a whole.

In examining this phenomenon, AQR has constructed market-neutral betting against beta factors that can be used to measure this idea.1 As a practical matter, the performance of this strategy suffers due to commissions and other trading expenses.3

As such, it may not be useful for individual investors. The strategy likely requires a large amount of capital and access to low trading costs to be successful.

Sentiment Analysis

A Social Sentiment Indicator

A social sentiment indicator analyzes aggregated social media data to help b usinesses understand how they are performing in the eyes of consumers. So cial sentiment indicators enable companies to discover what they are doing r ight and how they might improve.
These measures can also give investors an idea of how publicly listed stocks

might perform. Social Sentiment should not be confused with market sentiment indicators, which are designed to represent how a group or population feels about the overall market or economy. Keeping customers cheerful is paramount for companies targeting long-term success. When the public is happy with a service or product, and all its other interactions with the provider, company revenues profits are more likely to rise.

In the digital age, it has become much easier for companies and investors to gauge how well businesses are treating their customers. Social sentiment indicators can tell us a lot about the public perception of a company, at least in terms of what is being said on social media.

These indicators extract information users post publicly to Facebook, Twitter, blog posts, discussion groups, and forums. If the social sentiment indicator shows a negative change in reputation, the company might be able to address the problem before it grows and starts potentially heavily weighing on its share price.

The Advantages of Social Sentiment Indicators

Social sentiment indicators serve a variety of purposes. Companies might blame social media for triggering a rise in complaints and encouraging hate campaigns. However, these same firms can use the internet and social sentiment indicators to their advantage, too, including in the following ways:

- Identify trends to target new customers
- Develop successful marketing campaigns and gauge if they are spending marketing dollars wisely
- Determine how consumers feel about competitors and similar products
- Assess what to expand on and what to drop or change
- Protect and improve their brand identity and image

Social sentiment indicators are also helping to reduce the burden on

customer service email and call centers. Nowadays, it is possible to address questions and problems en masse via social media. In some cases, these communication methods might even be used to reach out to highly influential individuals with a track record of swaying sentiment on popular chat platforms.

Investors, too, can benefit from social sentiment indicators because the type of information that they collate tends to have a bearing on stock prices. If an investor spots that people on social media have suddenly started to complain about a particular company, they could opt to sell before the rest of the market reacts. Value investors, on the other hand, might use these tools to buy into a stock that they believe has been excessively punished by internet gossip.

Third-Party Information Can Enhance Data Analytics

Using third-party data sources can be challenging, but it is crucial for companies who want to gain an analytics edge to tap into data ecosystems. Analyzing external data can help companies see the risks and opportunities that they would miss with inputs limited to data generated from internal operations, customers, and first-tier suppliers.

According to one study, the data stored in data centers will nearly quintuple by 2021, reaching 1.3 zettabytes globally. Along with the volume of data available, the potential value of analyzing this data grows bigger by the day.

It's not surprising that companies on the leading edge of data and analytics are more likely to make use of external data. An MIT Sloan Management Review report published last year found that the companies making the most innovative use of data and analytics were more likely than others to leverage more external data sources, including social, mobile, and publicly available data.

Marketing offers, improved HR processes and new revenue streams gained from new products and services and anticipated shifts in demand are influenced by external data sources. Models have been built from data sourced from third party data to predict the best types of customers to market to with the appropriate campaigns. Several startups monitor data from social networks to predict job-seeking behavior and retention risk.

Size of the data and the complexity of how the data was obtained are challenges for those using external data. Other challenges of using external data include the refresh rate of the data, usage restrictions, if shared revenue is an expectation of the vendor and contractual agreements with the vendor.

Profitability Ratios

Objectives:

- Students will be able to define what profitability ratio is
- Students will be able to apply the Return on Equity equation when provided with a scenario of requisite inputs
- Students will be able to apply the Return on Assets equation when provided with a scenario of requisite inputs
- Students will be able to apply the Gross Margin Ratio equation when provided with a scenario of requisite inputs
- Students will be able to apply the Return on Capital Employed equation when provided with a scenario of requisite inputs
- Students will be able to apply the Operating Profit Margin equation when provided with a scenario of requisite inputs
- Students will be able to apply theNet Profit Margin equation when provided with a scenario of requisite inputs

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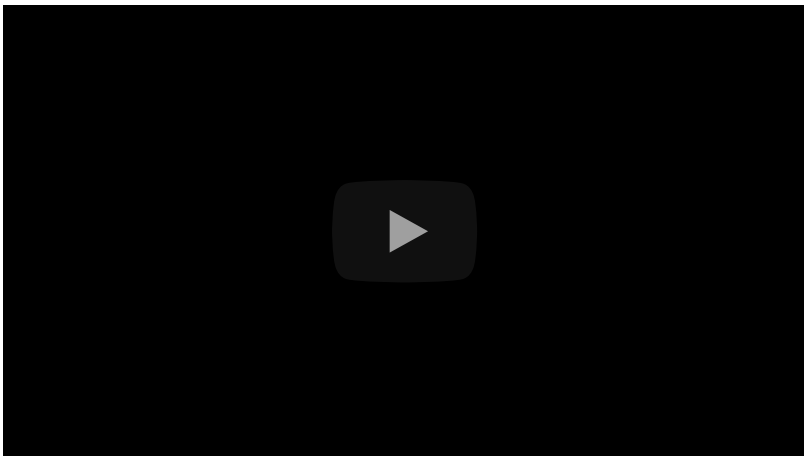
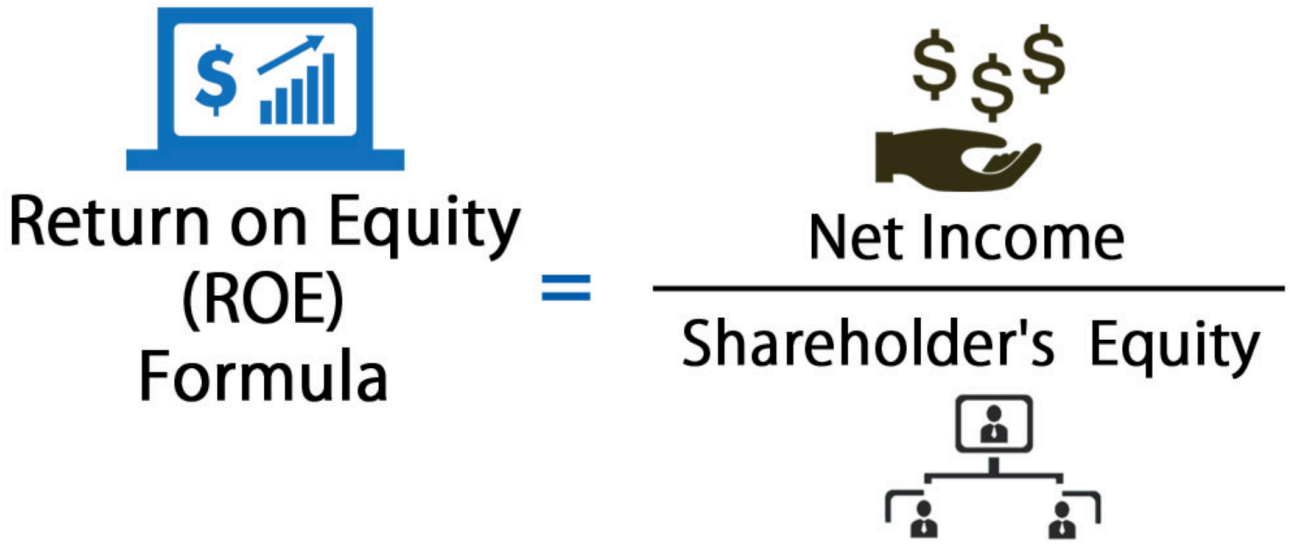


Return on Equity



Return on equity (ROE) is a percentage measure of a company's yearly return (net income) divided by the value of its entire shareholders' equity (e.g., 10 percent). ROE may also be calculated by dividing the company's dividend growth rate by its profits retention rate (1-dividend payout ratio). There are numerous ROE drivers, and the ratio will be broken down further.

ROE = Net Income / Shareholders' Equity

The return on equity (ROE) is a basic statistic for analyzing returns. It is feasible to determine a company's competitive advantage by comparing its ROE to the industry average (or lack of competitive advantage). Return on equity (ROE) looks at the bottom line to determine overall profitability for the firm's owners and investors since it utilizes net income as the numerator. This is an important ratio to consider as an investor since it ultimately decides how appealing an investment is. Asset efficiency, profitability, and financial leverage all affect return on equity.

Return on Assets

Return on Total Assets

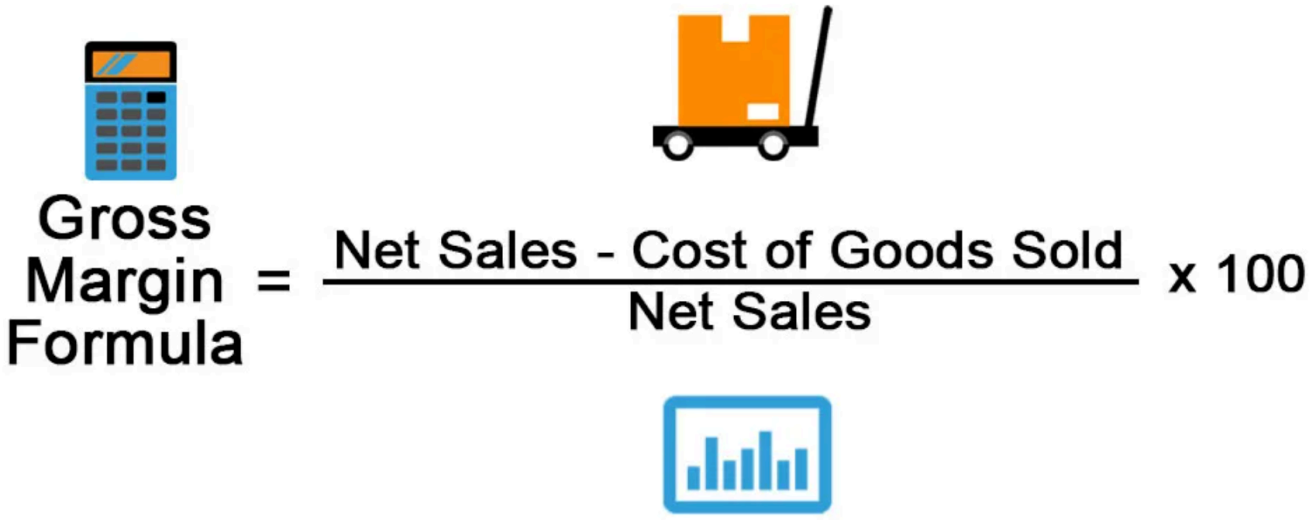
$$ROA = \frac{EBIT}{Average\ Total\ Assets}$$

The return on assets (ROA) is a sort of profitability ratio that compares a company's profitability to its total assets. This ratio compares a company's earnings (net income) to the total capital it has invested in assets to determine how well it is operating. The bigger the return, the more productive and effective the management is in its use of financial resources. The ROA formula is broken down below.

ROA = Net Income / Total Assets

The ROA formula is a crucial metric for determining a company's profitability. When evaluating a company's performance over time, or when comparing two businesses of comparable size and industry, the ratio is commonly employed. When comparing two distinct businesses using ROA, it is critical to evaluate the size of the business and the operations conducted. Varying industries often have different ROAs. Industries that are capital-intensive and require a high value of fixed assets for operations would often have a lower ROA, since the denominator of the formula will be increased by their big asset base.

Gross Margin Ratio

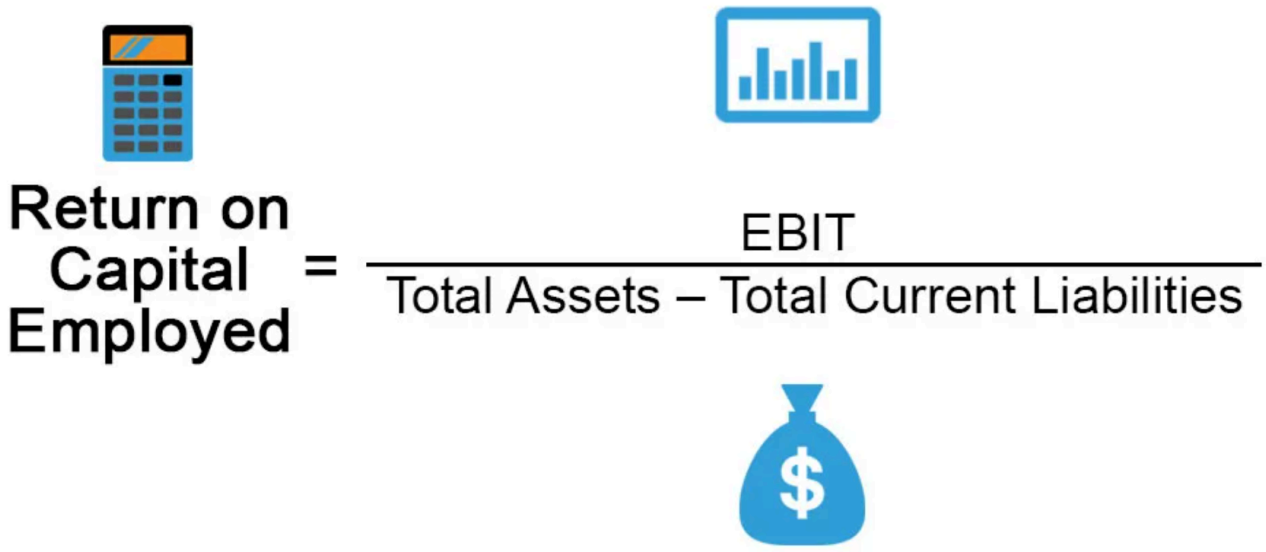


The gross margin ratio, commonly known as the gross profit margin ratio, compares a company's gross margin to its earnings after paying off its cost of goods s profitability ratio revenue. It demonstrates how much profit a firm has made over time (COGS). Because the ratio reveals what proportion of each dollar of revenue the firm keeps as gross profit, a high gross margin ratio is desirable.

Gross Margin Ratio = Gross Profit / Total Revenue = (Total Revenue – COGS) / Total Revenue

A low gross margin ratio does not always imply that a firm is underperforming. Rather than comparing gross margin percentages between sectors, it's crucial to compare them between firms in the same industry. Because it works in a service business with low production costs, a legal service company, for example, has a high gross margin ratio. A vehicle manufacturing business, on the other hand, will have a lower ratio due to high production expenses.

Return on Capital Employed



Return on Capital Employed (ROCE) is a profitability statistic that determines how well a business uses its capital to create profits. One of the finest profitability statistics is return on capital employed, which is frequently used by investors to assess if a firm is viable for investment.

ROCE = EBIT / Capital Employed = EBIT / (Total Assets – Current Liabilities)

The return on capital employed measures how much operational revenue is generated for every dollar spent on capital. A greater ROCE is usually preferable since it means more earnings are earned per dollar of invested capital. Calculating a company's ROCE alone, like any other financial measure, is insufficient. Other profitability ratios, such as return on assets, return on invested capital, and return on equity, should be utilized with ROCE to assess whether or not a firm is genuinely successful.

Operating Profit Margin

$$\text{Operating Profit margin} = \frac{\text{Operating Profit}}{\text{Net Sales}} \times 100$$

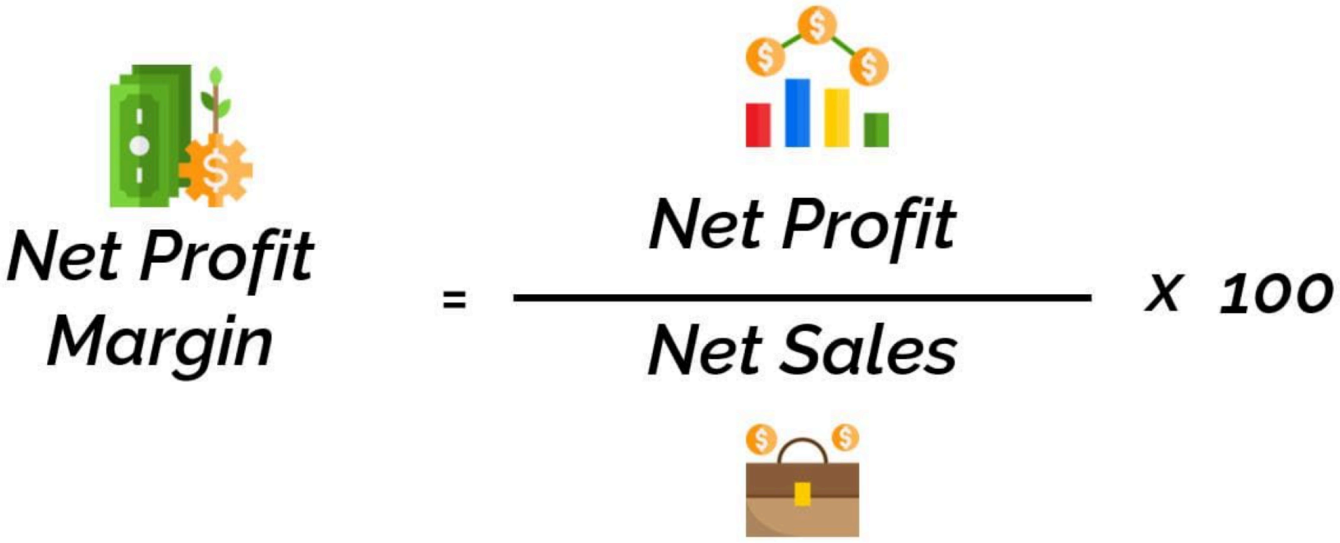
The operating profit margin is a profitability measure that calculates the proportion of profit generated by a company's activities before taxes and interest costs are deducted. It is presented as a percentage and is derived by dividing operational profit by total revenue. The EBIT (Earnings Before Interest and Tax) margin is another name for the margin.

Operating Profit Margin = EBIT / Total Revenue = (Total Revenue – COGS – Operating Expenses – Amortization) / Total Revenue

The operational profit margin is calculated as a percentage of total sales divided by operating profit. A 30 percent operational profit margin, for example, equates to $0.30 in operating profit for every $1 in revenue. An acquirer considering a leveraged buyout is a good illustration of how this profit metric may be applied. When the acquirer examines the target firm, they will be searching for ways to enhance the operations. The operational profit margin reveals how effectively the target firm performs in contrast to its competitors, and in particular, how well it controls its expenditures to optimize profitability. The removal of interest and taxes is advantageous

since a leveraged buyout would infuse a firm with entirely fresh debt, rendering past interest expenditure obsolete.

Net Profit Margin



The net profit margin (also known as "profit margin" or "net profit margin ratio") is a financial statistic that determines the proportion of profit a firm generates from total sales. It calculates how much net profit a firm makes per dollar of revenue. The net profit margin is calculated by dividing net profit (also known as net income) by total revenue and expressing the result as a percentage.

Net Profit Margin = Net Income / Total Revenue

By subtracting all of the company's costs from its total income, net profit is determined. The profit margin computation yields a percentage - for example, a 30 percent profit margin indicates the firm generates $0.30 in net profit for every $1 in revenue. The total sales of a firm in a certain period are referred to as revenue. The usual profit margin ratio of any firm varies based on the industry in which it operates.

Efficiency Ratios

Objectives:

- Students will be able to apply the Asset Turnover Ratio Formula when provided with a scenario of requisite inputs
- Students will be able to apply the Inventory Turnover Ratio Formula when provided with a scenario of requisite inputs
- Students will be able to apply the Days in Inventory Formula when provided with a scenario of requisite inputs

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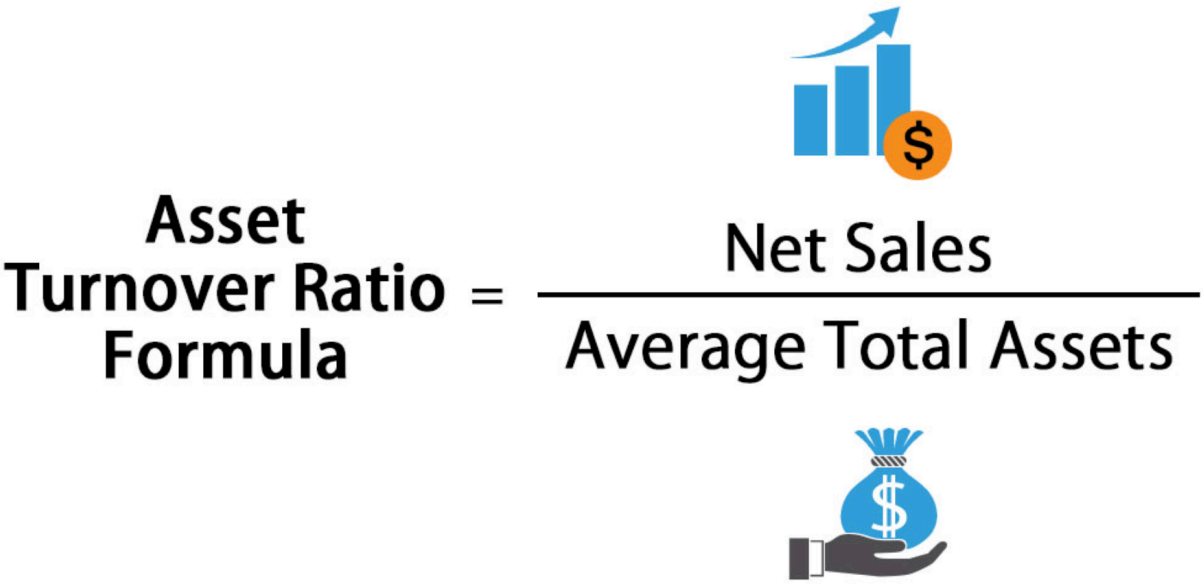
Asset Turnover Ratio



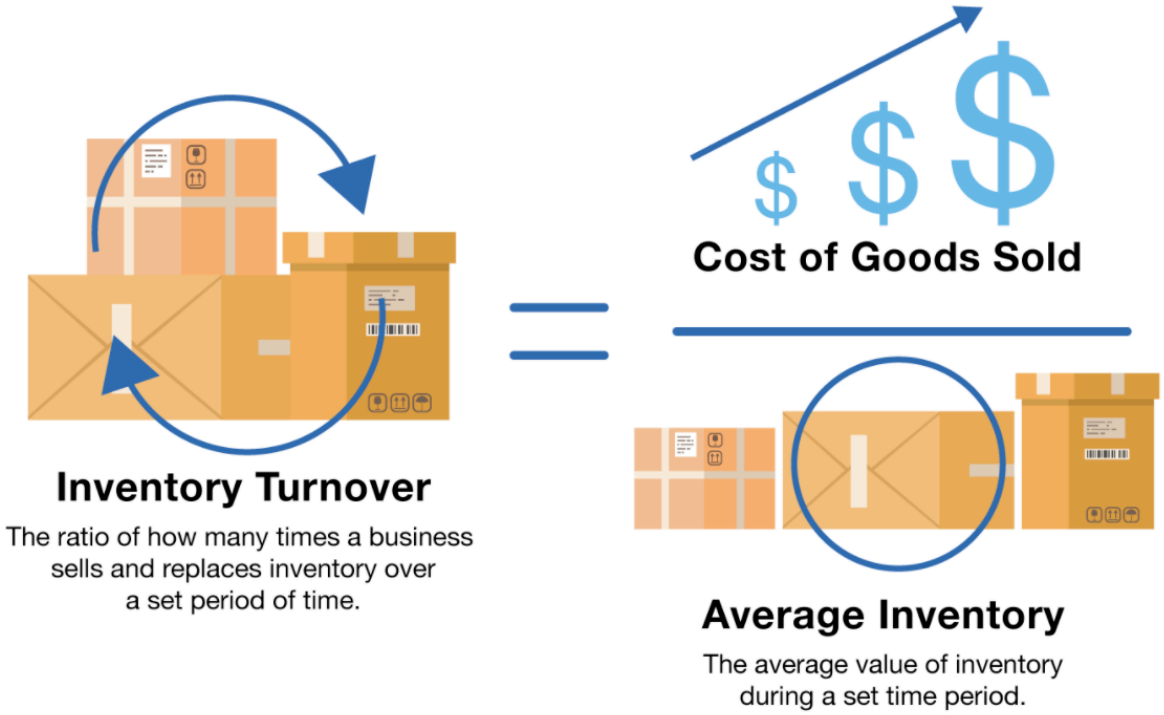
The asset turnover ratio is a measurement which allows to identify how well a company operates its assets in order to produce revenue. This ratio examines how much revenue is earned per dollar of total assets owned by the firm.

Asset Turnover Ratio = Net Sales / Average Total Assets

Average total assets = (Total Assetsending + Total Assetsbeginning)/2 is the formula used to compute this ratio. Note that instead of using average total assets, an analyst might utilize period end total assets. For example, a company's net sales for the year total $100,000. The company's total assets on December 31st were $65,000. The company's entire assets on January 1st were $57,000. The asset turnover ratio of the firm would thus be equal to 100,000/((65,000 + 57,000)/2) = 1.64. This indicates that the firm produces roughly $1.64 in net sales for every dollar of total assets.

A single period's asset turnover ratio, like many other ratios, isn't very informative on its own. When compared to asset turnover ratios of similar firms in the same industry, however, it might show how well a company is performing in comparison to its competitors. The optimum or average asset turnover ratio is determined by the company's industry. A greater ratio is typically considered positive since it implies that assets are being used efficiently. A low ratio, on the other hand, may indicate inefficient asset usage, collecting techniques, or inventory management.

Inventory Turnover Ratio



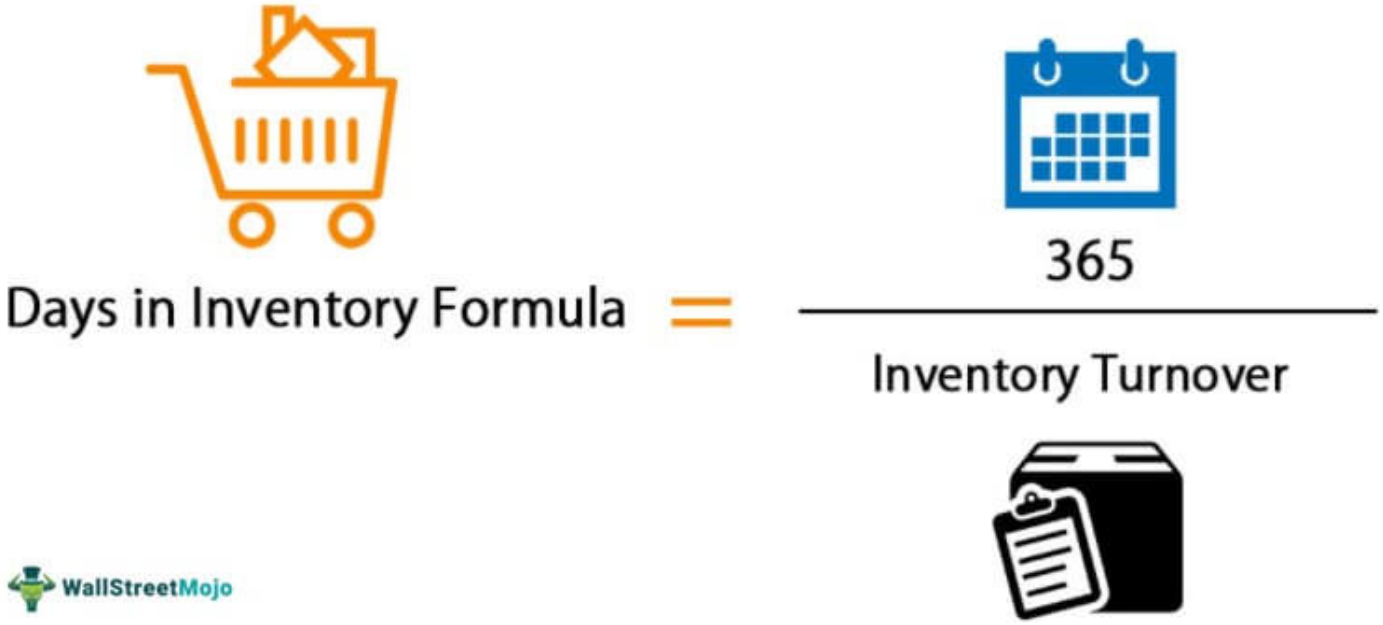
The inventory turnover ratio calculates how many times a company's stock of goods is sold and replaced in a particular period of time. This ratio examines the cost of products sold in relation to the period's average inventory. This metric shows how effective a company is in clearing its stockpiles.

Inventory Turnover Ratio = Cost of Goods Sold / Average Inventory

The average inventory ratio is determined as follows: Average Inventory = (Inventoryending + Inventorybeginning)/2. For example, a company's cost of goods sold for the fiscal year is $3 million. The company's inventory was $350,000 on December 31st. Inventory was $260,000 on January 1st. As a result, the inventory turnover ratio for the firm would be = 3,000,000 / ((35,000 + 26,000)/2) = 9.84. This figure indicates that the firm sold its whole inventory stock 9.84 times throughout the fiscal year.

The inventory turnover ratio, like the accounts receivable turnover ratio, may be adjusted to produce inventory turnover days, which is the average number of days it takes to sell a complete stock of products.

Inventory Turnover Days



The average number of days it takes to sell a stock of inventory is known as Inventory Turnover Days. This formula is derived from the inventory turnover ratio previously discussed. Inventory turnover days, like the inventory turnover ratio, is a measure of a company's efficiency.

Inventory Turnover Days = Number of Days in Period / Inventory Turnover Ratio

The inventory turnover ratio is required to compute this ratio: Cost of Goods Sold/Average Inventory = Inventory Turnover Ratio Using the same example, a company's cost of goods sold for the fiscal year is $3 million. The company's inventory was $350,000 on December 31st. Inventory was $260,000 on January 1st. As a result, the inventory turnover ratio for the firm would be = 3,000,000/((35,000 + 26,000)/2) = 9.84. This figure indicates that the firm sold its whole inventory stock 9.84 times throughout the fiscal year. These figures may be used to determine inventory turnover days, which are = 365/9.84 = 37.1.

Based on this, the company's average time to sell an entire stock of inventory is 37.1 days. This number should be compared to industry

averages, just like the inventory turnover ratio, to see how efficient the company is at converting inventory into sales compared to its competitors.

Liquidity Ratios

Objectives:

- Students will be able to apply the Current Ratio Formula when provided with a scenario of requisite inputs
- Students will be able to apply the Quick Ratio Formula when provided with a scenario of requisite inputs
- Students will be able to apply the Cash Ratio Formula when provided with a scenario of requisite inputs

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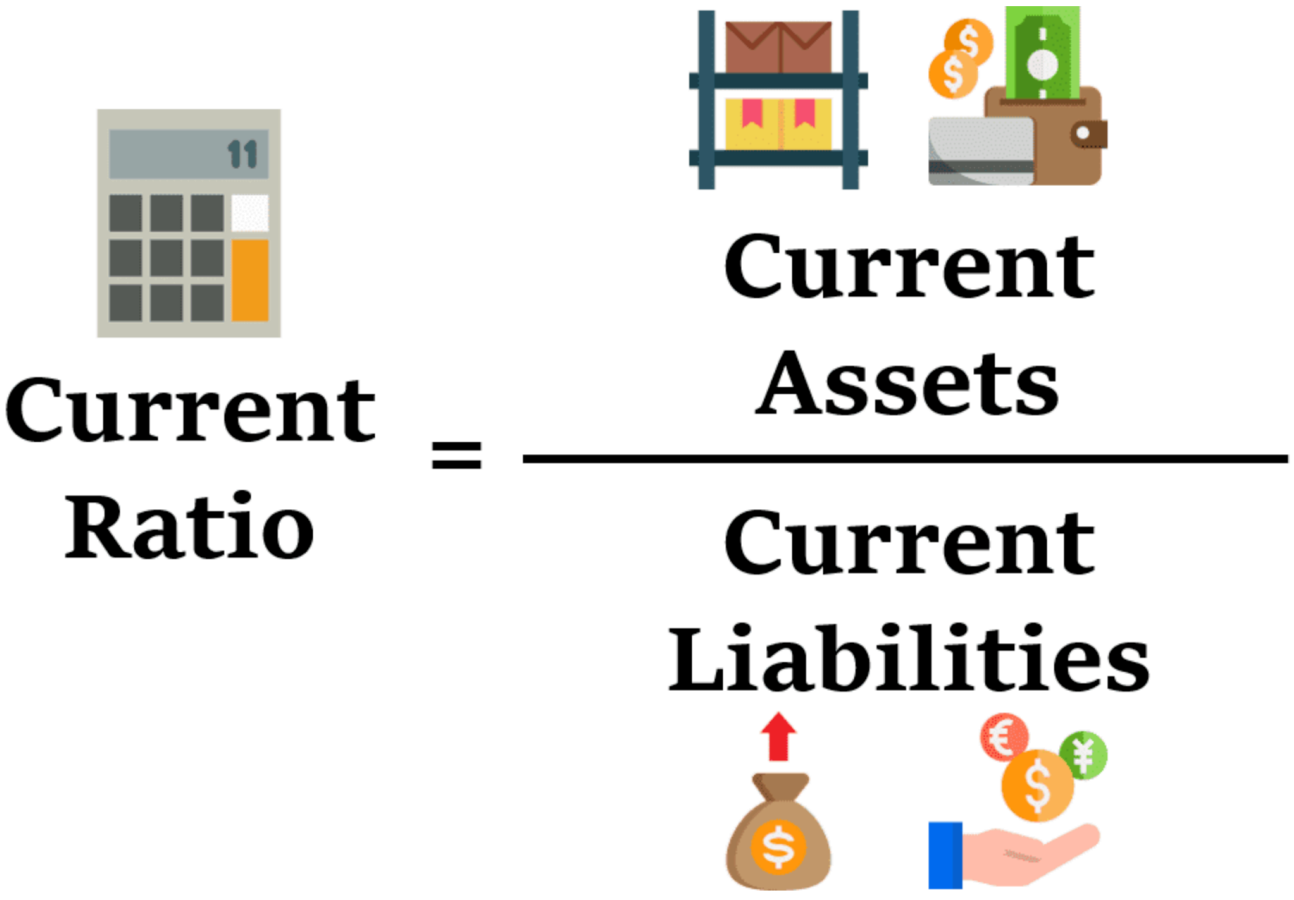
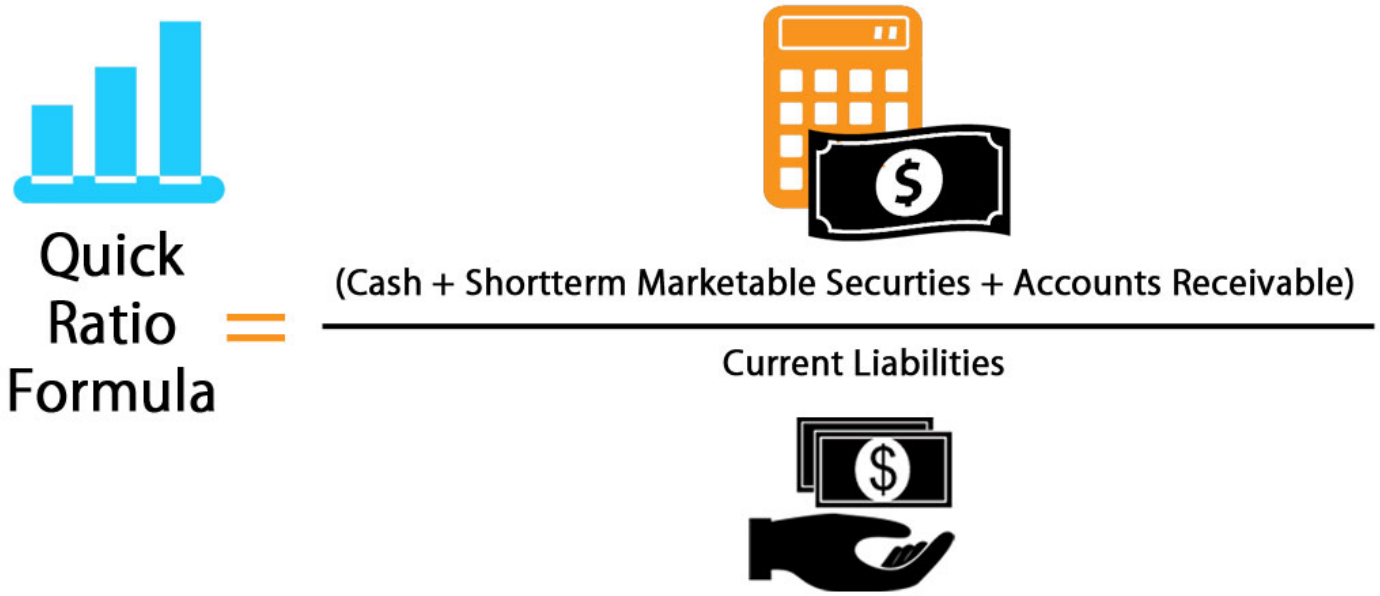


The current ratio, also known as the working capital ratio, assesses a company's capacity to fulfill short-term commitments due within one year. Total current assets are compared to total current liabilities in this ratio. The current ratio examines a company's ability to optimize the liquidity of its current assets in order to meet its debt commitments.

Current Ratio = Current Assets / Current Liabilities

Because it covers all current assets, including cash marketable securities, accounts receivable, and inventories, the current ratio is more comprehensive than other liquidity ratios like the quick ratio. The current ratio of a company with $60 million in current assets and $30 million in current liabilities is 2. According to this ratio of 2, a company's current obligations, such as accounts payable, may be paid off twice using current assets. A current ratio greater than one usually indicates a company's financial health. A high current ratio, on the other hand, indicates that the firm is sitting on too much cash rather than investing it in projects that will help the company expand.

Quick Ratio



The quick ratio, also known as the acid-test ratio, assesses a company's capacity to meet short-term obligations by identifying assets that may be converted into cash quickly. Cash, marketable securities, and accounts receivable are examples of these assets. These assets are referred to be "quick" assets since they can be turned into cash fast and readily.

Quick Ratio = (Cash + Marketable Securities + Accounts Receivable) / Current Liabilities

The fast ratio, unlike the current ratio, only considers the most liquid assets. The fast ratio assesses a company's capacity to meet short-term obligations using only assets that can be turned into cash rapidly. As a result, items like inventory and prepaid costs are excluded from the quick ratio. A company's quick ratio is 1.52 if it has $20 million in cash, $10 million in marketable securities, $18 million in accounts receivable, and $25 million in current liabilities. This means that the company's most liquid assets can cover 1.52 times its current liabilities.

A fast ratio larger than one indicates that the firm is financially healthy, since it indicates that the corporation can fulfill its short-term debt commitments using solely its liquid assets. A high quick ratio, like a high current ratio,

indicates that the firm is leaving too much extra cash on the table rather than investing it to create returns or growth.

Cash Ratio

The cash ratio, also known as the cash asset ratio, assesses a company's capacity to repay short-term debt commitments using cash and cash equivalents. The cash ratio is a tighter, more conservative metric than the current and quick ratios since it only considers cash and cash equivalents — a company's most liquid assets. Cash equivalents are assets that can be rapidly turned into cash and carry a low degree of risk. Savings accounts, Treasury notes, and money market instruments are examples of cash equivalents.

Cash Ratio = Cash and Cash Equivalents / Current Liabilities

Because it solely utilizes cash and cash equivalents in its computation, the cash ratio is more tighter than the current and quick ratios. The cash ratio shows how much cash and cash equivalents can meet a company's short-term debt commitments. A cash ratio of 0.6 means a firm has $10 million in cash, $5 million in treasury bills, and $25 million in current obligations. This indicates the company can cover 60% of its current liabilities with cash and cash equivalents, or 0.6 times its current liabilities.

A greater crash ratio is preferred by creditors since it implies that the firm can readily repay its loan. Although there is no optimal ratio, a ratio of 0.5 to 1 is typically chosen. A high cash ratio, like the current and quick ratios, shows that the firm is hoarding cash rather than investing it to generate returns or growth.

CAPM & Fama and French Three

Objectives:

- Students will be able to define what the Capital Asset Pricing Model (CAPM) is.
- Students will be able to define the parts of the CAPM formula.
- Students will be able to apply the CAPM formula.
- Students will be able to describe the assumptions and problems with the CAPM.
- Students will be able to explain the principles of the Modern Portfolio Theory.
- Students will be able to show an understanding of the Fama and French Three-Factor Model.
- Students will be able to explain how the Fama and French Three-Factor Model relates to investors.
- Students will be able to describe the three factors of the Fama and French Three-Factor Model.

CAPM

The Capital Asset Pricing Model (CAPM) describes the relationship between systematic risk and expected return for assets, notably stocks. It is used throughout finance for pricing risky securities and generating expected returns for assets given the risk of those assets and cost of capital.

Understanding CAPM

$$ER_i = R_f + \beta_i(ER_m - R_f)$$

where:

$ER_i = \text{expected return of investment}$

$R_f = \text{risk-free rate}$

$\beta_i = \text{beta of the investment}$

$(ER_m - R_f) = \text{market risk premium}$

Investors expect to be compensated for risk and the time value of money. The risk-free rate in the CAPM formula accounts for the time value of money. The other components of the CAPM formula account for the investor taking on additional risk.

The beta of a potential investment is a measure of how much risk the investment will add to a portfolio that looks like the market. If a stock is

riskier than the market, it will have a beta greater than one. If a stock has a beta of less than one, the formula assumes it will reduce the risk of a portfolio.

A stock's beta is then multiplied by the market risk premium, which is the return expected from the market above the risk-free rate. The risk-free rate is then added to the product of the stock's beta and the market risk premium. The result should give an investor the required return or discount rate they can use to find the value of an asset.

The goal of the CAPM formula is to evaluate whether a stock is fairly valued when its risk and the time value of money are compared to its expected return.

For example, imagine an investor is contemplating a stock worth $100 per share today that pays a 3% annual dividend. The stock has a beta compared to the market of 1.3, which means it is riskier than a market portfolio. Also, assume that the risk-free rate is 3% and this investor expects the market to rise in value by 8% per year.

The expected return of the stock based on the CAPM formula is 9.5%:

9.5% = 3% + 1.3 x (8% - 3%)

The expected return of the CAPM formula is used to discount the expected dividends and capital appreciation of the stock over the expected holding period. If the discounted value of those future cash flows is equal to $100 then the CAPM formula indicates the stock is fairly valued relative to risk.

Problems with CAPM

Modern financial theory rests on two assumptions: securities markets are ver y competitive and efficient; these markets are dominated by rational, risk-averse investors, who seek to maximize satisfaction from returns on their investments. Despite these issues, the CAPM formula is considered as a useful resource because of its simplicity and allows for easy comparisons of investment alternatives.

Including beta in the formula assumes that risk can be measured by a stock's price volatility. The look-back period to determine a stock's volatility is not standard because stock returns are not normally distributed. An increase in the risk-free rate also increases the cost of the capital used in the investment and could make the stock look overvalued.

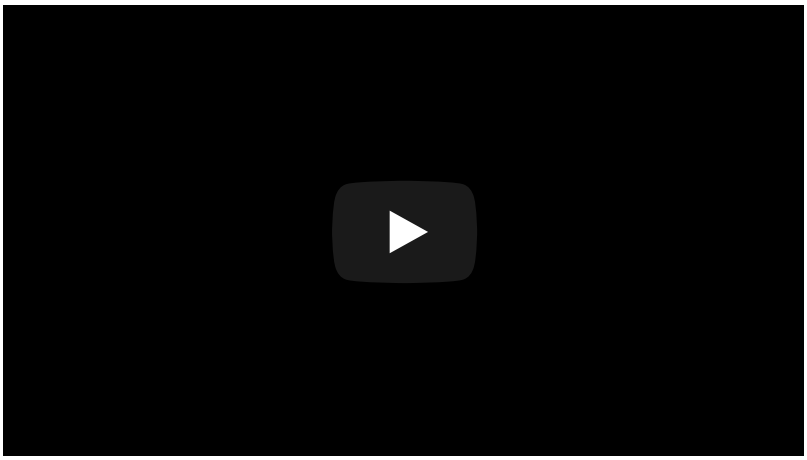
The market portfolio that is used to find the market risk premium is only a theoretical value and is not an asset that can be purchased or invested in as an alternative to the stock. Most of the time, investors will use a major stock index, like the S&P 500, to substitute for the market, which is an imperfect comparison.

If an investor could estimate the future return of a stock with a high level of accuracy, the CAPM would not be necessary.

The CAPM and the Efficient Frontier

If an investor wants to manage their risk, the CAPM is

supposed to help by using it to build the portfolio. If it were to be used perfectly to optimize the portfolio's return relative to risk, it would exist on a curve call the efficient frontier.



The CAPM uses the principles of Modern Portfolio Theory to determine if a security is fairly valued. It relies on assumptions about investor behaviors, risk and return distributions, and market fundamentals that don't match reality. However, the underlying concepts of CAPM and the associated efficient frontier can help investors understand the relationship between expected risk and reward as they make better decisions about adding securities to a portfolio.

Fama and French Three Factor Model

The Fama and French Three-Factor Model (or the Fama French Model for short) is an asset pricing model developed in 1992 that expands on the capital asset pricing model (CAPM) by adding size risk and value risk factors to the market risk factor in CAPM. This model considers the fact that value and small-cap stocks outperform markets on a regular basis. By including these two additional factors, the model adjusts for this outperforming tendency, which is thought to make it a better tool for evaluating manager performance.

Understanding the Fama and French Three Factor Model

Nobel Laureate Eugene Fama and researcher Kenneth French, former professors at the University of Chicago Booth School of Business, attempted to better measure market returns and, through research, found that value stocks outperform growth stocks.1

Similarly, small-cap stocks tend to outperform large-cap stocks. As an evaluation tool, the performance of portfolios with a large number of small-cap or value stocks would be lower than the CAPM result, as the Three-Factor Model adjusts downward for observed small-cap and value stock outperformance.

The Fama and French model has three factors: the size of firms, book-to-market values, and excess return on the market. In other words, the three factors used are small minus big (SMB), high minus low (HML), and the portfolio's return less the risk-free rate of return. SMB accounts for publicly traded companies with small market caps that generate higher returns, while HML accounts for value stocks with high book-to-market ratios that generate higher returns in comparison to the market.2

There is a lot of debate about whether the outperformance tendency is due to market efficiency or market inefficiency. In support of market efficiency, the outperformance is generally explained by the excess risk that value and

small-cap stocks face as a result of their higher cost of capital and greater business risk. In support of market inefficiency, the outperformance is explained by market participants incorrectly pricing the value of these companies, which provides the excess return in the long run as the value adjusts. Investors who subscribe to the body of evidence provided by the Efficient Markets Hypothesis (EMH) are more likely to agree with the efficiency side.

The formula is:

$$R_{it} - R_{ft} = \alpha_{it} + \beta_1(R_{Mt} - R_{ft}) + \beta_2 SMB_t + \beta_3 HML_t + \epsilon_{it}$$

where:

$R_{it} = \text{total return of a stock or portfolio } i \text{ at time } t$

$R_{ft} = \text{risk free rate of return at time } t$

$R_{Mt} = \text{total market portfolio return at time } t$

$R_{it} - R_{ft} = \text{expected excess return}$

$R_{Mt} - R_{ft} = \text{excess return on the market portfolio (index)}$

$SMB_t = \text{size premium (small minus big)}$

$HML_t = \text{value premium (high minus low)}$

$\beta_{1,2,3} = \text{factor coefficients}$

Fama and French highlighted that investors must be able to ride out the extra volatility and periodic underperformance that could occur in a short time. Investors with a long-term time horizon of 15 years or more will be rewarded for losses suffered in the short term. Using thousands of random stock portfolios, Fama and French conducted studies to test their model and found that when size and value factors are combined with the beta factor, they could then explain as much as 95% of the return in a diversified stock portfolio.

Given the ability to explain 95% of a portfolio's return versus the market as a whole, investors can construct a portfolio in which they receive an average expected return according to the relative risks they assume in their portfolios. The main factors driving expected returns are sensitivity to the market, sensitivity to size, and sensitivity to value stocks, as measured by the book-to-market ratio. Any additional average expected return may be attributed to unpriced or unsystematic risk.

What Does Fama and French Three Factor Model Mean for Investors?

It tells investors that they must be able to ride out the extra volatility and periodic underperformance that could occur in the short term. Those who have a long-term time horizon of 15 or more years will be rewarded for losses suffered in the short term. Investors are able to tailor their portfolios to receive an average expected return according to the relative risks they assume thanks to the model being able to explain as much as 95% of the return in a diversified stock portfolio.

What Are the Three Factors of the Model?

- **Size of firms**
- **Book-to-Market Values**
- **Excess return on the market**

Ratio Analysis

Objectives:

- Students will be able to provide and describe the four levers to achieve growth and profit goals
- Students will be able to provide and describe the three core applications of ratio analysis
- Students will be able to apply the Ration Analysis equation when provided with a scenario of requisite inputs
- Students will be able to apply the Return on Equity equation when provided with a scenario of requisite inputs
- Students will be able to apply the Return on Assets formula when provided with a scenario of requisite inputs

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The profitability and expansion of a company define its worth. Product market and financial market strategies have an impact on a company's growth and profitability. The firm's competitive strategy, operational policies, and investment decisions are all used to implement the product market strategy. Financing and dividend policies are used to implement financial market strategies.

As a result, managers can utilize the following four levers to achieve their growth and profit goals:

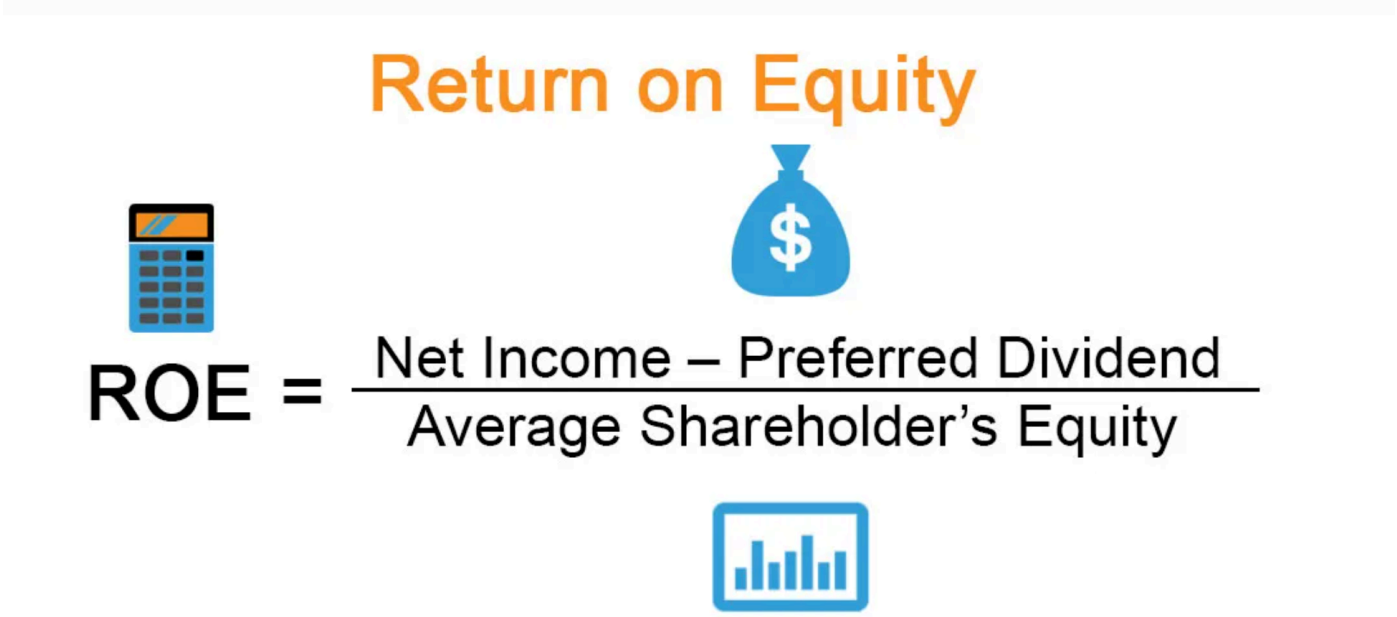
1. Operating management
2. Investment management
3. Financing strategy
4. Dividend policies

Ratio analysis is used to assess the success of a company's policy in each of these categories. Effective ratio analysis entails as much information as possible in linking financial statistics to underlying company variables. While ratio analysis may not provide an analyst with all of the answers about a company's performance, it can assist the analyst formulate questions for future investigation.

The analyst can use ratio analysis to:

1. Compare ratios for a company across multiple years (a time-series comparison)
2. Compare the firm's ratios to those of other companies in the industry (cross-sectional comparison)
3. Compare the ratios to an absolute standard

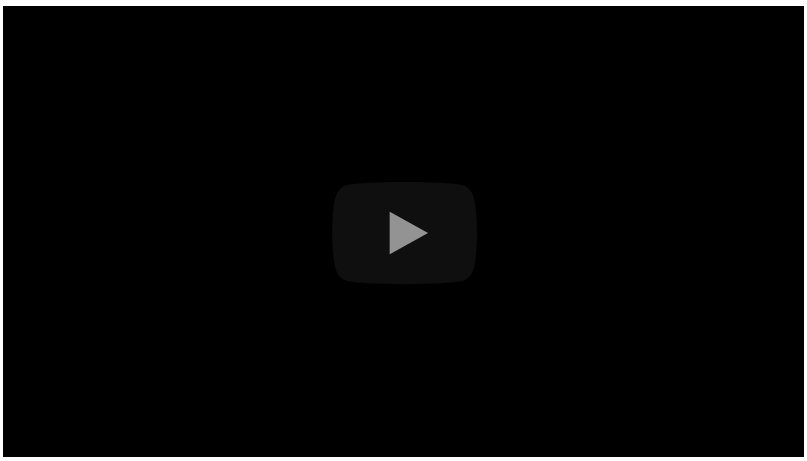
An analyst can use a time-series comparison to assess the success of a firm's strategy over time while controlling for firm-specific characteristics. Cross-sectional comparison allows for an examination of a firm's relative performance within its industry while keeping industry-level characteristics constant. There are no absolute criteria for most ratios. The only exceptions are measurements of rates of return that may be compared to the investment's cost of capital. The rate of return on equity (ROE) can be compared against the cost of equity capital, for example, subject to accounting distortions.



The return on equity is the beginning point for a systematic study of a company's performance (ROE).

ROE = Net profit / Shareholders' equity

Because it shows how successfully managers are using the capital invested by the firm's shareholders to create returns, ROE is a complete indicator of a company's performance. Large publicly listed companies in Europe achieve ROEs of 8 to 10% on average over extended periods of time.



The connection between the firm's ROE and its cost of equity capital determines the value of its equity in the long run. That is, companies that are projected to earn ROEs greater than the cost of equity capital over the long

term should have market values greater than book value, and vice versa.

A comparison of ROE to cost of capital is important not only for determining the firm's worth, but also for forecasting future profitability. In the absence of significant impediments to entry, generating continuous supernormal profits will attract competitors. As a result, competitive pressures tend to move ROEs toward a ‘‘normal" level - the cost of equity capital – over time. The cost of equity capital may thus be thought of as a benchmark for the ROE that would be seen in a long-run competitive equilibrium. Deviations from this standard occur for two main reasons. One is the industry circumstances and competitive strategy that cause a company to make abnormal (or abnormal) economic profits, at least in the near term. The second factor is accounting distortions.

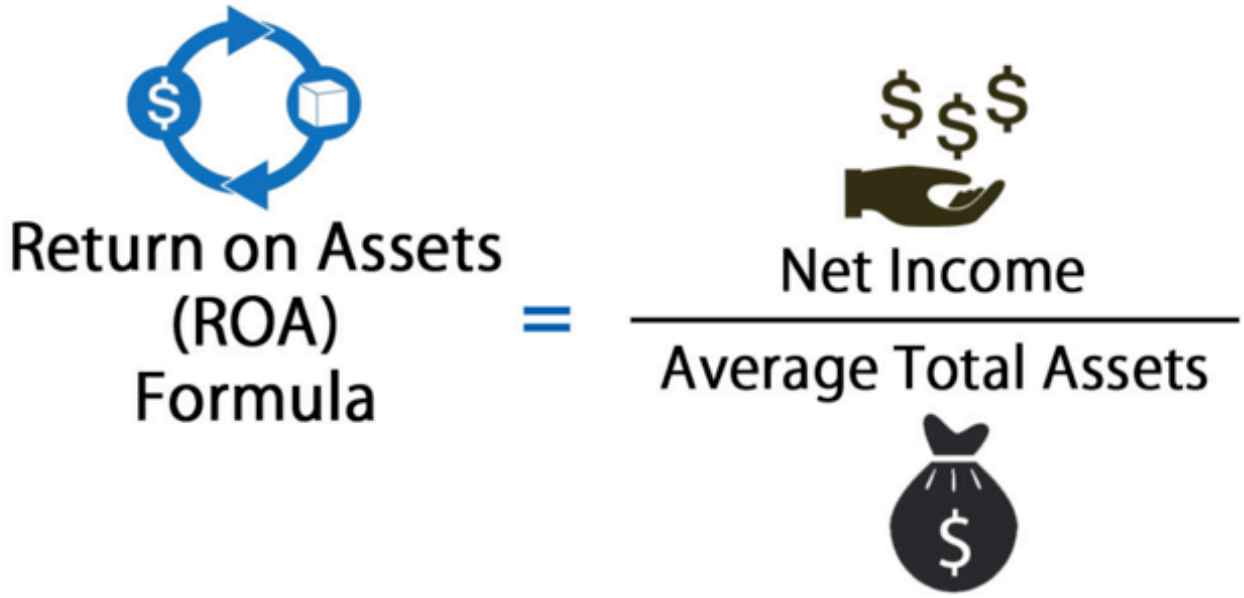
The initial equity, ending equity, or an average of the two can all be used to calculate ROE. The average equity is conceptually acceptable, especially for quickly developing businesses. Most organizations, however, don't care about the computational decision as long as the analyst is consistent. As a result, most analysts in practice utilize ending balances for simplicity. This observation applies to all ratios presented in this chapter that have a flow variable (items in the income statement or cash flow statement) and a stock variable (items in the balance sheet).

Two variables influence a company's ROE: how profitably it utilizes its assets and the size of the firm's asset base in relation to shareholders' investment. ROE may be divided into return on assets (ROA) and a measure of financial leverage, the equity multiplier, to better understand the impact of these two elements.

ROE = ROA x Equity multiplier = (Net profit/Total assets) x (Total assets/Equity)

The return on assets (ROA) shows us how much profit a firm may make for every euro invested in assets. For each euro invested by its shareholders, the

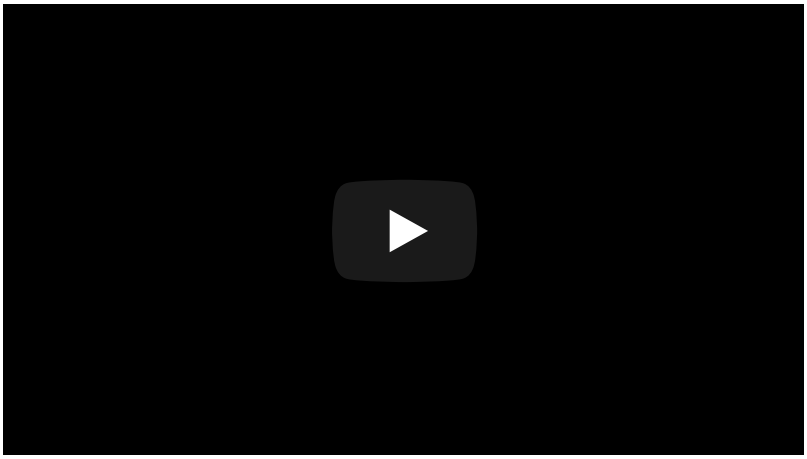
equity multiplier reflects how many euros of assets the company may deploy.



The ROA itself may be split into two components:

ROA = (Net profit/Sales) x (Sales/Total assets)

Net profit margin, also known as return on sales (ROS), is the ratio of net profit to sales; asset turnover is the ratio of sales to total assets. The profit margin ratio shows how much profit a firm may keep for every euro of sales it produces. Asset turnover refers to how many sales euros a company can earn for each euro invested in its assets.



Even though the previous methodology is commonly used in order to decompose a firm's ROE, it poses several limitations. In the calculation of

ROA, the denominator includes the assets claimed by all capital providers of the firm, however the numerator includes only the earnings available to equity holders. Operating assets and investment assets, such as minority equity investments and surplus cash, are among the assets. In addition, net profit comprises earnings from operational and investing operations, as well as interest income and cost, both of which are the result of financing decisions. It's important to distinguish between these performance sources for at least two reasons:

1. The tools used to value operational assets differ from those used to value investment assets. Financial statements, in particular, include a wealth of information on the financial and risk implications of operating activities, allowing the analyst to approach the analysis and appraisal of such activities with confidence. In contrast, it is frequently difficult to determine what makes up investment assets and what drives their profitability from financial statements, forcing analysts to rely on shortcut techniques or a firm's own fair value disclosures to estimate the worth of such assets.
2. Operating, investing, and finance activities all contribute differently to a company's performance and value, and their relative importance varies substantially over time and among companies. By combining operational and investment assets, the impact of these investments on retailer performance is obscured. Furthermore, rising financial leverage can have both a direct and indirect negative impact on return on equity by raising a company's financial risk and borrowing costs. The equity multiplier indicates the direct effect of leverage, whereas the net profit margin shows the indirect effect.

Finally, the aforementioned financial leverage ratio ignores the reality that part of a company's obligations are essentially non-interest-bearing operational liabilities.

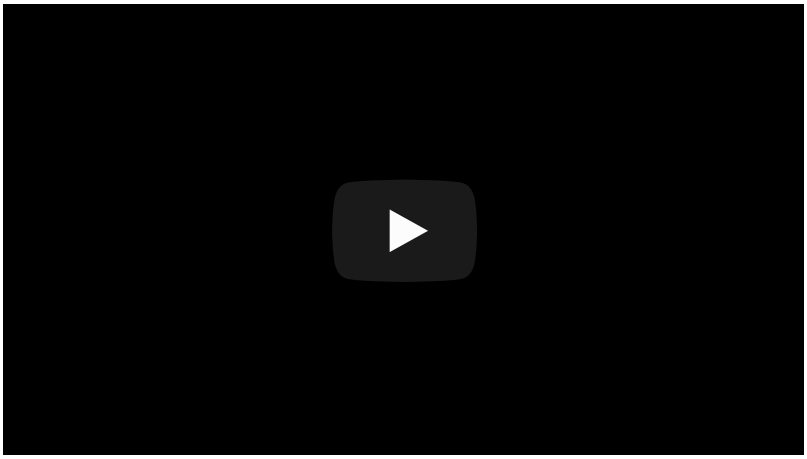
Cash Flow Analysis

Objectives:

- Students will be able to describe the concepts of cash flow analysis.
- Students will be able to explain how working capital applies to operations.
- Students will be able to define what a cash flow analysis model is.
- Students will be able to apply the concepts of the cash flow analysis model.

In their financial statements, all firms must provide a statement of cash flows. Firms categorize their cash flows into three areas in the reported cash flow statement: cash flow from operations, cash flow related to investments, and cash flow connected to financing activities. After paying for the cost of inputs and operations, cash flow from operations is the cash earned by the company through the sale of goods and services. The cash spent for capital expenditures, inter-corporate investments, acquisitions, and cash obtained from the sale of non-current assets is shown in the cash flow connected to investment operations.

The direct and indirect cash flow statement forms are used by businesses. The way they show cash flow from operational operations is the main distinction between the two forms. Operating cash receipts and disbursements are reported directly under the direct cash flow format, which is utilized by only a limited number of businesses in practice. Firms obtain their operational cash flows in the indirect format by making accrual adjustments to net profit. Many analysts and managers prefer the indirect style because it connects the cash flow statement to the income statement and balance sheet of the company.



Because revenues and costs are calculated on an accrual basis, net profit varies from operational cash flows. In net profit, there are two types of accruals. There are existing accruals such as credit sales and outstanding costs to begin with. Current accruals cause changes in a company's current assets and liabilities (such as trade receivables, inventory, and prepaid costs) (such as trade payables and current pro- visions). Non-current accruals, including as depreciation, deferred taxes, and equity income from unconsolidated subsidiaries, are the second kind of accruals in the income statement. Adjustments must be made for both types of accruals in order to calculate cash flow from operations from net profit. Adjustments must also be made for non-operating gains, such as earnings from asset sales, that are included in net profit.

The accrual adjustments that must be made to net profit in order to arrive at operational cash flows are expressly detailed in the indirect cash flow format.

Analysts should know how to generate an estimated indirect cash flow statement if a company utilizes the direct cash flow format. The first step is to determine a company's working capital from operations, which is defined as net profit adjusted for non-current accruals and profits on non-current asset sales. Non-current accruals like depreciation and deferred taxes, as well as non-operating profits, are generally included in the income statement or the notes to the financial statements. Making the necessary adjustments for current accruals connected to operations, the second step is to convert working capital from operations to cash flow from operations.

Examining changes in a company's current assets and current liabilities might provide information on current accruals. Operating accruals typically include changes in all current asset accounts save cash and cash equivalents, as well as changes in all current liability accounts except notes payable and the current part of non-current debt. The following formula may be used to compute cash from operations:

Working capital from operations

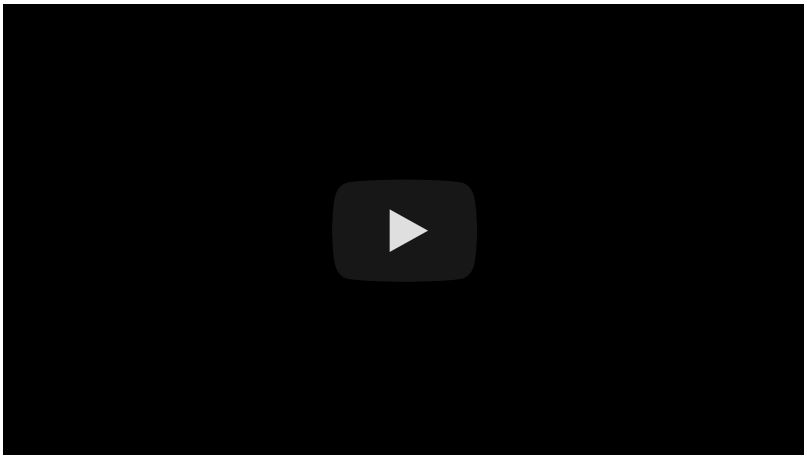
- Increase (or + decrease) in trade receivables

- Increase (or + decrease) in inventories

- Increase (or + decrease) in other current assets excluding cash and cash equivalents

+ Increase (or - decrease) in trade payables

+ Increase (or - decrease) in other current liabilities excluding debt.



Working capital from operations, after adjusting for changes in the balance sheet values of current assets and liabilities, is rarely equivalent to the operational cash flow shown in the direct cash flow statement. To match the operational cash flows in the two cash flow statements, the analyst must add a category of additional, unexplained accruals to the self-constructed indirect cash flow statement. This complexity occurs when events such as changes in consolidation or foreign currency exchange rate changes influence year-to-year variations in the balance sheet values of current assets and liabilities, but current accruals in the indirect cash flow statement are not.

To restate the cash flow data, analysts employ a variety of methods. They depict cash flow from operations in two stages, for example. Before operating working capital investments, the initial stage calculates cash flow from operations. The model does not include interest expense when calculating this cash flow. An analyst subtracts or adds three sorts of things from a firm's earnings before interest and taxes to arrive at this number:

- Subtract taxes paid plus (1 - tax rate) x interest paid, adjusted for the tax shield on interest payments. The tax shield adjustment ensures that the restated cash flow from operations is unaffected by the firm's financing arrangement.
- Non-operating profits or losses, such as those resulting from asset disposals or asset write-offs, should be added back since they are investment-related and will be evaluated later.

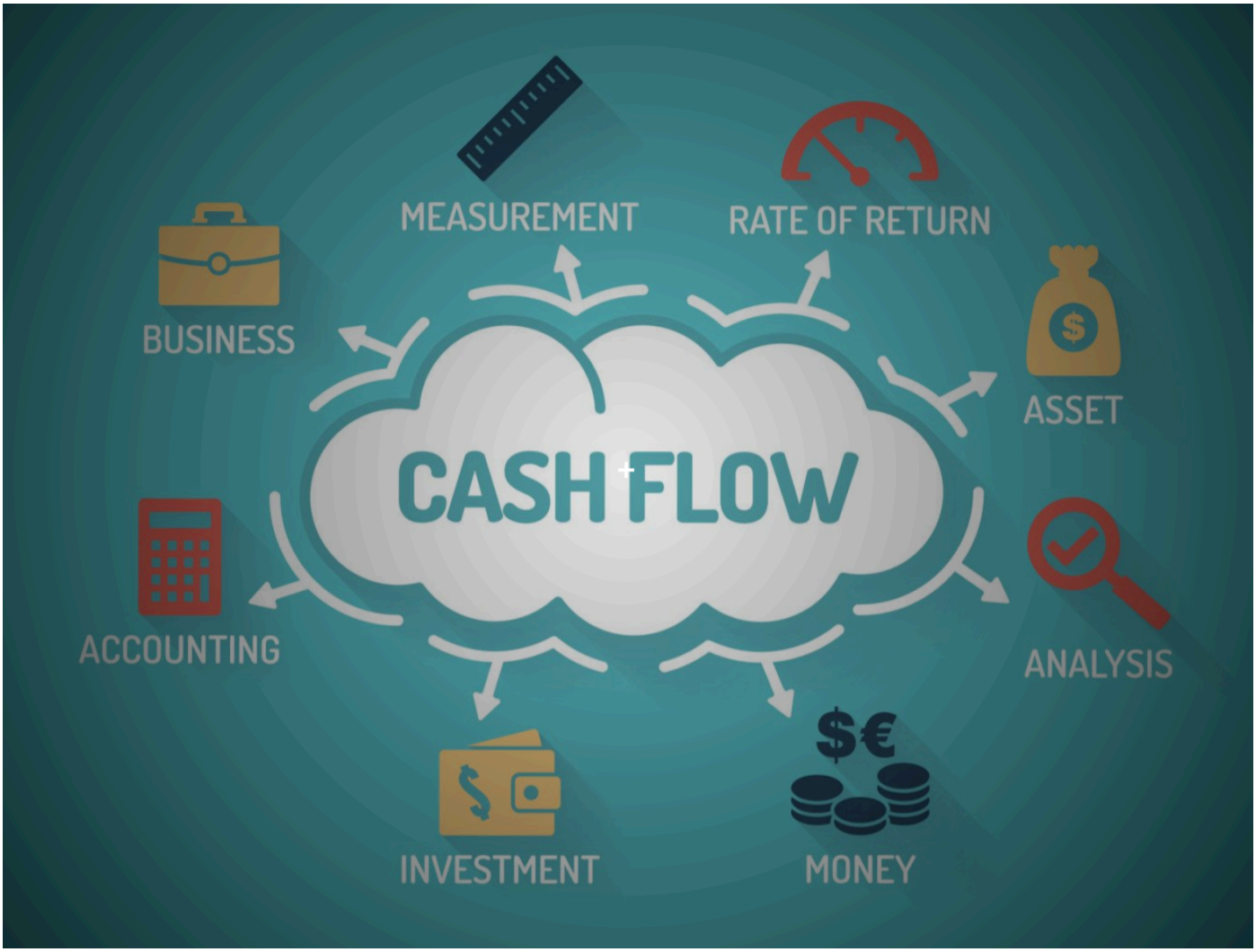
- Because they are non-cash operating expenses, add back non-current operational accruals like depreciation and deferred taxes.

A company's capacity to produce positive cash flow from operations is influenced by a number of factors. Healthy, stable businesses should be able to earn more income from their consumers than they spend on running costs. Growing businesses, on the other hand, may face negative operational cash flow if they invest heavily in R&D, advertising, and marketing, or in building an organization to support future growth. The way a company manages its working capital has an impact on whether or not it generates positive cash flow from operations. Cash flow is generally invested in operating working capital items such as accounts receivable, inventory, and accounts payable by companies in the early stages of their development. Firms' credit practices (trade receivables), payment policies (trade payables, prepaid costs, and allowances), and projected sales growth all influence net working capital investments (inventories). As a result, it's critical to consider a company's development plan, industry characteristics, and credit policies when assessing cash flow from operations after working capital.

The cash flow analysis model then concentrates on long-term investment cash flows. Capital expenditures, intercorporate investments, and mergers and acquisitions are all examples of these investments. After making operating working capital investments, any positive operating cash flow allows the company to pursue long-term growth possibilities. If the firm's operational cash flows after working capital investments are insufficient to sustain long-term investments, it will need to rely on outside borrowing to fund its expansion. Firms that can fund their development internally have less flexibility to undertake long-term investments. Being able to support expansion internally has both costs and rewards. Managers might utilize domestically produced free cash flow to support unproductive projects, which comes at a cost. If managers are compelled to rely on external capital providers, such inefficient capital expenditures are less likely. If it is difficult to convey the benefits of such investments to the capital markets, reliance

on external capital markets may make it difficult for managers to make long-term hazardous investments.

Any extra cash flow following these long-term investments is accessible to both debt and equity holders as free cash flow. Interest and principle payments are two types of payments made to debt holders. Firms with negative free cash flow must borrow more money to satisfy their interest and debt repayment commitments, or reduce their working capital and long-term investments, or issue more stock. This is definitely a financially hazardous scenario for the company.



Cash flow available to stockholders after debt payments is free cash flow. Dividends and share repurchases are two types of payments made to equity holders. Companies that pay dividends despite negative free cash flow to stockholders are borrowing money to do so. While this may be viable in the

near term, a company should not pay dividends to its stockholders unless it has a consistent positive free cash flow. Firms with a significant free cash flow after debt payments, on the other hand, face the danger of squandering that money on unproductive investments in order to seek growth for its own sake. As a result, an analyst should carefully analyze such companies' investment intentions.

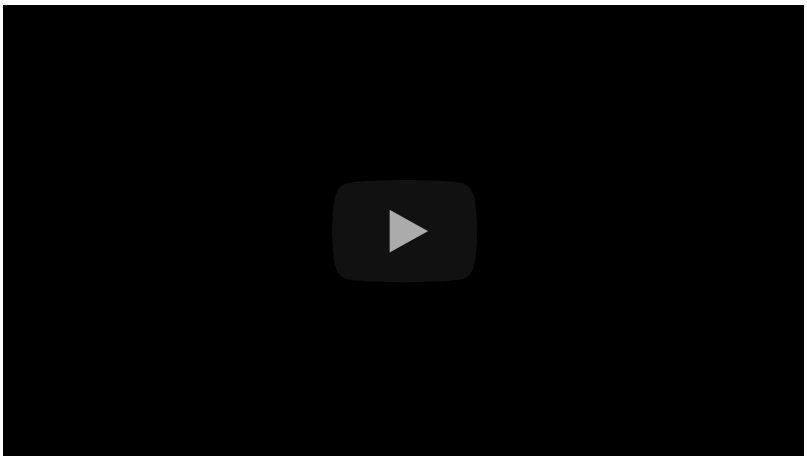
Fundamental Analysis

Objectives:

- Students will be able to define what fundamentals are.
- Students will be able to explains what a fundamental analysis is.
- Students will be able to differentiate between Macroeconomics and Microeconomics.
- Students will be able to explain how fundamental analysis relates to business.

Fundamentals provide a method to set the financial value of a company, security or currency and their subsequent financial valuation. They are include basic qualitative and quantitative information that contributes to the asset's financial or economic well-being. Fundamentals can be categorized into macroeconomic or microeconomic depending on their affect of the size of the financial entities. In business, profitability, revenue, assets, liabilities and growth potential are all considered fundamentals.

Understanding Fundamentals

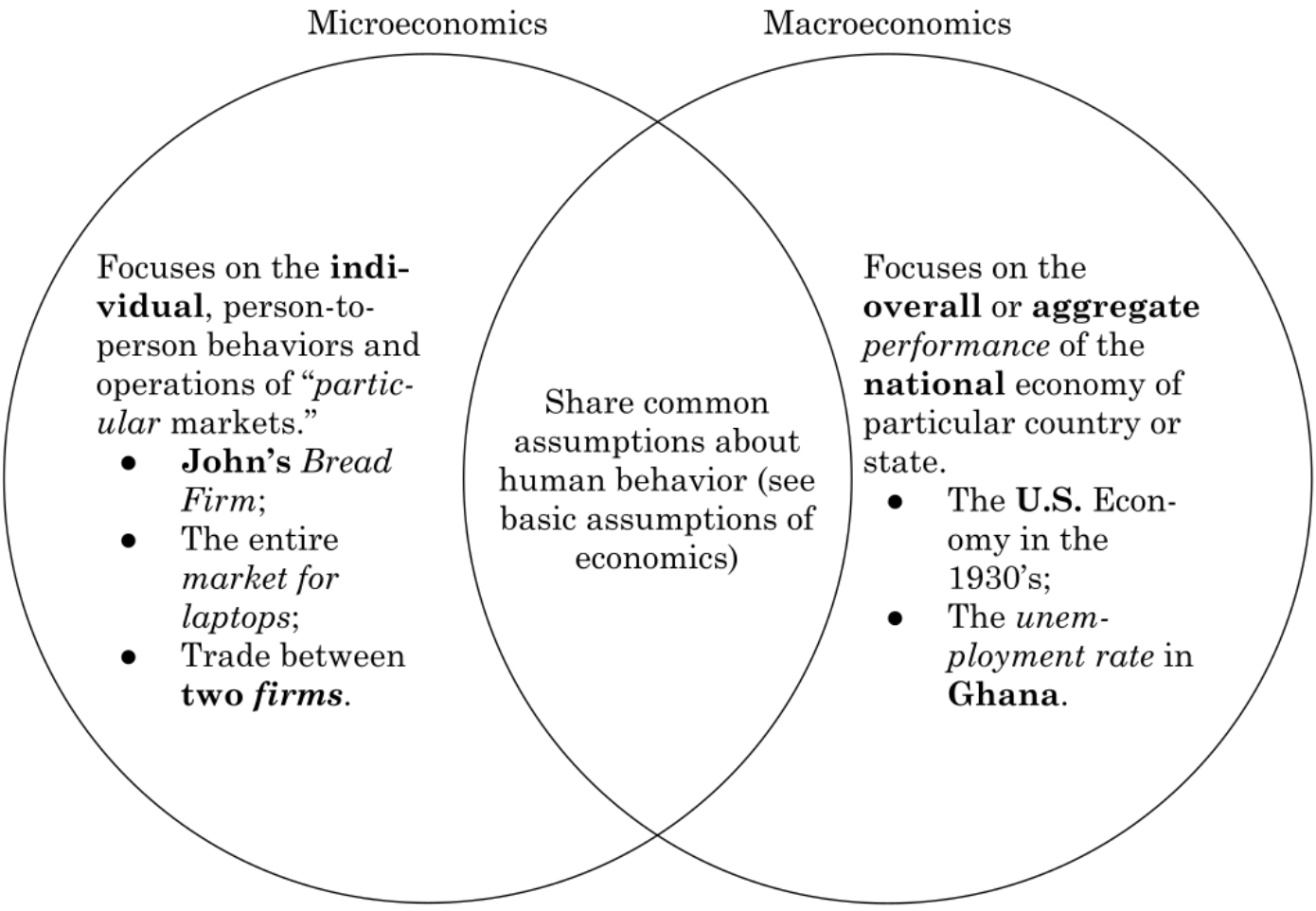


In business and economics, fundamentals are the primary characteristics and financial data imperative for determining stability and the health of an asset. Macroeconomics and Microeconomics can be included in this data.

Analysts and investors examine these fundamentals to develop an estimate to determine if the underlying asset is considered a worthwhile investment as well as if the valuation is fair in the market. Information like profitability, revenue, assets, liabilities and growth potential in businesses are considered fundamentals. To determine a company's feasibility of the investment, the use of fundamental analysis is considered.

National economies and currencies have a set of fundamentals that can be analyzed. Take for example, interest rates, GDP growth, trade balances and inflation levels as factors that are considered to be fundamentals of a nation's value.

Macroeconomic and Microeconomic Fundamentals



When talking of topics that affect an economy at large which may include unemployment statistics, supply & demand, growth and inflation, these are

examples of Macroeconomic fundamentals. Such categories can be applied to the analysis of a large-scale economy or be related to an individual business activity to assess changes based on large influences within the economy.

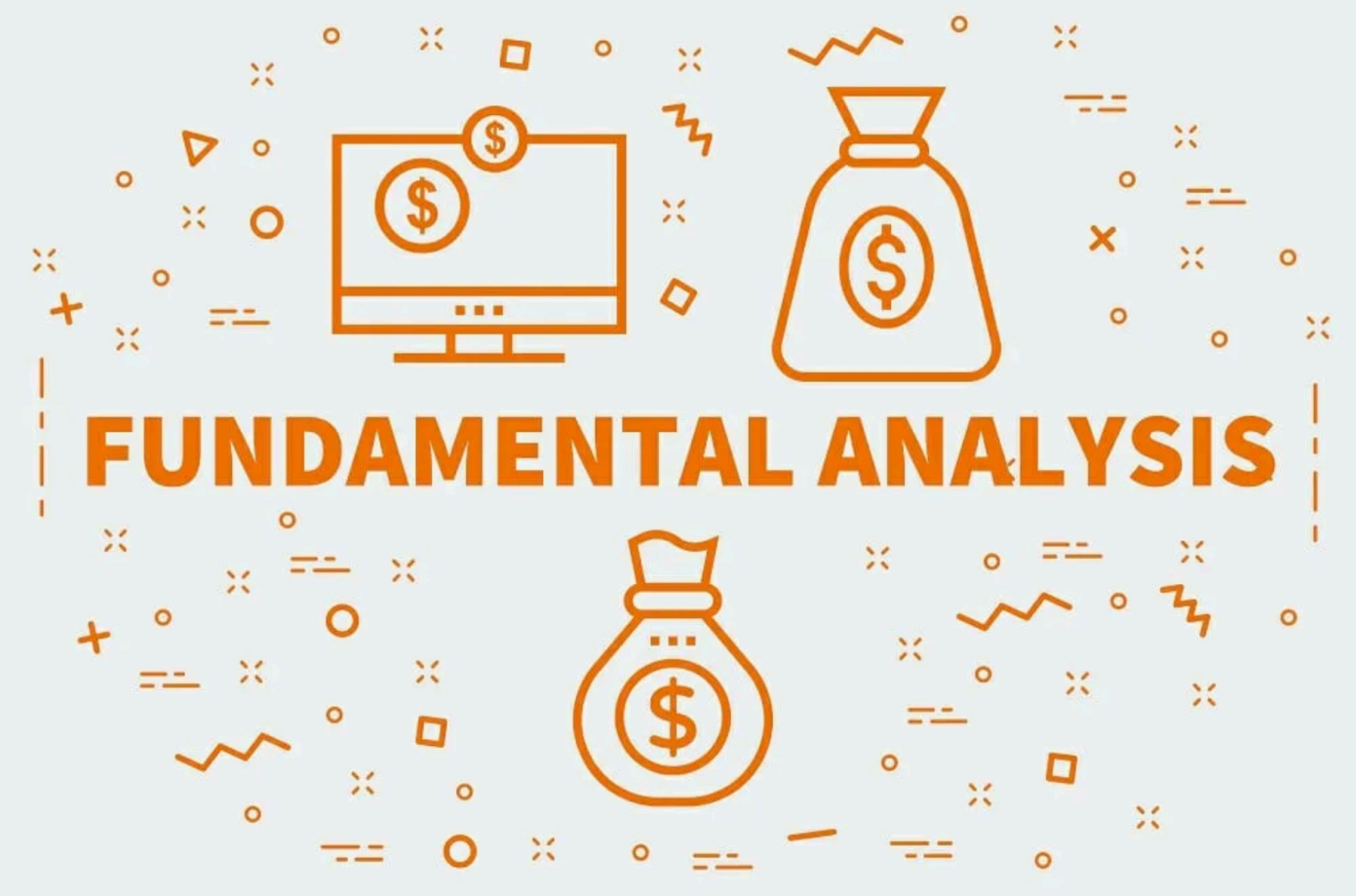
In contrast to macroeconomics, focusing on a smaller scale of activating with in segments is called microeconomics. The categories may be the same as its larger counterpart but the analysis is on a smaller and more concise practice. Consumer theory investigates how people spend within their particular budget restraints.

Fundamentals in Business

A business with strong fundamentals may be more likely to survive adverse events, like economic recessions or depressions, than one with weaker fundamentals. A company with little debt and sufficient cash is considered to have strong fundamentals.

Strong fundamentals suggest that a business has a viable framework or financial structure.By By looking at the economics of a business, including the overall management and the financial statements, investors are looking at a company's fundamentals. Conversely, those with weak fundamentals may have issues in the areas of debt obligation management, cost control, or overall organizational management. Not only do these data points show the health of the business, but they also indicate the probability of further growth. Also, strength may indicate less risk should an investor consider purchasing securities associated with the businesses mentioned.

Fundamental Analysis



Investors and financial analysts are interested in evaluating the fundamentals of a company to compare its economic position relative to its industry peers, to the broader market, or to itself over time. Fundamental analysis involves digging deep into a company's financial statements to extract its profit and growth potential, relative riskiness, and to ultimately decide if its shares are over, under, or fairly valued in the market.

Often fundamental analysis involves computing and analyzing ratios to make apples-to-apples comparisons. Some common fundamental analysis ratios are listed below.

- The debt-to-equity ratio (DE) measures how a company is financing its operations.
- The quick ratio measures the company’s ability to meet its short-term obligations.
- The degree of financial leverage (DFL) measures the stability or volatility of the earnings per share (EPS).

- The price-to-earnings (P/E) ratio compares investment to earnings dollars.
- The DuPont analysis looks at return on equity (ROE) by looking at asset use efficiency, operating efficiency, and financial leverage.

Fundamental analysis should be carried out with a holistic approach, utilizing several ratios and including a bottom-up as well as a top-down analysis to come to specific conclusions and actions.

Barra Risk Factor Analysis

Objectives:

- Student will be able to define the Barra Risk Factor Analysis.
- Student will be able to provide a basic understanding of how the Barra Risk Factor Analysis is used in regards to risk and investments.
- Students will be able to apply the Barra Risk Factor Analysis when provided with a scenario of requisite scenarios.

The Barra Risk Factor Analysis is a multi-factor model, created by Barra Inc., used to measure the overall risk associated with a security relative to the market. Barra Risk Factor Analysis incorporates over 40 data metrics, including earnings growth, share turnover and senior debt rating. The model then measures risk factors associated with three main components: industry risk, the risk from exposure to different investment themes and company-specific risk.

Understanding Barra Risk Factor Analysis

An element that investors and portfolio managers scrutinize when evaluating the markets or portfolios is investment risk. Identifying and measuring investment risk is one of the most important steps taken when deciding what assets to invest in. This is because the level of risk taken determines the level of return that an asset or portfolio of assets will have at the end of a trading cycle. Consequently, one of the most widely accepted financial principles is the tradeoff between risk and return.

One method that a portfolio manager might use to measure investment risk is evaluating the impact of a series of broad factors on the performance of various assets or securities. Using a factor model, the return-generating process for a security is driven by the presence of the various

common fundamental factors and the asset's unique sensitivities to each factor. Since a few important factors can explain the risk and return expected on investment to a large degree, factor models can be used to evaluate how much of a portfolio's return is attributable to each common factor exposure. Factor models can be broken down into single-factor and multiple-factor models. One multi-factor model that can be used to measure portfolio risk is the Barra Risk Factor Analysis model.

The Barra Risk Factor Analysis was pioneered by Bar Rosenberg, founder of Barra Inc., and is discussed at length in Grinold and Kahn (2000), Conner et al (2010) and Cariño et al (2010). It incorporates a number of factors in its model that can be used to predict and control risk. The multi-factor risk model uses a number of key fundamental factors that represent the features of an investment. Some of these factors include yield, earnings growth, volatility, liquidity, momentum, size, price-earnings ratio, leverage, and growth; factors which are used to describe the risk or returns of a portfolio or asset by moving from quantitative, but unspecified, factors to readily identifiable fundamental characteristics.

The Barra Risk Factor Analysis model measures a security's relative risk with a single value-at-risk (VaR) number. This number represents a percentile rank between 0 and 100, with 0 being the least volatile and 100 being the most volatile, relative to the U.S. market. For instance, a security with a value-at-risk number of 80 is calculated to have a greater level of price volatility than 80% of securities in the market and its specific sector. So, if Amazon is assigned a VaR of 80, it means that its stock is more price volatile than 80% of the stock market or the sector in which the company operates.

Reading Material

Barra-Type Factor Structure: