Macroeconomic Theory and Stabilization Policy
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Lecture – 6

Now, I begin first lecture today that will be on the third topic, in these books they also mentioned that this is the classical model, I will talk about the first macro model algebraically that I have seen this is the classical model, so this is the topic 3.

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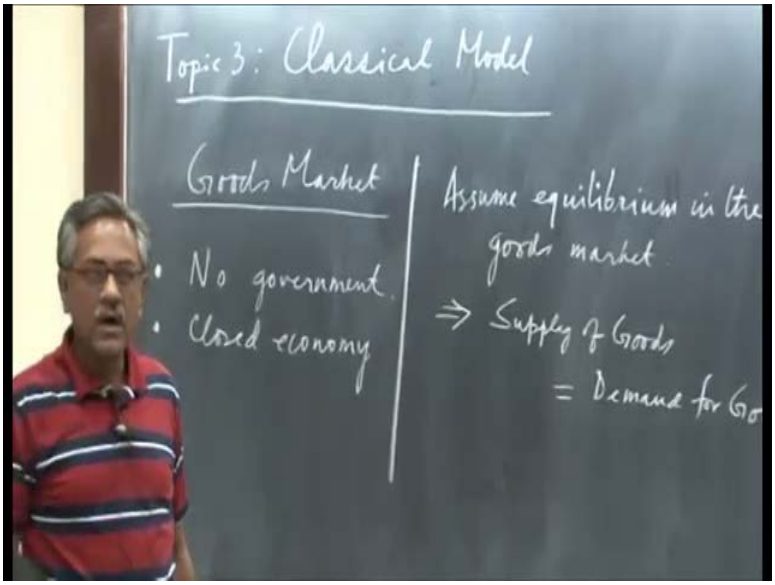

So, I begin talking about the classical model first macro model, now what did I tell you in topic 1, that structurally a macro model is broken up into 3, sections the goods market, the money market and the labor market. The goods market, and the money market constitute the demand side of the model, labor market along with the few other things constitute the supply side of the model.

So, in the classical model it should be the same thing, there should be a good market, there should be a money market, and there should be a labor market. So, let us talk about the goods market, if you recall the classical model was or does talk about along run economic situation, and Keynesian model or model stock about describe a short run and medium run economies. And the classical model describes the long run what happens in

the long run, we usually assume in the long run there is full employment; that means, any un employment that exists is frictional unemployment.

In the long run all you have is full employment, hence this model that I am going to call classical macro model, this one must be describing or having those features long run features like full employment. In the goods market, the literature if you go back to the original literature the right things of the classical macro economics, you find that there are some scatter writing here and there, but they all put together with essentially mean, we were asked to read some of the books.

When, we where students from where it was not so clear, what classical model meant sometimes, although may be we have read 20 to 25 pages is still was not clear, what the model mean, but the model basically means this. Imagine our country or an economy where there is no government, so the first assumption is that, there is no government, so we will ignore government expenditures that the first assumption, no government.

Given that the private economy or what we call the economy, therefore constitute or, therefore is made up of private economic agents who have two kinds of activities. If you go back to your discussion on national economic accounting, to types of activities say the expenditure method you go back to that, is that they have the consumption activities, they spend money and they have private investment activities.

There is no government and also we are going to assume in this classical model, that is a closed economy, their no export and import the country is close to any foreign interaction, interaction with any other country. So, there is no export, no import, and we would have only a closed economy, so we would next thing we will assume is that, it is a closed economics is no export, no import with other countries.

Now, the problem is to set up the goods market in the classical model, I essentially require 2 identities, that I would make use of to describe the goods market. What will be the goods market showing, the goods market will be showing essentially an equilibrium condition, all market show equilibrium condition in terms of supply and demand. So, what I would be looking for is what are the variables, that define this equilibrium condition, we would assume equilibrium in the goods market.

The equilibrium in the goods market is essentially would mean, that supply of goods should be equal to demand for goods. This to describe this equilibrium condition, because in economics I tell you we have equilibrium condition everything, we describe in terms of equilibrium condition, unless we reach equilibrium condition, we are very unhappy. This is how economics construct models, this equilibrium models are very rare, so in order to set that up, what we would require we would require two kinds of identities, that are I will make use of.

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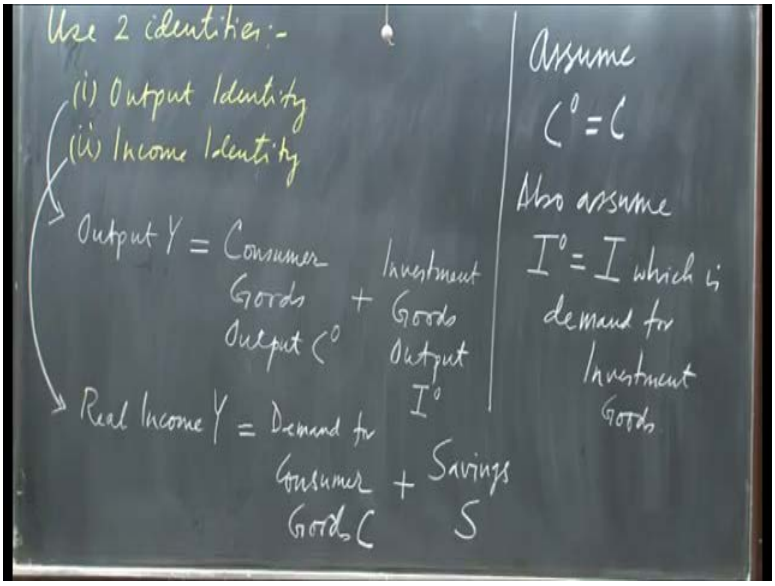

We will use two identities, one is called the output identity, the second one is called is the income identity, now what is now output identity. The output identity would essentially say that output y is equal to consumer goods output C naught you can call that, plus investment goods output I naught, so there are two kinds of output that are produced.

Now, the income identity essentially says real income Y, that I need to explain that why real income have become Y, is equal to demand for consumers goods plus what do they do. If they get income they spend on consumer goods, what else they do, which is consumption goods expenditure is essentially plus very good, who said savings, very good plus savings.

Now, this is the manipulation that I will do, this is how it is defined, essentially this real income of the people determine the demand for goods, this is how the expenditure

approach under national income accounting, under simplified form. You spent on consumer goods plus whatever you could not spend is saved, what I would assume is that, and which I have already done that the output is equal to real income.

Let me explain this first, then I would explain the rest of the things, when will the value of goods that I produce, say take on factory value of goads, that I should use will be equal to total income generated from that factory. And say that factory represents a company, when will that be a case, if the value of goods are measured at factor cost, then you minus the indirect taxes, add the subsidies which I though in national income accounting. Then what ever value of that goods part as gone to wages, part as rent, part as any other raw material, cost, etcetera, part as invest income, and whatever remained which we call the organizers profit.

All are factor income, so value of goods is equal to factor income generated will be true if the variable are measured at factor cost, but if the variable are at the market prices, then the value of goods is not equal to factor income, because at market price you also have governments including which are taxes. So, the factor income plus taxes which is govermence income, mix up the market price, so it is not all factor income, so all I am saying here using the same notation.

Now, you take the real value by defecting GDP defalcator, a consumer price index, whole sale price index, you remember for nominal variable, I can go real variable. 10 kg of apple, I brought 5 rupees 50 rupees per kg, 500 rupees I have spend, total value of apple 500 rupees, the real value of apple nominal value divided by the prices is 10 kg's of apple. So, the real output is in real terms, which is equal to real income; that means, value of output is equal to income, in real terms difficult terms, if they are measured in factor cost.

So, I am not using market price variables, number 1 point, number 2, if this represents the demand side, and this represent the supply side, supply is equal to demand, will be true under what condition, y is equal to y already. This is supply and this is suppose demand, income determines demand, now when these two will be equal, if the right hand sides are equal.

Let me make a few assumptions, let see if this makes sense to you, let us assume, that consumer goods output is equal to consumer goods demand, let us call consumer goods

C naught, the consumer goods demand, that is called as C. And let us call that S savings, give these variables name, let us assume C naught is equal to C; that means, output of consumer goods is equal to demand for consumer goods.

Suppose, we assume that, also assume investment goods output, I naught is equal to I which is demand for investment goods, companies demands for investment goods, what are investment goods different from consumer goods. What will they be, machines, inter mediatory goods, these are demand for investment goods, which is different from consumer goods, and 2 types of goods are produced in the economy, output identity is same.

One is investment goods output, machines, rods, tools implements and factories, etcetera, and then you have consumer goods output, which you and me consume, which is called final goods [FL]. This is the identity I said, output identity, so suppose I am saying this investment goods output also matches investment goods demand, which a have not written anywhere, let us call that I.

Now, you tell me when will the equilibrium condition go, if this is the demand real income measures the demand for goods, your income will measure, your demand for goods, and what you do not demand is you saved. Now, you tell me when would the supply output to be equal to demand for output, when will that be condition hold, if consumer goods output is equal to demand for consumer goods. If investment goods output is equal to is also, demand for investment goods in place it implicit assumed, assumed in the background.

Then when will equilibrium conditions supply of goods equal to demand for goods under what condition, when will that be true when savings is equal to investment, this will be true when savings is equal to investment, when savings will equal to investment. So, I am assuming that real income measures, this income that identity demands for consumer goods for savings, output of goods is this, also I made one assumption that investment goods output is equal to investment. Demand which is whatever, demand for investment which is not shown here, another thing what you can write here is as I assume output which is supply.

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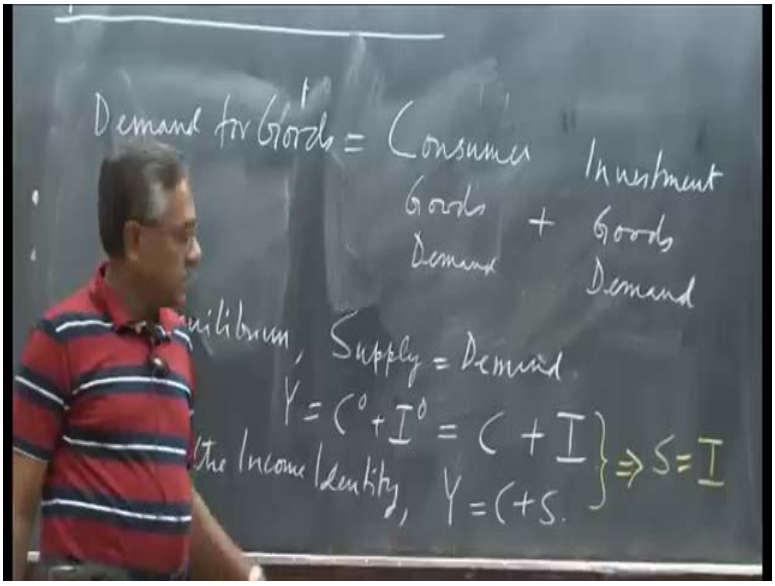

And you can write demand for goods is equal to consumer demand or demand for consumer goods plus investment goods demand, now in equilibrium supply is equal to demand. Therefore, what you have is consumer goods output plus investment goods output is equal to consumer goods demand plus investment goods demand, you can write that.

Therefore, if consumer goods output demand for consumer good if I assume that, then automatically investment goods output will be equal to demand for consumer goods, now given the income identity, what you have is you can write Y is also equal to C plus S. Therefore, through comparison this is also Y remember this is also Y C naught plus I naught this is also Y, so given the comparison real output income is equal to real income, it follows the C and C and S and I, which I have written earlier.

Therefore, it follows the income identity, given the income identity it follows that S should be equal to I, you can put it this way, instead of jumping one stage from the output identity, and the demand identity I did not show. It can also be shown just one assumption is required, consumer goods output should be equal to demand for consumer goods, therefore investment goods output should be equal to investment demand.

Now, since Y and Y are the same C plus S should also be equal to C plus I C C are same variable, therefore S should be equal to I, in equilibrium. You can put it this way, I may jumped one stage, I did not show the demand kind of equation or identity there, I told

demand identity I did not show, the total demand identity means it will always be true. Total demand is consisted of 2 items, demand for consumer goods, and demand for food investment goods, total output again an identity, it will be a consumer goods output plus investment goods output, whatever the amount is.

If you make one assumption which I make, assume C naught I equal to C, then also assume is not required this follows, if you assume C, when this is not what is required, C naught is equal to C, then I naught from equilibrium condition it follows. That I naught is equal to I, investment good output is equal to investment goods demand, the basic point is these identity establish that in equilibrium savings should equal to investment, that is the main message that comes out. That means, whatever money in real terms economies saves, may be they put it in a bank is also demanded by the firms for investment purposes, the balance in equilibrium, if a whole is, therefore what I would do is the following.

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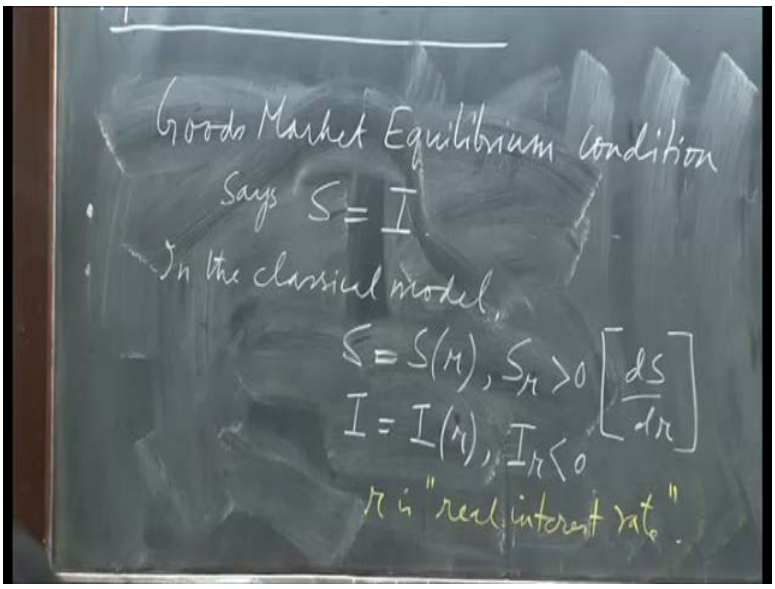

Therefore, the goods market equilibrium condition, says or implies savings is equal to investment this is very important, in the classical model savings is the function of r where S r is positive, S r is nothing but d S d r that derivative. And I r is the function of r square I r is negative, r is real interest rate, what it says is that as interest rate in economic increases, savings increases. If bank pays higher interest rate, then economics is more, and if banks charge higher interest rate when they give out loans to the

companies, companies demand less amount loan, because interest rate is the cost of borrowing for the companies.

If they a taking loan from and bank says this quarter interest will be higher their discourage to borrow, because that increase the cost of borrowing. So, the interest rate has to different kind of relationships or savings and investment has 2 different kinds of relationship with interest rate, savings have a positive relation with interest rate higher, people like to save more could money in the bank, because the interest gives them a better return.

So, they preferred not to pay, now because savings is not spending not to spend now, spend in future when I earn more where as for the companies, if the interest rate is high, then they are discourage to borrow. So, the borrowing amount, loan amount goes down therefore, the investment amount also goes down they demand less, this is the standard relationship or standard functional relationship of savings, and investment.

That is easy for us to understand using our common sense or experiences whatever; however, there is catch why real interest rate, remember one thing, which I probably did not mentioned. In macro models unless specified, all variables are always are defined in terms of real magnitude, so consumption investment, income, they are all in real terms. Because, in money terms I told you it can be very confusing, if the output volume is going up or not, because prices can increase and in many terms in nominal terms the value of output can be shown to be higher which does not necessary means the physical volume of output is higher.

Therefore, in macro models, which I told you I was talking about that in relation topic 2 real variables, constant variables, etcetera, those variables definitions I used. In macro models all variables unless specified, that this will be nominal terms, for instance one variable in nominal term, which you will find in macro models is prices. Prices are not in real terms, prices are always in rupee terms, current prices nominal terms, then another variable which you will find nominal terms, later you will see money supply.

Money supply is not, we may use real value of money supply, but money supply is explicitly mentioned in macro models, which is in nominal terms, how much rupee supplying floating in the economy, I will define money supply later. Now, here savings is a real savings in the economy not nominal; that means, the money they have saved in

physical volume, they can demand or can be use to buy more goods, higher savings means investment also in real terms, and their function in real interest rate.

Now you would ask me the question sir, the interest rate, that banks pay, you when you open an account or fixed deposit account, the savings account or when a company borrows money the interest, they ask them to pay is it really the real interest rate or the nominal interest rate. What kind of interest rate are they, well that interest rate which the bank tells you, which is the deposit rate, which is the savings rate or fixed deposit account rate 8 percent, 7 percent, 9 percent, whatever it is.

They are not real interest rates, they are nominal interest rates, then you would say, sir why do we have real interest rate, if they are nominal interest rate why do you have the real interest rate. One simple quick answer to that is that, these static models, classical models or Kantian model, when we talk about that, we do not have dynamic variables, which are time derivative variables, so we do not talk about inflation directly here. So, normally what we do any price change anything we show, we show that has a once, a onetime change in time the two time change in price, or a precision change in price which is the basis for inflation or deflation.

So, since they are static models, and we do not have dynamic models that Y dot d y d t, p dot d p d t or whatever s dot d s d t, we do not have then we essentially have the static variables, we cannot really talk out inflation. So, we in some way is we can give you a hint as what inflation mean in a model like that, or what this model would have for this inflation, but we directly do not have explicit do not have inflation as a variable here.

Inflation variable usually we use pi as a notation, you will not see pi, but you will see p is pi level, which can be CPI, GDP reflector, whole WPI, whatever and if changes, if not process change we cannot talk about we change once in a, something is changing it has also changed. Nothing is saying that it will keep on changing beyond that, so we do not have inflation number 1, since we do not have inflation, we need not talk about nominal interest rate, you would say sir nominal interest rate inflation, why is that connection.

This is famous economists early 20th century American economist, wrote some books and they still is used, and he defined one of the most easiest way I will call it correct way the relationship between nominal real interest rate, let me write it down before I go in to further discussion on the classical model.

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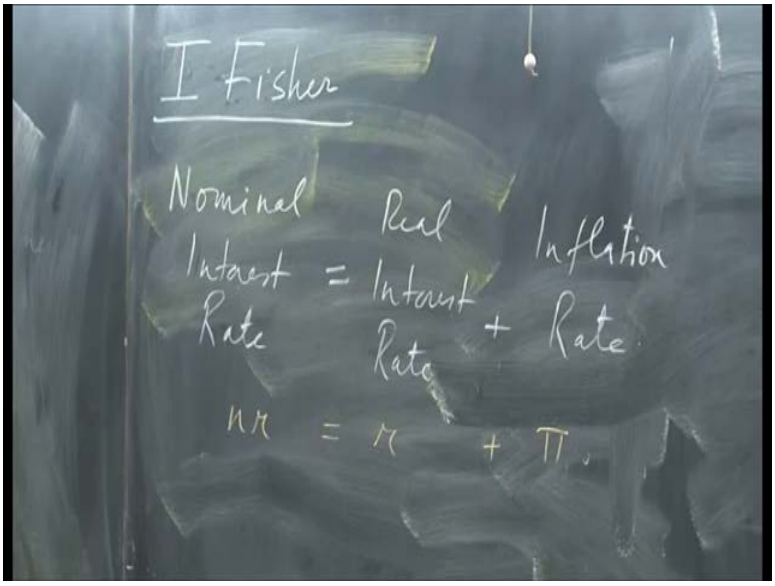

What he wrote I fisher gave a relationship between nominal interest, and real interest rate, he said that nominal interest rate is equal to real interest rate plus inflation rate. So, suppose I say in terms of algebraic notation nominal interest rate is n r, which is equal to r plus pi. So, that is the relationship he established an algebraic relationship, it is like identity nominal rate is always equal to real rate plus inflation rate, what does it mean, the inclusion here is probably not very difficult, how can I explain that to you.

Let me explain that to you suppose a business man is borrowing money from a bank, and paying at the nominal rate of 14 percent, 16 percent, 18 percent whatever it is. Thus the bank interest rate, loan rate, we call that loan rate in India elsewhere also, the loan rate two standard rates are there interest rates in banks deposit rate your savings account [FL] multiple deposit rate [FL] various kinds of savings account etcetera, fixed deposit.

And one is the loan [FL] and that also will be multiple loan rate, because there are various kind of loans, working capital loans fixed loans etcetera, money and banking course about that will talk about that. We need not go into that, we know that when banks gives out loan to a company, company is suppose to pay an interest, as a loan rate. When we also know when we open a account put money in a bank, we get the deposit rate, and interest rate which is called deposit rate, suppose a bank have borrowed a money at 18 percent something.

Now, when the bank borrow the money if he also stock by with that money some raw materials etcetera, for whatever purpose, for his investment purpose, for his company purposes, he has brought raw material at the current prices. And also some stock exists form the previous period, and then after 1 period, whatever the period say 1 year, usually interest payments are like spread over 1 year. They counted per year and then they be broken up into quarters that is different, but 1 year per annum they call, it is interest rate are per annum.

So, 1 year the company has also produced some goods and brings to the market, if there is a non going inflation the company, when you brings the product to the market, and sells it. What happens, the cost are at the previous period rates, but there is inflation, so he sell the goad with an inflation rate added to the market price, and he makes extra profit. He could have sold in yesterday price, because the cost is of yesterday price, but inflation prices when he bring the product to the market prices are gone up by 5 percent, 10 percent.

Whatever he sells the goods at a higher price, and make a extra profit, which you can call a premium extra [FL], then when he goes to the bank and pays the interest rate after 1 period for the loan he has taken. The company has taken, the company is essentially making a payment of real interest rate, because the pi which is the inflation rate, part of the nominal interest rate, nominal interest rate has 2 parts.

The pi part already he has recovered by selling the good, in the market at the higher price this period, so effectively he pays an interest rate to the bank, which is r, and not n r, because the pi part is already deducted from. So, n r minus pi, pi is the general inflation rate, which is already given him an extra profit, so that part on the loan, he has already kind of recovered intuit roughly speaking what I am saying.

So, effectively what he is paying interest to the bank is a real interest rate, so when a company or a firm or a business man borrow money from the bank, what he looks at is when the bank say this is the interest rate, he really look at the real interest rate. It takes into account the current inflation, because inflation always gives the privilege to the company to sell the goods at the higher price next period, and that comes as an easy interest payment through the market to him, which is need to just transfer to the bank.

And what he effectively pay from his pocket is the real interest rate, so to a company business man what real matters is the real interest rate. Now, for a depositor consumer or a saver to put money in the bank, while savings is also function real interest rate, when you put money in the bank and get the interest rate after one period, prices are gone up. So, the interest rate 9 percent, you cannot really use in the market to buy goods for yourself, 9 minus 5 percent inflation interest rate, because price have gone up more costly.

Therefore, 9 minus 5 4 percent is your net gain, as an interest income from the bank do you understand what I am saying, so for a saver it is a loss if there is an inflation, because the purchasing power of money has fallen. Same money 100 rupees cannot buy that amounts the goods, because price are goods have gone up, so with the interest income coming to you after one period, does not give you do not think nine percent extra income [FL].

Actual income [FL], which consumers do not think usually, consumer usually look at nominal interest rate [FL] inflation, but effectively what happens. Is that his real income that he has got we see from the bank in terms of income, is the real interest income, not the nominal interest income, the inflation will cut into it is income in terms higher prices, and he would not be able to enjoy that money, because higher prices he pays to shopkeepers.

So, savings and investments are both functions a real interest rate, it is important we do in macro economics, we do not make them function on nominal interest rate, unless we have very specific reason to do that. Similar, thing you will find in text books, explanation of real interest rate is in terms of the various things the in term of proclivity of capital, etcetera I did to I can talk about that, I will talk about that little bit later.

They equate really interest rate with margin productivity of capital, which requires a micro economics, and margin proactive essentially is same thing as more and more machines are hired, you get an extra output by extra machine, when you hire or you buy. So, we need to compare that value of extra output with the interest rate, because the interest rate is my cost by obtaining money from the bank, and the extra output that you get the value from selling the extra goods that you produce from getting the loan, and buying the machine.

So, in equilibrium it is an equilibrium concept there real interested rate should match, margin pro activity of capital. Margin proclivity of capital for those of you who have not taken micro economics, may be it is difficult you can use masques book to find out what it is, it is essentially a demand function for capital. So, the margin proclivity of capital decline, they say diminishing margin productivity, and in equilibrium interest rate matches with marginal productivity, why because real interest rate to a company is like a cost.

That he pays to the bank for borrowing money, but the companies benefit is by borrowing the money purchases some machine, something else produce as an extra good, which sells in the market, and now answer you. So, the extra revenue that I earn I compare that with extra cost that I incur, by borrowing money from the bank. So, there is a equilibrium concept there involved, as soon as the cost is more than the return I stop borrowing money.

So, this is marginal productivity of capital in terms of the return, and the cost of borrowing is in terms of r, so there is another explanation that is therein the text books is that r has to be compare with marginal proclivity of capital. But, I do not want to go into that because many of you do not have much micro economics, but if you open manqué etcetera manqué is another book also, macro economics with principles of macro economics something it is said.

These explanation are there, why investment is the function of rate of interest is a inverse function, because if rate of interest goes up, which is a real rate companies invest less, because it is a cost of borrowing and why it is. So, why is the cost of borrowing, so important because essentially you compare that with return that you get from borrowing money, if the cost is higher given diminishing marginal proclivity lesser amount of capital.

So, I am scared to go into that micro economics, because many of you have been admitted of course, in to this course without having the micro economics knowledge, but if you want to check that out, you can check it is a demand function it is a simple thing in principle macro economics. So, what I am going through right now is goods market remember, and please check if my initial lectures today, I hope they are not confusing income identity, goods identity, the demand also has an identity.

Demand for goods should be consumer demand and investment, and therefore from that it follows the equilibrium supply is equal to demand, then savings should be equal to investment. Please find out if that, because in the initial of first 15 20 minutes, I skipped one step, there which I put it here on this side of the board, so find out if they are alright or not, and let me know we can have a discussion class later.

So, goods market description I have not complete it, but I have just told you algebraically, essentially browns out to goods market equilibrium means savings is equal to investment. So, I need a diagram here I will draw that, which describes the goods market equilibrium condition, in books you will often find there is a diagram, I do not think the diagram is required, but there is a diagram.

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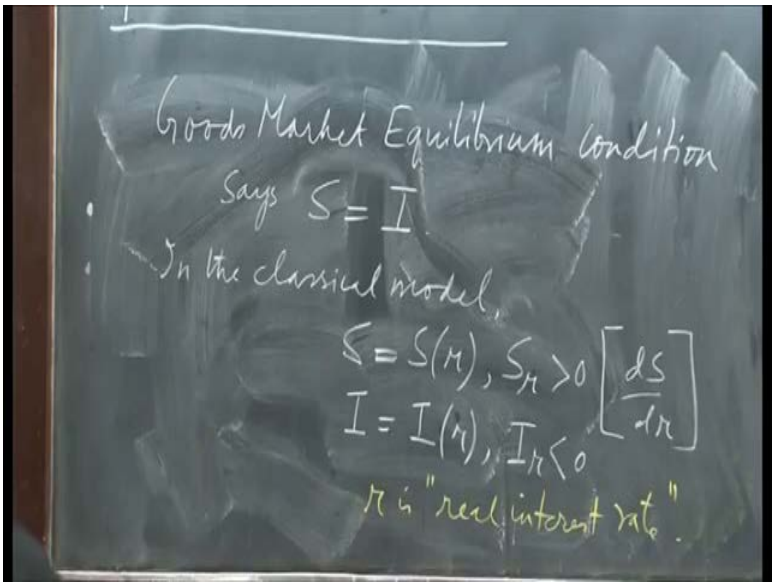

The diagram is as follows, they have savings and investment here and real interest rate and investment is downward sloping line savings is an upward sloping line, so you have an interest rate equilibrium value, and here where savings is equal to investment. This kind of diagram can be drawn it is not very much needed, but this diagram you will find in the books. So, this is the goods market equilibrium condition, next let us go to the money market, the demand side as 2 market goods market, and money market.

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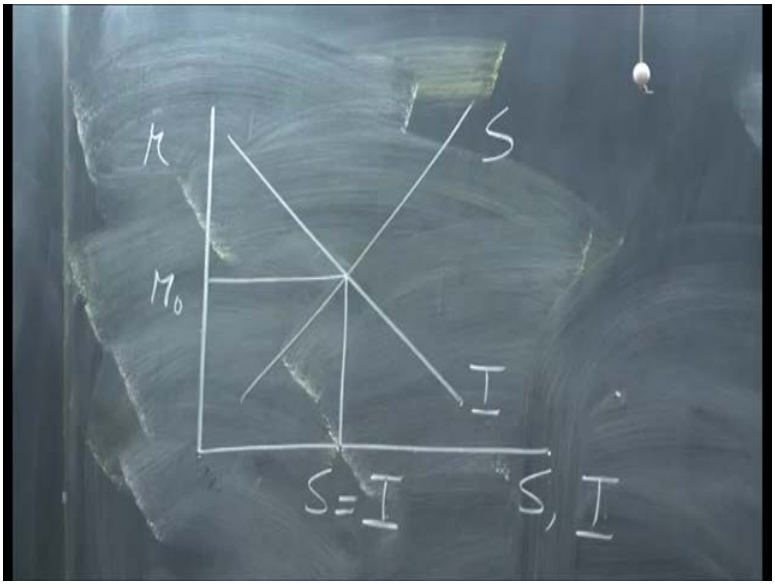

Let us go to the money market, again in the money market you have an equilibrium condition that would dictates things, the equilibrium condition is very simple supply of money should be equal to demand for money. And since, in macro economics both variables are expressed in real terms, and you can imagine demand for money will be in real terms, the supply of money is mentioned in very funny way. Supply of money is written as, the supply of money is the nominal money, the rupee that you have in your pocket assumed, but that is divided by pi level.

So, that it becomes simple of supply of money or supply of real money divided by price level, it is written simply because equilibrium condition will be equal to demand for money, and the demand for money would be kind of in real terms. So, nominal cannot equal to real, so make the nominal variable a real variable by dividing it by prices, and then you have the demand for money, now supply of money what it is.

Of course, we all know the cash that we carry unfortunate, I do not have much money, but it does not matter its good or otherwise I do not know I may get wrong. If I have supply of money everybody knows this currency, cash and currency consists of 2 items, this is what I teach in other course, money and banking course. It has notes and coins, so supply of money is notes and coins, but if you look into the definition of money supply, I have to go to the boss of money supply in a country, boss the big boss of money supply is this central bank, so in India it is RBI.

So, RBI decides were the supply of money going to be they will see, there is a supply of money has all kinds of definitions, if you talk about M 1 is one supply of money called M 1. Then you this currency with the public plus demand deposits in the banks or with banks, demand man deposits are essentially savings account deposits etcetera, these are called demand deposits.

The other kinds of deposits in bank are time deposits, time deposits are like fixed deposit, recurring deposit etcetera, so they take the demand deposit not the fixed deposit value in M 1 together it is called supply of money. So, supply of money has various definitions, it can have M 1 definition in India, now if you go to a M 1 definition in USA, you will find it s different. Then in USA mollify M 1 A another definition, which does not exist in India the we have in India M 2 in US you also have M 2, but it is different, M 2.

Then there is a famous M 3, so in India we have, so there are various ways you can define money, in simplest form for our model macro model, M can be consider to be M 1 that is the money. You have in your savings account, which is nearly cash you can go to the bank, when the bank opens, you write the cheque, you withdraw the money, and go and spend it. And also currency with the public exist in our walletat, home with my friends, so they are all part of M 1, so to me M 1 is suitable definition of M, but there are other definition of M.

That I am trying to tell you, which we need not know now, M 1 [FL] M 2, M 3, M 4, [FL] M 1, [FL] for macro models. That is essentially the cash or mere cash, which is with the bank, when the accept that in today we have automatic teller machines. So, the cash is even easy do not have to wait for the bank to open, you can go to the automatic teller machine insert your card, take the money out provided you get good money sometimes, I have told you do not get good money from there, that is it anyway.

So, you can go to the bank, so M over P is the standard definition of supply of money, the question is what is demand for money, here comes we the macro issue, this was the big issue in the 60’s and 70’s even 80's I found. The demand for the money in the classical macro economics, the demand for money was very simple demand for money, I think it originated I am not, so sure, it had 2 origins.

One demand for money a kind of thing was developing with Irben fisher in US, whose name I wrote, when I was trying to describe the relationship between nominal interest rate, real interest rate and the inflation, very important. You was trying to do something at the same time in England, Cambridge the demand for money theory was developing, on the other side of Atlantic it is very interesting economics.

If you look into the history, it has been simultaneous sometimes developing on both sides of Atlantic, north one is really cooperating with the other one, sometimes they belong to different schools fighting, the similar kind of thinking on some issues. So, the demand for money in the classical macro economics is only of one type, in Keynesian macro economics, you will find various other kind of demand for money, the usual demand for money.

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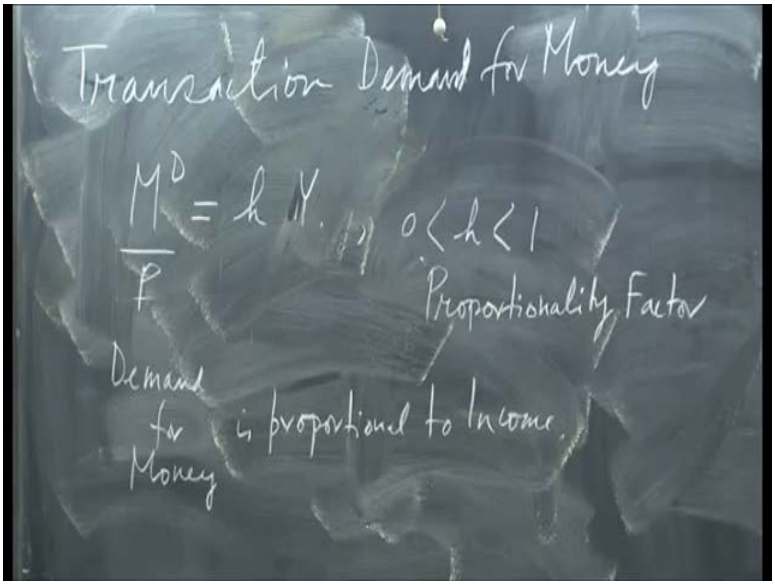

That we have in the classically macroeconomic is the transaction demand for money hypothesis, which is primarily developed in the Cambridge university, essentially says that people demand money for transaction. They have to pay the rent, they have to buy the [FL], they will have to pay the children school fees, they will have to go to city to buy other goods, all are transaction purposes. So, that is why people demand money or demand cash, hence if that is true if you accept this hypothesis transaction for demand for money.

Then is very simple, that the transaction demand for money if you call that real money M D will be proportional to the real demand for money P, you can say is proportional to real income. You demand for money for transaction purpose, you depend upon on your income, it is very simple this is proportional to that, if your income goes up you will spend more, where h is the proportionality factor lies between 0 and 1. So, demand for money is proportional to what it is saying income and the proportionality factor h is less than 1.

This is the proportionality factor, h is the proportionality factor, so this is the simple demand for money, now what they do in this macro model for supply is equal to demand in the money market, would essentially mean that M over P would be equated to will become equal to h Y is equal to supply of money to demand for money.

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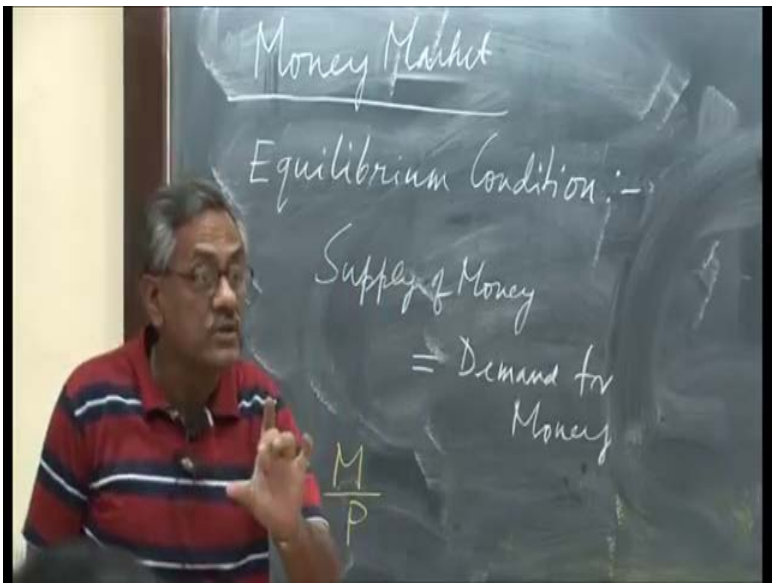

So, M over P is equal to h Y, and then they do a very interesting thing, there comes the manipulation this equation is usually not written in classical model, what they write is that or M into 1 over h is equal to P Y, and then they write M V is equal to P Y. Where, V is called velocity of money, and P into Y, what will it be P into Y, Y is real income, what did you say, very good P Y is nominal income, and you will not know, this M V also as a name.

M V together velocity of money, and m together, this whole thing together has another name called total effective supply of money, now what is velocity of money, here is

some mode intuition, which I have to explain to you, before I proceed further. And I hope you will understand, what you was saying here is the total supply of money real supply of money or total nominal supply of money, if you cross multiply p would h into P Y, P Y is the nominal income, so you are saying and h is a factor less than 1.

Now, if m equal to h P Y, if P goes there, you are saying that h is less than 1; that means, the total supply of money the currency you need at any point of time in the country, in rupee terms is less than the total value of goods produced in the country. The currency needed in the country or the way that exits in the country, M is less than P into Y, the total value of goods produced in the country, which will be bought and sold transacted, because h is the factor lying between 0 and 1.

So, it is like 80 percent, 90 percent, 70 percent, 60 percent, whatever 0.6, 0.7, 0.73, 0.8, 0.81, whatever and if M is equal to h which is proportionate factor less than 1, into P into Y the total value of goods that you have produced in a country. In a year, which will be bought and sold, you are saying a very important thing here, you are saying the total money required to buy the goods is less than the total value of goods that you buy.

Here comes the question velocity of money, which I told you, this h when it transfer to the other side, then it becomes 1 over h, and 1 over h becomes V I told you, if h is less than 1 1 over h is more than one. So, V is more than 1, and what is this velocity of money, you have to understand this, velocity of money in simple terms is very simple have this 100 rupees after class, this lecture I get usually very thirsty.

I go to a canteen, some lab canteen go and sit there some time few days I cannot sit out it is, so hot order thumps up or Fanta or whatever. Destroy my lever, but every day I do that fortunately only 3 days a week I destroy my liver there [FL] they will find more things available to destroy your liver, you can finds out that there.

Now, you destroy your liver you will go there and buy it, 100 rupees I give him, he give me back the change to me that 100 rupees does it stop there, and cannot be used to any more buy goods any more no. So, in the evening going back home with his wife, there is a canteen man with it is wife who sit here, they realize that they have 2 kids at home, they have to buy something for them, they stop at Ravatpur or Kalanpur. Get of the auto, buy some goods, go back home may be [FL], may be gifts, which I do for my kids for instance, so you go and buy the goods.

So, you takes up my 100 rupees note, if I have man watching it, you know a spy or something a camera like this fellows has camera, a camera is saying my goodness, he is taking my 100 rupees. And he gives to somebody in Ravatpur who following day I see he gives it to somebody else, so what happens currency does a not stop with one time use, currency has velocity of circulation. So, the total effective supply of money has to match with total value of goods, but money itself is much less in amount than the total value of goods, because the money circulates in the economy.

Like air impure, air destroy sphere, then travels to the next village destroy somebody there, and it destroys goes to the facility building destroys some more people there, thank god IIT Kanpur is shut down, you may wish that. So, it keep son travelling, similarly money cash keeps on circulating, it is a velocity of circulation it has, and essentially it comes it starts the moment I write demand for money is proportionate to income.

That a less I require less than my income to buy goods, it is not very clear, but I set out, I setup the problem. Then when I put the equilibrium condition with the supply, here supply is equal to demand, and I bring it over here, then I realize if I transfer h to the other side, then it becomes v, which is more than the number. Then I see the total value of goods is equal to not M, but M V were V is a number greater than 1, 3 4 5 whatever the average velocity of money is.

In fact, in my money and banking course I showed average velocity of money in India, what number is it is about 4 or 5 now, 4 point something, average velocity of money. So, like a miser for instance when you see miser money it deal with very seldom to bring it out to spend, so velocity is very low what you spent what you call that spendthrift person is usually very high. It keeps on spending money, when I take up issues on money and banking that other the course, as to whether the velocity is going up or down in India why it is, so any way I need not get into that.

So, M V is equal to P Y, you have now the funny thing is that I started talking about transaction demand for from the Cambridge version, that the Cambridge economist were thinking like that, but the M V is equal to P Y, this relationship. That I have written was developed without realizing that is to that with the equilibrium condition, in the Cambridge version without realizing that, this particular yellow color version, developed without Irben fisher writing it, very interest in US.

Whereas, Cambridge economist where going along the line, and was writing something like M over P into Y, so today in classical macro economics the money market has boom the descriptions, and things that are to be discussed under these two things. One coming from the Cambridge tradition one coming from the classical macro economics, that irben fisher from the US, but both mean the same thing to me at least.

Great thinkers may debate about it we need not debate in class, because at this point at this stage you need to just know of few things, you need not go into the minor details of it where all good against for. So, M P is equal to h Y is the money market equilibrium condition, and you can also draw a diagram here, if you wish M over P is equal to h Y you can draw a diagram, whichever way you want. One way of drawing it will be is they are all in disconnected diagram, so I am not drawing I am not putting, so much emphases at this stage, but the diagram can be drawn for instance.

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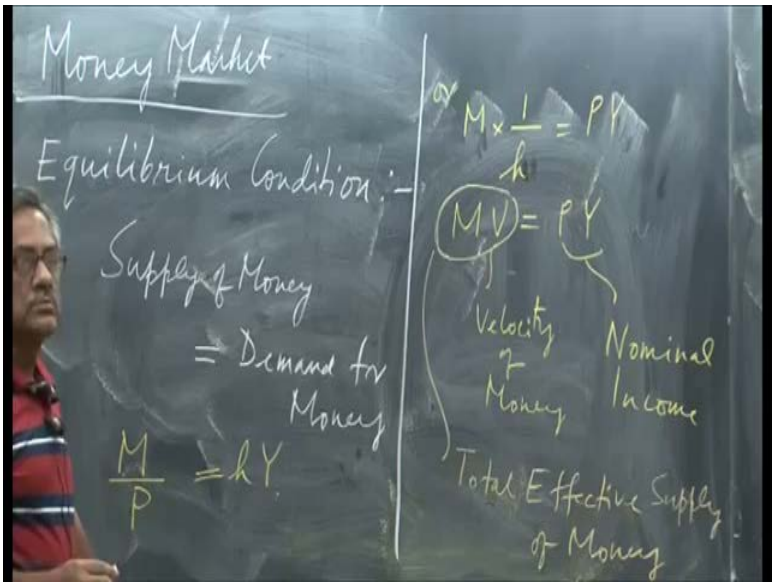

The money market diagram will be, I can have M over P here, and I can have you would wonder sir, what will you put there, well later I need something like this. So, let me draw say rate of interest, will be an important thing for supply of money demand for money later you will see, there had rate of interest. I am putting rate of interest, but rate of interest is not a variable unfortunately, so it will be M over P is a direct line which is M over P some value, and then that should be equal to h Y.

So, suppose I put Y here, so demand for money will be h Y, h M over P over demand for money is h Y, h is some fraction. So, essentially for equilibrium condition it will coincide, h Y line alright co it will coincide with this, and that is equal to h Y that what will it be no deal, hardly any interesting diagram, but I need this later I need this later, I will come back to that. So, no interesting diagram I have here anyway, I tried to claim that there are interesting diagram that you can draw, supply of money is equal to demand for money simple vertical line.

So, you have the money market, and the goods market yes.

Student: (Refer Time: 63:03)

No that is the h Y line [FL]

Student: (Refer Time: 63:08)

H Y is equal to M over P this equation I am drawing, that all its no interesting line, but I need this later I will tell you why I need this later, no big deal here really cannot draw nice savings investment line I drew. The goods market, but the money market you really cannot draw nice diagram, now if this part is alright, then we have the goods market and the money market covered.

So, now, I can go to the final labor market, now essentially y I go to a labor market is I want to describe the supply side of the story, this is the demand side of the story. So, now, I have to describe the demand side of the story, here again unfortunately some micro economics is required to understand some of the things.

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So, we would talk about now, the supply side of the story, the supply side of the story the demand side of the story is over the money market and the goods market, the supply side of the story is you have essentially the production function. You have to write the production function, because the how would our company supply without the production function. So, here is some micro economics that are coming in, but let us see how you feel comfortable with it, first I have to describe the production function.

And the production function usually is written like this Y the output is produced using labor, let us call that N, and some fixed amount of capital, this is labor, and this is some fixed amount of capital, and some technology etcetera are given. Further can feel, you can think about this best way is to think about micro able company producing something, a small y, a company is producing a small y using say a simple word some machines and some people are hired labor. So, machines are fixed, this is usually we assume that, but this creates the controversy sometimes the macro economics.

Sir, you are talking about classical macro model and you are also talking about what do you say a long run situation, but what we learn from micro economics in the long run capital or any other factor no other factor can be fixed. This is micro economics what it says, what is the long run in micro economics, in micro economics long run is no factor can be fixed, anything can be variable, in the short run is the case where factors are fixed.

For instance you take the class room, where you generate education, where you say education is good alright some good, some knowledge. Now, if you take the number of chairs, this is fixed in the short run, in the lower run I can expand the wall, add more chairs then it becomes the variable factor, it has changed. Now, one thing is very, very variable here, which you know is that for instance say the number of students, if it is name input the number of students say input, of course it is a variable, you can see look around, so many chairs are empty.

You can bring in more people tomorrow, I see there are few more students, even what is present today is not present tomorrow, so labor is always the variable factor, which is very convenient. In fact, their what happens in western word in capital society, their recession a company lay the workers, you would not hear a company is selling assets, the first thing the company does is lay worker very variable. Now, you are out of rescission you are in the recovery, economies is improving you keep on hiring people, the job the headlines news comes, such and such company has hired called back, it is 10,000 of it is workers.

In the rescission 2 years back, such and such company laid of workers in Europe, 6000 workers in Asia, something else happened this is what the multinational do, continuously or any company. So, labor is often in variable factor which changes even in the short run and of course, you can change long run, but in the long run according to economists micro economics is a situation where some factor are fixed. And usual it is looked upon one of the important factor, which is fixed other one can be land fixed this [FL] only in the long run if I buy more.

Now, in this supply function you see k naught, k naught basically means is a fixed factor, capital is given along with some technology etcetera other things, so you want you a long run you are talking about, how come capital is fixed. I guess what they have in mind this is a very obstruct thing, this is for convenient because this is our production function has developed, is that what they have in mind here is that in the long run you reach some sort of equilibrium.

Where, then the capital gets fixed, it is not over the entire long period capital had been fixed, but when you reach the equilibrium capital gets fixed, you have reach the best possible state, in that sense capital is fixed in the long run, and labor is still variable

around long run very interesting. So, how they manage this analysis, sometimes it gets very confusing they call classical macro economics a long run, they are labor variable capital fixed etcetera.

Now, this production function typically exhibits the following properties given the fixed factor, if I keep on hiring people I get the increased output, but the additional output keeps on falling. So, when I had no body working, I have one person I get a output, when I have 2 person I get a huge amount of output, then three person some more output not, so huge amount fourth person some more output not that amount extra that I got. So, the increment on output keeps on falling, we have increments we have increases in output, if we have more people, and then we can reach saturation point.

In relation to number of chairs I cannot have any more student here, they would be standing there they by in the class sitting on the passage there, on the stairs I can reach a saturation point in relation to the fixed factors. That can also happen, but initially imagine in this class room as happened in morning as when I came one person here, 2 persons there, one there, one there, one there were sitting.

Then gradually more labor came, and more product I hope is getting more productive, but the incremental output doest increase, with micro phone advanced technology does, because my voice reaches at the back row. Earlier, my voice used to never reach the back row, so production function that you have here you can consult the micro economic book.

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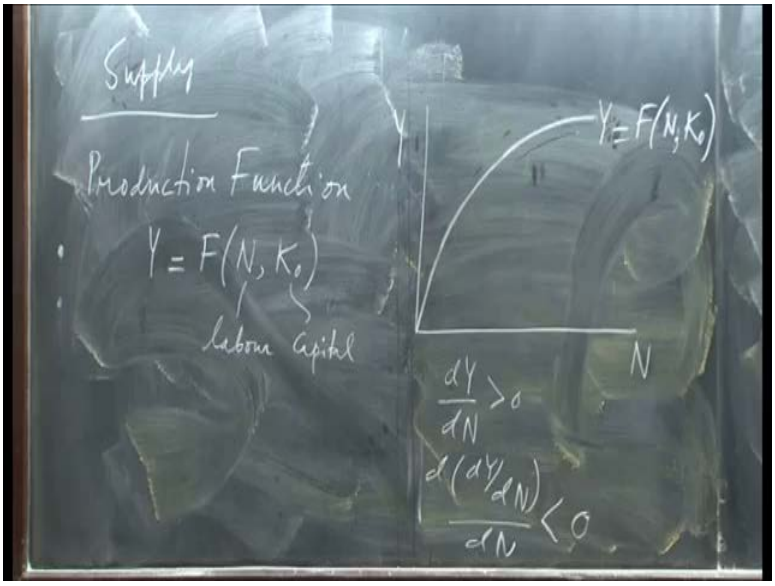

Simply can be draw like this, you have N here, you have Y here, and it is a line like this which is Y is equal to F and N K naught, what does it mean, that increment output which is the marginal d y d n is greater than 0. Tangent is upward sloping, but reaching a 0 point at that saturation point 0, the tangent measures d y d n the incremental output, the tangent measures the d y d n, but you can see the tangent is getting flatter. Means d y d n the incremental output marginal output is falling, so if you have the second derivative of that this slope basically means d y d of d n with respect to d n is less than 0.

The slope of the function is falling d y d n is the slope, and second derivative of that is less than 0, means the slope is falling the line is getting flatter; that means, every times I hire more people I get an extra output, but that extra is shrinking [FL]. I will be reaching a saturation point basically. So, I cannot keep on hiring any more, enough we have, and that is always in relation to the fixed capital or fixed factors that I have if I change the fixed factors.

Then the whole bowl gets changes the dimension changes, then I can have more people I can have 1000 students here with micro phones, everywhere you know like a big hall like a consorts hall or something theater hall [FL]. So, this production function is what we teach in micro economics has a diminishing marginal productivity, it is called diminishing marginal productivity, the marginal increment in output diminishes it exhibits diminishing marginal productivity.

Essentially, because the fixed factors of production are constant, so in relation to that if you keep on hiring people you will get a extra output, but not necessarily phone is since you have some computers. You are one person first, then you all person hire whatever optimum you require, if you have more what will happen, you does not have a job then he fools around go around sits with you for 5 minutes, goes and sits with him for 10 minutes.

It does not have work, it disturbs him, it disturbs that output construct start falling, in that can also happen a tangent can become negative downwards sloping, so d y d n need not be positive d y, d n can become negative even, but we do not think. That any relational economic or rational firm or in economics, that d y d n would keep on falling at to the point, where it becomes negative or 0, we usually do not think that. What will happen why would a company keep on hiring people, only when it happens you know it happens in public sector company due to this used to have banks [FL].

And then he orders the bank manager hire 50 of my people, they do not have any work, so banks become over saturated with people, and you have what you call negative marginal productivity of works, because they were hired under pressure. The profit maximization firm would never do that, a the profit maximization firm would hire, so long as its profit are maximize work increasing. And they will stop hiring, if the profits start falling even forget about falling if profit start falling, it will start expiring which I do not have an equation here profit I am talking only about output level.

But, in public sector company what happen, it reduce what happened in India, keep on hiring people, so you do not need them, and so show the country or whoever that you hired people to do favors to the voters, who have voted you to power. So, we are not under public sector company here, so F N K naught labor capital or could keep on increasing this production function. So, what we have essentially we write the production function under the supply side relationships, where labor market is important, and we put the productivities F N greater than 0.

And F N, N less than 0, which you have understood first derivative and the second derivative, which describes the production function, now after this, we need the labor market.

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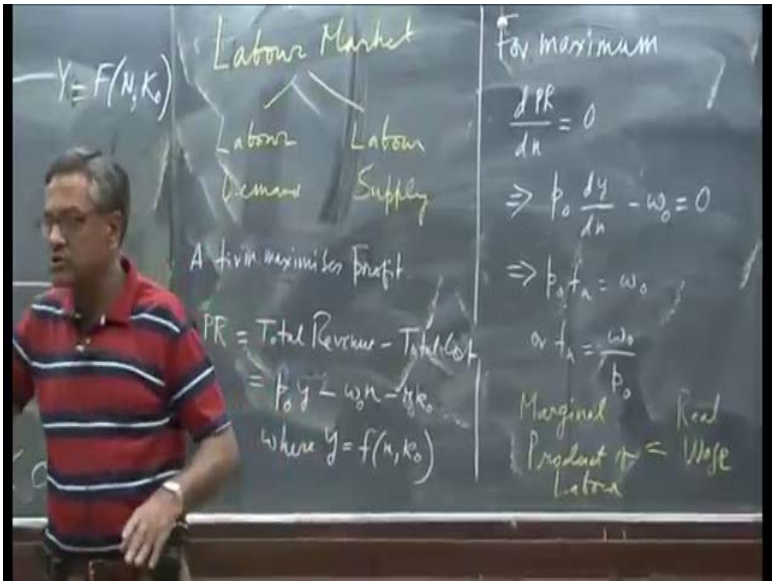

As, you know the labor market will have another supply side, the labor market will have two equations, labor demand and labor supply, now again unfortunately I have to bypass that you can consult a book microeconomics, you can do it later. Read out both the labor demand curve, and the labor supply curve has a micro theory behind it, although it is macro relationships, this is macro economics.

You are studying, but these functional relationships have their origin their root in micro economic theory, like the production function which is the micro production function called aggregate production function for the economy essentially comes from micro theory. In theory of firm micro economics, we use companies production function like that similarly the labor demand function, and the labor supply function also come from a micro theory with a micro underpaying.

The labor demand function essentially comes from the theory of firm, and the theory of firm in micro economics says that a company maximizes firms maximizes profit pi, which is pi was inflation profit micro economics [FL] inflation [FL], therefore maximizes profit. So, call profit may be call that something like variable P R, which is what the total revenue that a company earns, total revenue minus total cost, thus the profit, total revenue minus total cost that is very simple.

So, what is total revenue, a company total revenue is suppose price which is given p naught, says small price p naught into some output, it produce y minus total cost. Say

wage into N is labor, capital N was labor here for a company small n is the labor, minus some rate of interest into small k naught which is the capital stock uses. So, that the total cost the labor cost and the capital cost, I subtracted minus, minus that the profit and small y also have production function like a relationship, which is the function of n and K naught.

Where, small y small y is equal to some n and K naught the production function of company, so the profit of the company is total revenue minus total cost. Total revenue is the price at which I sell the goods, and come back home with the revenue as total revenue sales [FL] sales revenue minus the total cost K naught. Now, if you maximize this profit, if you use optimization calculus, you get the first derivative set to 0.

So, for maximum set the first derivative 0, for maximum you have d PR with respect to d small n is equal to 0, that is you keep on hiring people till your profits are maximum, capital is given. So, I am trying to maximize profit here means I keep on asking students to come who are paying fee to come, till my profits are maximum, so I have some costs in mind and students fee gives me the total revenue, and I have till my costs and revenue balance in certain way.

So, that my profits are maximum that kind of example I am trying to give, so d PR by d n 0, you put the d n PR 0, what you get here is that, this implies p naught is a constant d small y d n minus omega is equal to 0 [FL] It will differentiate with respect to n you get the P naught the price into d y d n minus omega, suppose a omega is also a constant, the wage you pay, suppose this is also a constant they are all constant, so omega naught [FL].

So, this equation essentially implies that p naught into small f n is equal to omega naught, or small f n is equal to omega naught to a p naught, so profit maximum the first condition I used for maximum. You require second order condition also, because it can be minimum or maximum for maximum, second order condition is negative, second order derivative should be negative.

What a minimum second derivative should be positive using the optimization rules very simple, but I do not want to get into that. Now, what you see here for profit maximization firm, how much would he have labor that is demand labor till marginal

product of labor f n, which is called marginal product of labor marginal product [FL] d y d l has output increases has you have more people, that is the labor productivity.

So, what it is saying is essentially the marginal product labor is equal to omega p naught, what will it be omega is the money wage rate omega p naught will be omega is the money wage rate, which is the wage you pay to the labor per month, per day, per hour, per year whatever. So, omega over p what will it be real wage rate, because omega is the money wage, that you pay the rupee then omega over p is the real wage, so what it is saying marginal productive labor should be equal to the real wage rate.

That what it is saying, it should be equal to real wage marginal product of labor is equal to real wage, so the company gives the hiring, people for profit maximum it works I was telling you about this few minutes ago. When I explained the production function the interest rate thing in the previous class, that company keeps on hiring people also the same thing till the wage it pays in real terms matches the real benefit the gain it gets from extra output by hiring you.

I am measuring your hiring by looking at how much I get in terms of output, in relation to how much I have to pay you, to come and work for me very simple the equilibrium relationship. So, essentially therefore, marginal product labor becomes the demand curve for labor, because of marginal board falls the demand for labor increases, I can keep on hiring people I will tell you very simple.

If now marginal product of labor is like this in the aggregate production function I have written, f n is greater than 0, f n n falling it will be an downward sloping line, f n n falling slope is downward sloping. So, what it is saying in the cost to the company falls, it can hire more because the marginal point is declining to hire more, so you reach equilibrium later, because the cost are lower you can keep on hiring, so in terms of diagram, therefore what is happing is if I draw, it here in terms of diagram.

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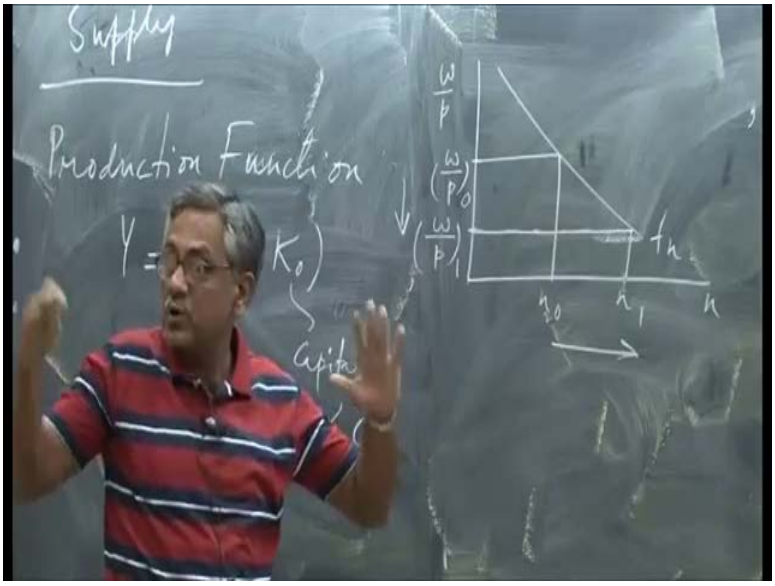

What is happening is that if for a company the marginal product of labor is downward sloping, and you have labor, here and the company is paying some omega over p as a wage if omega over p is here some value. Then I have people till that point n naught, if omega over p drops for some reason to a lower value, I can have more people and go to n 1, if omega over p drops, I can go to more people, because my cost in hiring has gown down. And given diminishing marginal product; that means, as load is higher productivity falls, extra output that I get falls this is the assumption I made.

Therefore, for a lower cost I can keep on hiring till my productivity in the company fallen enough to reach equilibrium point, which is equal to the real wage. So, essentially you develop demand for labor function, how you had a more labor, how you had less labor demand for labor, demand curve is always downward sloping, supply curve is upward. So, download sloping really, so downward slopping basically means for instance a consumer demand, if price is low, then I buy more goods.

In this case the price is the cost to the company of hiring people, if the cost is low in hiring people I hire more people. See it becomes a demand curve for labor, from a profit function of a company it comes, which is micro economic theory, that what we teach in micro economics the theory of firm. That for maximum profit, you have people till marginal product of wage, at that simple algebraic relationship says the following thing that there exist the demand for labor, which is downward sloping.

So, if the cost of hiring is low I demand more people I have more people in my company, if the cost is high then I hire less lesser amount of people in my company. So, the macro demand for the company will drop that I will show you, in the next class which is Wednesday will essentially comes from the process function of a company, which is micro theory. Unfortunately I have to you some micro theory here without the micro theory, which is very simple profit, I will function I will which is total revenue minus total cost, and you do the first derivative relationship.

Then you get the macro labor demand function also, but the supply function labor supply function is much more complicated micro theory, I will not go into that I will fortunately I will bombard you with that equation on the board by saying you memories. It the micro theory, there is much more complicated, but the micro theory behind the labor function which I just started working, for you on the board is very simple, which you have the algebra.

So, tomorrow on Wednesday I will conclude the labor demand function, for the macro and then I would just write the labor supply function on board, without really explaining them much to you. A little bit of explanation in terms of intuition I will give you, but not the micro theory, but unfortunately, fortunately for some of you it is good probably that you know this kind of profit function exist in micro theory, which is used to get labor demand function.