Economics

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1 SUPPLY AND DEMAND

Concepts of supply and demand form the very foundations of economics. The interactions between supply and demand decide the price of a product. It is best to explain them by using an example. Let us take an agricultural produce, brinjal (good of interest) and see how restaurants (bulk consumers) would react to different price points (offering prices) and how farmers (producers) would react to different price points (asking prices). A transaction (a purchase) happens when the asking price and the offering price are the same (so both are satisfied).

1.1 NATURE OF DEMAND

Restaurants have limited weekly budgets for vegetables. Based on the prices of different vegetables, they will have to decide how much of brinjal to buy, how much of potatoes to buy, how much of capsicum to buy and so on.

Demanded quantity falls when offering prices of that good increases

Coming to our good of interest, if the offering price of brinjal is Rs. 30/kg, then, let us say restaurants in Pune overall will buy 200 tonnes of brinjal. But, if the price of brinjal were to go up, to say Rs, 70/kg, it is intuitive that restaurants would buy lesser quantity of brinjal and instead would buy more of some other vegetable. If the price of brinjal goes even higher, the restaurants would buy even lesser brinjal.

On the other hand, if price of brinjal were to go to a lower value, say, Rs. 40/kg, it is conceivable that restaurants would now increase the consumption of brinjal at the expense of a more pricy vegetable. And if the price of brinjal falls even further, consumption of it will increase even further.

To conclude, demand falls as price rises and vice versa. This is depicted in Figure 1.1.

1.2 NATURE OF SUPPLY

Supplied quantity falls when asking prices of that good decreases

The nature of supply is exactly opposite to that of the demand. As the asking price of the good increases, supply also increases. The higher the asking price of brinjal, the more incentive there is for the farmers to grow brinjal instead of some other vegetable. So as the asking price of brinjal increases, more and more farmers

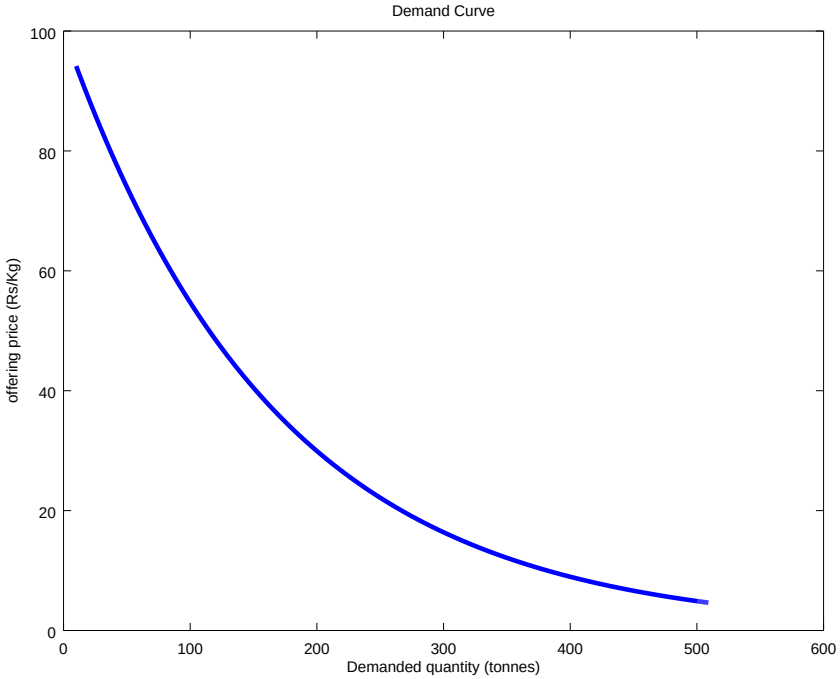

Figure 1.1: The Demand Curve

will grow brinjal and hence there will be more and more supply of brinjal in the market. A hypothetical supply curve for brinjal may look like Figure 1.2.

1.3 TRANSACTION

Transaction happens when supplier and consumer like the price point for a certain qty of goods

Remember that, the quantities we have so far talked about, namely, offering price, asking price, supplied quantity, demanded quantity, are just hypothetical values - In other words, the demanded quantity *would be* 200 tonnes, *if* the offering price is Rs. 30/kg. This doesn't mean brinjal would ever be offered at Rs. 30/kg or that 200 tonnes of brinjal will be transacted. Similarly, on the supply side, again we hypothesize that, *if* the asking price is Rs. 70/kg, then 200 tonnes of brnijal *would be* supplied. That doesn't mean consumers would ever be willing to pay Rs. 70/kg and 200 tonnes of brinjal will be transacted. Thus the supply and demand curve need to be thought of as a result of a "what if" survey answered by producers and customers and not as the result of some real life transactions.

A transaction can happen only when supplier agrees to supply a certain quantity of brinjal at a price that the consumer is willing to pay for that quantity of brinjal. Mathematically speaking, this happens where the supply curve meets the demand curve. And that point would eventually decide how many tonnes of brinjal was

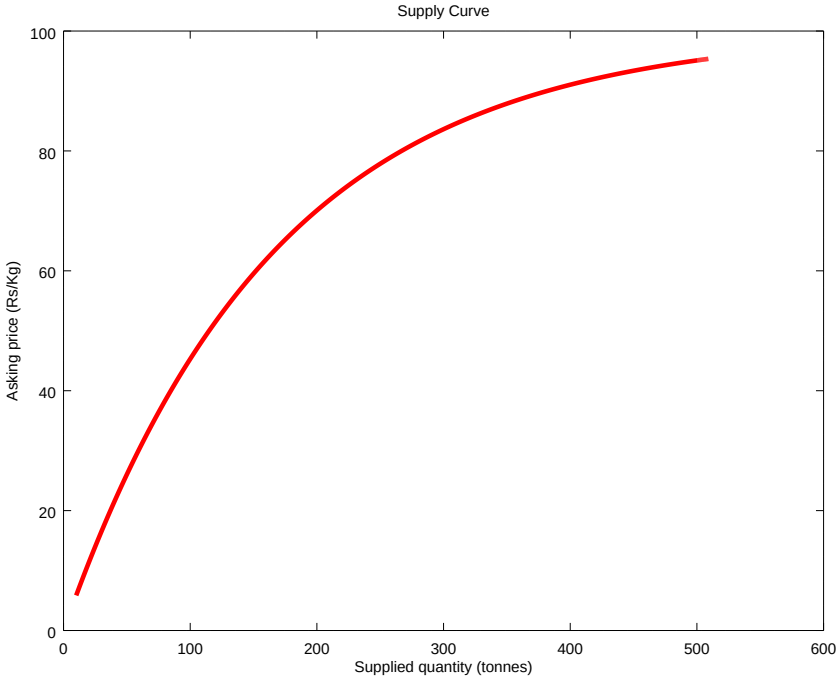

Figure 1.2: The Supply Curve

actually transacted and at what price.

As you can see from Figure 1.3, in our case a transaction happened at a price point for a given quantity that was acceptable to both the parties. This transaction point is where the "what if" hypothetical scenarios end and a real deal happens. You can see that now the x and y axes are denoted as "quantity" and "price" as opposed to hypothetical terms like "demanded quantity" or "Offering price".

It is important to note that, though hypothetically, consumers may want to buy more brinjal than the actual trasacted quantity of 115 tonnes, they just didn't have a choice as supplier wasn't willing to supply more than 115 tonnes and consumer wasn't willing to pay more than 50 Rs/kg.

1.4 CAVEATS

The supply and demand theory described in prior sections give us a good framework to understand economics at a very basic level. However it hides a lot of nuances as discussed in the following subsections.

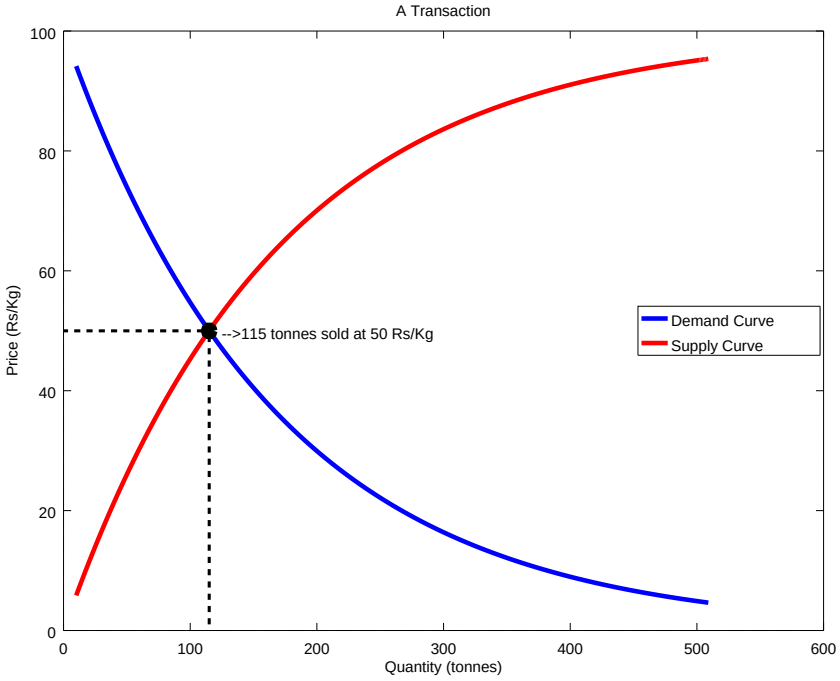

Figure 1.3: A Transaction

1.4.1 Simple Supply Demand Curves are Macroeconomic Model

The simple supply demand curves we dealt above describe us the situation in an average sense. In reality, though we said that 115 tonnes of brinjal was transacted at Rs. 50/kg, it is not that every single transaction happened at Rs. 50/kg. It is possible that 75 tonnes were transacted at 42 Rs/kg and 40 tonnes were transacted at 65 Rs/kg. So our demonstrated transaction point of 50 Rs/kg is merely so in an average sense, i.e., (75*42 + 40*65)/(75+40) = 50.

There are several reasons why two transactions happened at two different prices:

- Some party may not have market intelligence to know what other parties are generally offering/asking the commodity at
  - How often do people have access about supply-demand data? Even if they had, how often is the data usable in decision making? - The data could be too old or irrelevant to the local context
- Human factor is involved: Some are good at bargaining, some aren't. Some customers may have strong preferences for certain suppliers based on trust built over years

1.4.2 Not Everyone is a Rational Actor

How many of us approach the act of selling/purchasing some brinjal methodically considering market intelligence (even when it is available), the price of alternatives (other vegetables) etc.? Big restaurant chains may make choices methodically, but small restaurant owners may buy things based on imperfect and rough calculations.

1.4.3 Many Supply and Demand Curves

Even though we have shown a single supply and single demand curve, they are so just in an average sense and do not reflect the price preferences of every individual involved in brijal transactions. For instance, in expensive restaurants the cost of raw materials (vegetables) could only constitute a very small fraction of the price of the dishes and may not bother to switch the supplier just because s/he is quoting a slightly higher price for brinjal than the rest of the market. Another example could be that there is a restaurant that is famous just for their baingan barta - unlike others, this customer won't switch to an alternative vegetable as the offering price changes.

1.5 LATERAL SHIFTS IN SUPPLY/DEMAND CURVES

There are many factors that affect the supply and demand curves. Some of them cause the curves to retain their shapes, but shift laterally - to the right of the left. For instance, if the purchasing capacity of the entire population went up due to strong development in the country, the demand curve could shift right. If fuel prices increase, the supply curve could shift left. This is demonstrated pictorially in Figures Figure 1.4, Figure 1.5.

Note how, when demand shifts right or supply shifts left, the transacted quantity and overall transacted amout changes from their respective original values.

There is one more important thing to note here. We have seen earlier how the supply and demand curves represent only the preferences of an average consumer - let us what are the implications of this when the supply/demand curves shift laterally.

When the purchasing power of the average consumer increased, the demand curve shifted right resulting in higher transaction prices for brinjal. Now the economic development that caused the average purchasing power to increase could have been an unequal one with some sections of the society benefitting while some other sections left out entirely. Suppose, the economic development greatly increased the purchasing power of the lower middle class and the upper middle class but didn't benefit the poor at all. But unfortunately, the new selling price of brinjal is abour 14 Rs/Kg more than the price of it before the lateral shift, but the poor, still having the old purchasing power, can afford only lesser brinjal than before.

Lateral shift in curves adversely affect those left out by economic developemtn

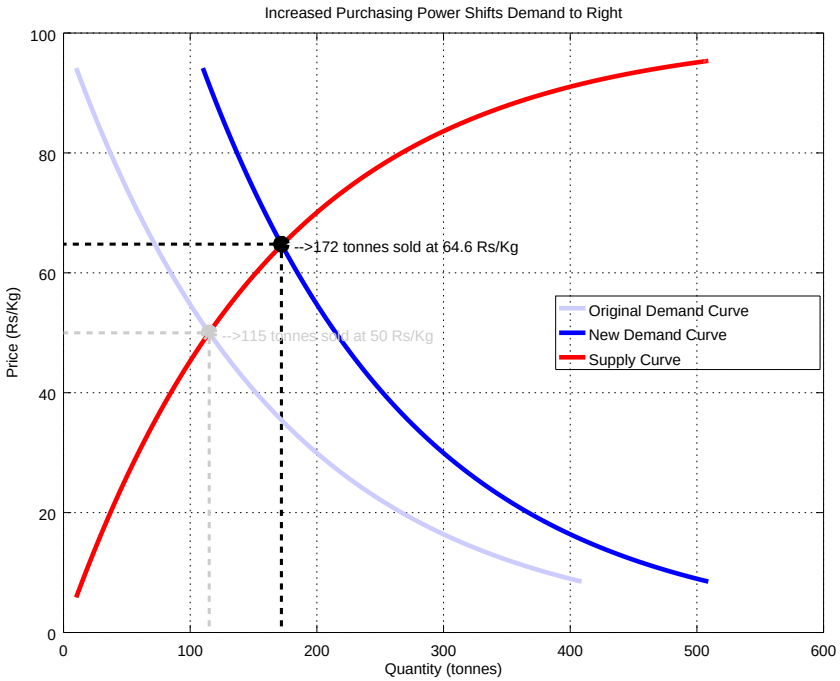

Figure 1.4: Demand Shifts Right

Similarly when the fuel prices increase, shifting the supply curve to the left, again the transaction price of brinjal increased making it less affordable to poorer sections of the society.

The examples were deliberately chosen as those which would affect, not just brinjal, but all vegetables. One can deduce then that in either example, poorer sections would end up consuming lesser vegetables in general and (they and) their children would become malnutritioned. If fuel prices continue to rise or if economic development continues to benefit only certain sections of the society, it is conceivable that this malnutrition problem would become a long term thing and children from poorer sections could become permanently affected with stunted growth and lesser physical capacity, well being. This is where government intervention is required - government could tax the rich with higher purchasing power and subsidize vegetables for the poor thereby pulling the demand curve back to its original position. Similarly government could reduce the fuel tax or subsidize fuel which will prevent profit margins of suppliers from going down therey pulling the supply curve back to its original position.

Govt. may intervene to shift curves to original positions to help the poor

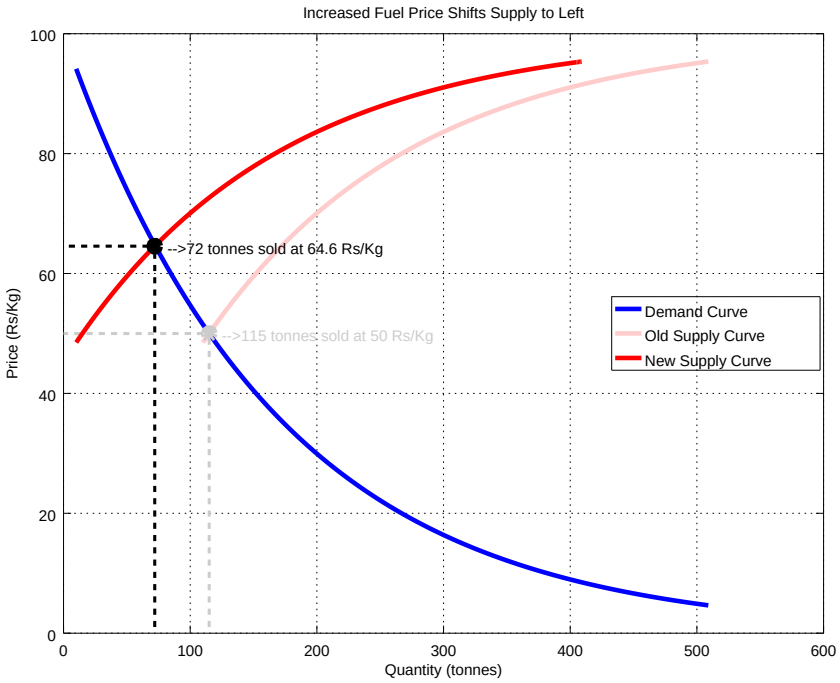

Figure 1.5: Supply Shifts Left

2

CAPITAL AND INCOME

Ever since modern economy started, people have been debating on this question: "What share of profit of a venture should go to the investors and what share of it should go to the labourers". Capitalism and Communism are just byproducts of these debates. Anyone trying to solve economic inequalities will, at some point or ther other, have to meditate upon this simple question. This question is also at the heart of a related debate about government regulations: How much government should regulate; Whether we should have a small government of a big government. And of course, for entrepreneurs this question will have to be answered before their venture can start.

We will not attempt to answer this question in this chapter (people do PhDs on this!). Instead, we will explain the simple terms "Capital" and "Income", understanding which will equip the reader to attempt to answer this question.

Capital is a stock. It corresponds to the total wealth owned at a given point in time 't' . In other words, it corresponds to wealth appropriation over all the previous times (previous years, previous months, days, whatever the time unit is) combined. Thus the unit of capital can be USD, INR, GBP, gold etc. A house, a car, furniture, factory machinery, money in fixed deposit/equity/mutual funds etc., are all different forms of capital.

Income is a flow. It corresponds to money made over a stipulated period of time - so it is not a quantity accumulated over a period of time. The unit of income can be $\frac{USD}{year}$, $\frac{INR}{month}$, $\frac{GBP}{hr}$ etc.

For an individual, her yearly income may include her income from salary as well as returns from mutual funds, rent from a house, interest from savings acc. Her income, thus, has two distinguishable parts: income from labour (salary) and income from capital (mutual fund returns, rent, savings interest etc.)

For a company, its income would equal its revenues per year. Of this, whatever is paid to the workers is the income from labour (Labourers got that money because it was ascertained as part of the revenue that was generated because of their labour, and hence one they deserved). Whatever is remaining in the revenue is the income from capital (The machinery they own, investment they received, land they had purchased etc.)

2.1 EQUATIONS PERTAINING TO CAPITAL AND INCOME

- $NationalCapital = PrivateCapital + PublicCapital$
- $NationalCapital = DomesticCapital + NetForeignCapital$
  - Net Foreign Capital for India is Capital in other countries owned by India *minus* Capital in India owned by other countries
- $NationalIncome = DomesticOutput + netincomefromAbroad$
- $NationalIncome = CapitalIncome + LabourIncome$
- $\alpha = r * \beta$
  - $\alpha =$ Capital's share in income. Unit = %
  - $r=$ Rate of return on capital. Unit = $\frac{\%}{time}$
  - $\beta =$ Capital to income ratio. Unit = $time$

The last equation deserves a deeper explanation. Imagine a company A that produces 1 million $\frac{\$}{year}$ of goods (and sells them successfully). Assume that to do this, they needed capital (office buildings, machinery, coffee machines, transportation vehicles etc.) worth 5 million $ and they needed labourers (CEO, VPs, directors, managers, engineers etc.), worth 600K $\frac{\$}{year}$. Then,

- Their income due to labour would be $600K\frac{\$}{year}$
- Their income due to capital would be total revenue minus payment to labourers. i.e., $(1\ million - 600\ K)\frac{\$}{year} = 400K\frac{\$}{year}$
- Rate of return on capital is $\frac{400\frac{\$}{year}}{5\ million\ \$} = 0.08\frac{1}{year}, or 8\frac{\%}{year}$
- So, in our formula, we have,
  - $r=$ Rate of return on capital $= 8\frac{\%}{year}$
  - $\beta =$ Capital to income ratio $= \frac{5million\ \$}{1\ million\frac{\$}{year}} = 5\ years$
  - $\alpha =$ Capital's share in income $= \frac{400\frac{\$}{year}}{1\ million\ \$} = 40\%$

2.2 EXPENDITURE AND VALUE DEPRECIATION

An individual is bound to spend part of his income (which is the sum of both income from capital and labour), for daily expenses such as food, entertainment etc. This is expenditure. It is important to note that items that one purchases which can be sold back, ex., TV, fridge etc., should not be included in expenditure. Such items are just different forms of capital. The part of the income that an individual saves or converts into other types of capital (house, car etc.) gets added to his existing capital.

For a company, expenditure includes money spent on employees (their salary, benefits, coffee, lunch etc.,), energy expenses, machinery maintenance costs etc. Note that, out of this money spent on employees, their salary is referred to as "income due to labour" in the previous section. The rest of the company's expenses have to come from the "income due to capital" part of the revenue. After these expenditures, whatever is left of the income from capital gets added to the existing capital. This is how capital grows over time.

What remains of an individual/-company's income after expenditure gets added to existing capital

Any capital asset can appreciate or depreciate in value. The value of a house or gold could appreciate over time, while the value of a car will most likely depreciate over time, unless we are talking about classic cars. Now appreciation of capital should not be confused with income from capital. For instance, the appreciation in the value of a property is capital itself appreciating. But the rent collected from the property is income from capital.

3 MACROECONOMICS

Macroeconomics is about studying economics using country-wide/world-wide aggregate economic indicators such as national income, inflation, unemployment etc.

3.1 MACROECONOMIC TERMS

3.1.1 Gross Domestic Product

GDP is the monetary value of all the products and services coming from within the geographic borders of an entity (say, a country) over a stipulated period of time (say, an year). One can also state GDP in terms of national income: If we subtract income from foreign countries from the national income and then factor in capital value depreciation, we get a nation's GDP.

GDP is usually specified in USD, although it can be specified in any other currencty - it is just that since USD usually holds in value, in an average sense, against all other currencies in the world, it is used as a universal unit for measuing GDP of a country. Having said that, even if the GDP of two countries are both listed in USD, it would be incorrect to compare, say Britain's GDP figure with India's GDP figure and infer how Britain is relatively wealthier than India. Such direct comparisons are meaningless because what 1 USD can buy in India is much more than what it can buy in Britain [1]. This is the topic of our next section.

3.1.2 Purchasing Power

From one country to another, there can be huge differences in what one can buy with a given amount of money. Let us consider an example of India vs. Britain. At today's (Apr 3, 2016) exchange rate, 1 GBP = 94 INR. But one can buy 4 times as much goods in India using 94 INR that what one could buy in Britain using 1 GBP. Similarly one can buy 3.333 times as much goods in India using 66 INR (1 USD = 66 INR), than what one could buy with 1 USD in the U.S. In other words, Indians

[1] It is separate topic in itself as to why this disparity exists. But just to give an idea, one may think of health care expenses as being cheaper in India than Britain because India has more doctors or doctors in India charge lesser fee or both.

have more "purchasing power" than Americans - if we assume that Indians always buy domestic goods and Americans do likewise.

It is important to remember that the process that is used to find out this purchasing power considers a select basket of goods. It is debatable whether a particular basket of goods make sense or if the idea that the same basket of goods mean the same thing in different countries is acceptable. For instance, in the U.S., whether there is a lack of public trasport, the prices of bus tickets for a given distance of travel could be several times than that in India. However, in the U.S., not many people value public transport as much as people in India do. So if the basket of goods contains the cost of public transportation, then obviously India will fare better compared to the U.S. - but such a comparison may not be useful at all.

GDP (Nominal) Vs. GDP (PPP)

In the previous section, we talked about GDP. That quantity is generally referred to as *GDP (Nominal)*. In other words, it is indicative of a country's economy only in a nakesake sense. People usually factor the puchasing power into this GDP figure and come up with another quantity called *GDP (PPP)*. Thus, India's GDP in 2014 was 2.051 trillion USD (nominal) and 7.411 trillion USD (PPP) [2].

3.1.3 Wholesale Price Index and Consumer Price Index

One of the indicators for the economic wellbeing of the people of a country is a weighted sum of the prices of a basket of goods in that country. If the prices considered are whole sale prices, then it is WPI and if they are prices at the retail shops, then it is CPI. Unlike GDP and PPP, WPI/CPI is not used to compare one country's economy against that of another. Hence different countries use different basket of goods and different weightages for them. Normally the chosen basket contains basic goods that every citizen would like to buy, thus including food, clothing, soap, fuel etc.

3.1.4 Inflation

Inflation is closely related to PPP and WPI/CPI. It is a measure of by how much the WPI/CPI has increased (or decreased) in one year as compared to the previous year or a chosen benchmark year [3]. If inflation increases, it could mean that the purchasing power of the common man has decreased. In general, when an economy sees huge development, it results in increased spending by citizens which would raise the demand on many goods leading to rise in inflation. If the fruits of economic development reached only a selective section of the people, then inflation could result in the sections that were left-out in the economic development to

[2] Since the U.S. is the standard economy against which the purchasing power of all countries are measured, the purchasing power conversion factor of USD is 1. Thus for the U.S., GDP (Nominal) = GDP (PPP)

[3] India used to use WPI to measure inflation. But we have recently switched to CPI.

suffer - some of the items that they could afford ealier could become unaffordable due to rise in inflation.

Effects of govt. regulations on inflation

In countries where governments regulate the economy, the government usually takes measures to decrease inflation or keep it from increasing. In India, RBI is tasked with controlling inflation. When inflation needs to be reduced, RBI increases interest rates - i.e., interest rates on the loans they give out to other banks. Consequently other banks also increase their loan interest rates. This ends up discouraging people to get loans and hence reduces their spending, thus bringing down the inflation. On the other hand, when RBI goes for "rate cuts", it encourages people to go out and spend.

Measures to control inflation have both positive and negative effects. When RBI increases interest rates, the common man may benefit due to reduction in the prices of essential goods. But since it reduces spending, people will no longer give as much business to shops, theatres, real estate companies and that would result in decrease income to the said businesses. Consequently, in order to keep the profit from dropping, these companies could decide to cut down on expenses, which could then result in employees being laid off. Thus RBI has to walk a fine line to make the common man happy while preventing him from losing his job.

RBI rate increases/cuts have some side effect on people's investment behaviours. When RBI cuts interest rates, banks consequently follow. As a result, companies can go to banks for money via loans than go take money from people via bonds. So bonds become less attractive. But now that companies will have increased cash flow (since they can easily raise cash but getting loans from banks), they are expected to become more productive - so equities (shares) become more attractive. And when RBI increases rates, the exact opposite happens.

3.2 A NOTE OF CAUTION ON MACROECONOMIC INDICATORS

As the name suggests, macroeconomic indicators give us only the big picture about the economy. When the GDP of a country increases, as compared to previous years or as compared to other countries, it indicates that the country, overall, is doing good. But it doesn't say anything about how equitable the economic growth has been. In other words, while the collective income of all the citizens has gone up, it is possible that the income of some citizens increased tremendously while the income of some others didn't increase, or at worst, actually decreased. In fact, it is normal that most of the country's GDP comes from a tiny percentage of its population. In the U.S., in 2013, 23 % of the national income (closely related to the GDP) was due to incomes of just 1 % of the population! Thus macroeconomic indicators may not indicate the well being of majority of the population! There are better indicators for measuring the well being of the majority of the population. One such is HDI, the *Human Development Index*, a measure invented by Amartya Sen. Similar to how the purchasing power or inflation is measured, HDI uses a

weighted sum of a basket of indicators such as life expectancy, literacy rate, crime rate, women's safety and factors indicative of the general standard of living.

4 ACCOUNTING

Income statement, balance sheet and cash flow statement are three important financial statements in accounting.

4.1 INCOME STATEMENT

Income statement shows the items related revenue, operational expenses and profit. Table 4.1 shows a sample income statement.

Figure (INR)	2008	2009
Net Sales	1,500,000	2,000,000
Cost of Sales	(350,000)	(375,000)
Gross Income	1,150,000	1,625,000
SG&A	(235,000)	(260,000)
Operating Income	915,000	1,365,000
Other Income (Expense)	40,000	60,000
Extraordinary Gain (Loss)	–	(15,000)
Interest Expense	(50,000)	(50,000)
Net Profit Before Taxes (Pretax Income)	905,000	1,360,000
Taxes	(300,000)	(475,000)
Net Income	605,000	885,000

Table 4.1: A Sample Income Statement

- **Net Sales:** Revenue from sale of goods. It is also referred to colloquially as 'Revenue' or 'Revenue from sales'
- **Cost of Sales:** Cost of production. This includes cost of labour, raw materials, energy cost incurred towards production of goods etc. Depreciation (Capital

value depreciation) can be accounted as part of the Cost of Sales only when the asset in question is directly associated with production - Otherwise it will be included in OpEx (see below). Cost of Sales is also referred to as COGS - Cost of Goods Sold

- **Gross Income:** Net Sales - Cost of Sales.
- **Operating Expenses:**
  - SG&A Selling, General and Administrative expenses: Includes advertisement cost, salaries to employees not directly involved in production likes sales personnel, executives and R&D expenses[1]. Sometimes R&D expenses are shown separately as an item. This is so as to give investors an idea about how much the company is spending on order to have a bright future.
  - Depreciation and Amortisation: Depreciation of assets not related to production) and amortization
  - Other operating expenses
- **Operating Income:** Gross Income - Operating Expenses.
- **Other Income:** Interest/Dividends from investments
- **Extraordinary Gain (Loss):** Something that isnt́ recurring (otherwise it would have been accounted for in one of the above bullet points.
- **EBIT**: Earnings before interests and taxes = Operating Income + Other Income + Extraordinary gain (loss)
- **Interest Expense:** Interest to be paid on loans to banks, on bonds.
- **Pretax Income:** EBIT - Interest expense

Apart from these there are some other terms dervied from the above terms. These are:

- **Gross Margin:**
$$\frac{Net\ Sales - Cost\ of\ Sales}{Net\ Sales} * 100\%$$
- **Operating Margin:**
$$\frac{Operating\ Income}{Net\ Sales} * 100\%$$

[1] Whenever there is a confusion as to whether an expense is part of COGS or SG&A, one can check if that expense varies, more or less, linearly with number of goods produced - If yes, then it is part of COGS. For example, in a car manufacturing plant, the salaries of labourers who put the car together will have to be added to COGS as producing more cars implies employing more such labourers or keeping them in the employ for a longer period of time

4.2 CASH FLOW STATEMENT

The cash flow statement is distinct from the income statement and balance sheet because it does not include the amount of future incoming and outgoing cash that has been recorded on credit. It shows whether the company will be able to pay its obligations on time and hence won't risk bankruptcy. Cash flow statement involves three components:

- **Core Operations** component of cash flow reflects how much cash is generated from a company's products or services. Generally, changes made in cash, accounts receivable, depreciation, inventory and accounts payable are reflected in cash from operations.
- **Investing** component records cash outflow due to conversion of cash into other forms of capital (ex., machines, building) and cash inflow due to divestment (ex., selling machines, building)
- **Financing** component records cash outflow when dividends are paid to investors and cash inflow when capital is raised from investors.

4.3 BALANCE SHEET

Balance items has three major items namely Assets, Liabilities and (Shareholerś) Equity. The following equation shows the relationships among them:

$$Equity = Assets - Liabilities$$

- **Assets:** Includes all forms of money realizable
  - **Current Assets** are those that can be quickly converted into cash when needed. The most important ones are:
    - **Cash:** Needs no explanation. More cash implies more liquidity and hence protection against tough times. It also means possibility of an investment at short notice (market for a new product suddenly opens up). Dwindling cash is a sign of trouble. But if lots of cash is lying around balance sheet after balance sheet, it means the company is struggling to grow or the management is short-sighted and do not know how to invest the cash.
    - **Accounts Receivable:** Money that we are expecting to receive. This could be because we had sold our product on credit and soon the customer is going to pay for it.
    - **Inventory:** Raw materials purchased but not utilised, finished good that is not yet sold or any intermediate good not converted to finished product yet. Inventory turnover (cost of goods sold

divided by average inventory) measures how quickly the company is moving merchandise through the warehouse to customers.If inventory is growing faster than sales, it signals deteriorating fundamentals. On the other hand, if the inventory isńt keeping up with sales, the company would miss out on sales opportunities.

- **Long Term Assets** contains
  - **Fixed Assets:** Machinery, buildings owned etc. Usually the value reported for fixed assets are not easily verifiable and companies tend to inflate these figures. So investors dońt pay too much attention to these
  - **Intangible Assets:** Intellectual Property, Copyrights, Brand value, Good Will etc.

⋆ **Liabilities:** Whatever the company owes to others - that is money it needs to pay, but has not paid yet.

- **Current Liabilities:**
  - EMI type payments on debts
  - Rent, wages owned etc.
- **Long Term Liabilities:**
  - **Long-term Debt:** Interest/capital payments on debts, bonds

⋆ **Equity:** Sometimes called "net assets". Contains two important parts namely,

- **Paid-in Capital:** Money that was originally put in when the company started and directly invested at some other point in time.
- **Retained Earnings:** Money retained from net income (after paying dividends, if any) within the company to be reinvested.

There is something called an Off-Balance Sheet Debt that investors should be aware of. This is a way companies use to hide away some debts.

4.3.1 Quick Ratio

$QuickRatio = \frac{CurrentAssets - Inventory}{CurrentLiabilities}$. If this is $>= 1$, it means the company has enough liquidity to cover their short term obligations.

5 FINANCE

5.1 RISK VS. RETURN

Why would anyone invest money instead of keeping the money at home in a safe? it is because we want to grow our money. Why do we want to grow our money? There is a need and greed to do so - The need is that, inflation will render our money less valuable in the future. So we have to grow our money at least as much as inflation devalues our money. The greed is self explanatory. In this section, our entire focus will be on how much growth one expects from an investment - We will start with the simplest of markets, where there is only one security in which we can invest, and introduce more and more securities to see how our decision would change in each case.

5.1.1 Single riskfree bond

Suppose the market only has one security - it is a riskless government bond, which offers \$1 after one year. How much should we pay for this bond? Suppose inflation rate is 2% yearly. Then it makes sense that, at a minimum, if we stick $\$x$ into $\$x * (1.02)$. The reason is, if it doesn't pay at least this much, we would just buy all the non-perishable items in the CPI basket with $\$x$ and keep it home and sell them after 1 year and make $\$x * (1.02)$. So if the bond face value is \$1, then we cannot pay more than $\frac{\$1}{1.02} = 0.9803 * \$1 = \$0.9803$. The multiplicative factor 0.9803 in the above calculation is called the **discount factor** - It is the factor by which we discount a future dollar. One can think of it as a way of converting a future dollar into today's dollar (just like we would use a conversion factor to go between two different currencies). If we want to converse in terms of the denominator, the value in excess of 1 is called the **rate of return** or simply **return** - i.e.,

$$r = \frac{\$1}{\$0.9803} - 1 = \frac{\$1 - \$0.9803}{\$0.9803}$$

. So the return is essentially profit divided by invested amount[1].

[1] We are assuming that there won't be any tax on the profit. This isn't necessarily true. But for pedagogical reasons, we will assume that there is no tax in any investment. Also we are assuming that there won't be any warehousing cost if we want to buy instead a basket of CPI goods and store them. If this is not true, the returns we demand from a riskfree bond may be even lower than the inflation rate

U.S. treasury bonds, considered riskfree typically trade at a few basis points above the inflation.

5.1.2 One risk-free bond and one risky bond

Now, let us say that we have a choice between a riskfree government bond and a corporate bond that is risky - risky in that, there is a chance of default. Let us say that on a \$1 investment in this bond, there is a 50% chance of default where we get \$0 in return after one year and a 50% chance that we will get $\$2x$. This means the expected value of this investment is $0.5 * \$0 + 0.5 * \$2x = \$x$. The question is what should be the value of $\$x$ that will make us invest in the corporate bond instead of the riskfree government bond? Since \$1 invested in a government bond will give us \$1.02, $\$x$ must be greater than \$1.02. How much greater? The answer is entirely a personal choice - And hence it will vary from one person to another. Let us call the return from this risky bond as$R_i = \frac{\$x}{\$1} - 1$. Suppose we call the risk free return of the government bond, r_f, we have:

$$E[R_i] = r_f + risk\ premium$$

where, the risk premium is the excess return on top of riskless return that we need in order to invest in the corporate bond

In the wake of that question, we can make the following additional observations:

- The probabilty of default is a prediction. And the prediction may be right or wrong. So the risk premium must contain within it, an uncertainty premium - because there is any uncertainty involved at all as compared to a risk-free bond - and also a prediction premium because we are taking a risk in making a prediction of the probabilities. In other words, there is a probability that your probability estimates are wrong
- Other people in the market may estimate the chances of default differently than us, besides the fact that they may want a demand a different risk premium than we do.
- The price of a security, whether or not it is risky, will depend entirely upon supply-demand. So the price may be higher than what we demand or lower. Even though the prices are fixed by the market, our decision to invest or not should depend only on our appetite for taking risks and the returns that we want. There isn't really such a thing as a "fair price" for a security.
- The predictions about chances of default can be made only with available data - i.e., present and past data. We cannot predict based on future data

So far we have considered government bonds to be risk free. But the truth is, the risk free return is a misnomer because it is just a rate the market collectively

demanded as something greater than the rate of inflation - And the rate of inflation itself is a prediction (although very accurate). This is the reason why the price of government bonds (which is a function of only r_f as the cash flows are constants) varies from time to time. If it was truly risk free, that wouldn't be the case!

5.2 ONE RISK-FREE BOND AND TWO RISKY BONDS

Suppose we have two corporate bonds in the market, one - call it bond A - that gives \$2 or \$0 with a probability of 0.5 each and another - call it bond B - that gives \$1.5 or \$0.5 with a probability of 0.5 each. Both have a one year maturity period. The expected nominal value of both bonds at the end of the year is the same - \$1. But would we pay the same price for either of the two bonds? intuitively, it doesn't sound right to pay the same price to both bonds. However articulating this intuition is difficult with bernoulli R.V.s. We will instead explain it with normal R.V.s in the next section. For now, it feels like the price should be a function of the standard deviation and not just the mean nominal value of our investment at the end of the year - because standard deviation is the thing that is different between bond A and bond B: For bond A, it is \$1 and for bond B, it is \$0.25.

Before we move on, it is worthwhile to note that, with bond A and bond B, although our demanded returns R_A and R_B are different from each other, both will differ only in their risk premiums - i.e., both are required to be higher than the risk-free return. Taking all of these into consideration, we could come up with the following equation:

$$R_x = r_f + f(\mu_x, \sigma_x) + prediction\ premium(x)$$

where f is a function that results in a unit less quantity.

5.3 MARKET WITH DIVERSIFICATION POSSIBILITIES

Suppose there are two corporate bonds, identically distributed such that each has terminal nominal value of \$1 if it succeeds and \$0 if it doesn't. If we buy two units of any one of the two bonds, then there is a 50% chance that we will come up empty handed and 50% chance that we will come with \$2. Instead, suppose we buy one of each bond and create a portfolio. What will be the terminal value of that portfolio? The following table shows all the possibilities:

We can obseve that, with diversification, we get a trade off between the upside and the downside - With the portfolio, we can see that, we have only a 25% chance of coming up empty handed, as opposed to 50% of the time in the single bond case. This did come at a price: The chance of getting a \$2 return is now only 25%, whereas it was 50% before. What we have done with the portfolio is that we have reduced the risk of coming up with nothing at the cost of reducing the chances of getting the highest possible return.

	Bond B succeeds	Bond B fails
Bond A succeeds	$2	$1
Bond A fails	$1	$0

Table 5.1: Nominal terminal value of our portfolio

Note that the benefits of diversification is only available when the two bonds in question are independent of each other. But what if they are not independent? We look at the following possibilities:

- Both bonds are perfectly, positively, correlated: In this case, there is no difference between investing in a portfolio of two bonds or putting all your money in just one bond. The payoffs and their probabilities are identical
- Both bonds are perfectly, negatively correlated: In this case, the payoff is certain! We will get $1 in all possible scenarios. So the portfolio basically becomes equivalent to a risk-free bond!

In general, when two bonds are perfectly, negatively correlated to each other, if we put them together in the portfolio we get $\sigma_P = \sigma_X - \sigma_Y$, where σ_P is the portfoilio standard deviation. So if $\sigma_X = \sigma_Y$, then $\sigma_P = 0$, which is what happened in our example case above and we ended up with a certain payoff. Even if $\sigma_X \neq \sigma_Y$, still, σ_P becomes small as long as X and Y are negatively correlated. Note that the expected payoff for a portfolio is, $E[P] = E[X] + E[Y]$ no matter whether X,Y are correlated positively or negatively or completely independent.

5.4 TERMINOLOGY

- **Market Capitalization:** Outstanding stock * share price (of a company)
- **Creditor** is someone to whom the company owes money in the form of loan/bond interest/capital payment. In other words, the assets contributed by Creditors appear in the liabilities portion of the balance sheet.
- **Investor** is someone who owns equity in the company. In other words, the assets contributed by the investor shows up in the equity portion of the balance sheet.

5.5 METHODS OF FINANCING

The sources of financing are, generically, capital self-generated by the firm (retained earnings) and capital from external funders, obtained by issuing new debt and equity

- **Debt** *from the companyś PoV* is attractive when loan interest rates are low. The good thing about debt is that, it is a simple expense that does not change the ownership structure of the company. It appears as a predictable expense in the balance sheet. Since it is considered an expense, income taxes are calculated after debt payments are made. The downside of debt is that it does affect the cash flow statement, and when the company is going through hard times, the need to pay off creditors on time could create headaches.
- **Debt** *from the creditorś PoV* is attractive as it is less riskier than equity. When a company becomes bankrupt and is liquidated, creditors are first paid followed by preferred stock owners and if there is anything still left, only then are common stock owners paid.
- **Equity** *from the companyś PoV* is attractive because, it is not obliged to pay the equity owners, i.e., investors, money on time - Basically investors are the owners of the company and if the company is losing money, it is same as owners losing money. The downside is that, equity owners will now have a say in how the company should be run, where it should invest its retained earnings etc. If company sells 50% of its stock to someone early on when the company was not doing well, that someone will continue to own half of the company indefinitely even if the companyś earnings have drastically improved over the years.
- **Equity** *from the investorś PoV* is attractive because it usually has more returns than debt - this comes, of course, from the inherent risks involved.

6 INVESTING

6.1 TECHNICAL ANALYSIS

Technical analysis involves looking at a stocks movements in the stock market and basing investment decisions solely on them. Technical analysts assume that risk and return go hand-in-hand.

Return is simply the money one would obtain while selling a stock s/he owns. Although return could also involve dividends, in practice, technical analysts look for short term returns which, most of the time, involves only money earned from selling stocks rather than dividends. When the term "Returns" is used quantitatively in technical analysis circles, it means annual return[1].

Risk has no official definition. It makes sense to think of it as the probability of losing certain amount of the invested money. One could draw a probability distribution curve of possible amounts of profit in the x-axis and their probabilities in the y-axis. In such a probability distribution, risk would be the area under the distribution to the left of 0 in the x-axis[2]. One could also pick any negative x-axis value and term the area under the distribution beyond that value as the risk of losing more than that value. Note that, in this context, volatility of a stock would correspond to the variance of the distribution - the higher the variance, the higher the volatility.

Technical analysts use the following measures of risk/return to make their decisions

- **Alpha** is the excess return of investment (RoI) of the fund relative to the RoI of the benchmark index of that investment category. Alpha is a measure of returns.
- **Beta** is the volatility of the fund relative to the market as a whole. Beta is a measure of risk.
  - $\beta = \frac{covariance(f,b)}{variance(f)}$
  - $\beta = correlation(f,b) * \frac{\sigma(f)}{\sigma(b)}$

[1] I still dont́ know if it means annualized returns

[2] assuming that the distribution was drawn after making inflationary adjustments

- **R-squared** is the cross-correlation coefficient between the benchmark index and a fund. It represents the percentage of a fund portfolioś or securityś movements that can be explained by movements in a benchmark index. The higher the R-squared value, the tighter the correlation and higher the likelihood of it following market movements (for that fund category) In other words,
$$R^2 = correlation(f, b)$$
- **Standard Deviation**, $\sigma(f)$ is the standard deviation of the fund returns from its mean
- **Sharpe ratio**
$$Sharpe\,Ratio = \frac{Return\,of\ the\,fund - Risk\,free\,return}{\sigma(f)}$$

[3,4]

Alpha can be seen as a measure of the fund managerś performance. High alpha and lower Beta together make a fund better than others. Alpha and Beta need to seen in the context of R-squared. If R-squared, i.e., correlation between the fund and the index, is week, then there is no point in looking at alpha and beta. On the other hand, If R-squared is strong (high), it may mean that the fund manager simply managed the fund such a way that it followed the index. This is useless as we can also do this simple management - Why pay a fee to the manager to make the fund perform as good as the market?

[3] "Risk free return" in the U.S. context means U.S. treasury bond returns
[4] It is not clear whether "return" here means annual return or annualized return