Macroeconomic Theory and Stabilization Policy
Prof. Dr. Surajit Sinha
Department of Humanities and Social Sciences
Indian Institute of Technology, Kanpur

Lecture - 12

Now, I have a few things to talk about investment which is started in the last class. Then I would conclude investment and go onto the second half of the course, which is much more useful as a as a tool of economic analysis or as a economic theory which can be used to understand things. So, the second half I will begin, let me complete investment part, investment is an additional thing I am doing in this course because many people do not understand what it means by investment. So, briefly what I said in the previous class is that investment can be of two types, net investment and replacement investment. Together they are called gross investment or investment. So, investment expenditures in a country need not be a new machine created, it may be old machine replaced and still part of investment, but that is replacement investment.

The example I was trying to give you suppose this chair breaks down and we get a replacement, that is not new investment, chair was there, but I get a replacement which is a new thing produced by some company, but it is not part of macroeconomic net investment or new investment. Typically, in a country more than 80 percent of the investment in a year is replacement investment, which is sometimes called a precession investment or depreciation of capital lead to depreciation of capital creates.

This requirement of replacement investment, we call it sometimes maintenance cost, service cost all sorts of names we have now. So, if that is true than in macro economics sense what kinds of investment do take place in a country in a year, well if you look around you find that there are three kinds of investment activities going on all the time, one which is famous investment. We all know that called business fix fixed investment, business fixed investment is the investment that many people think, even lots the people say. If you ask a businessman he would talk about money he put in.

So, it is business activities that connects investment usual in peoples mind and business fixed investment is just not how much money you put in, but how much of physical capital stock the company has acquired. Physical capital stock of a company consists of office spaces, buildings plants, factories whatever machines tools they are part of

business fixed investment. Except for say the other cost that a company has say raw material, costs, labor costs, they are not a rent.

They are not part of investment expenditures or not part of capital stock. Capital stocks consist of if IIT Kanpur put this building it is part of the capital stock of IIT Kanpur. When you are the fixture inside our part of the capital stock of the of IIT Kanpur and I was telling you that in a war, the worst thing that can happen to a country is this historical accumulation of capital stock, historical means what time. You cannot build the building one night, over time in a month, in a year and a Kanpur city cannot be created in one month, but you can destroy Kanpur city in one month in a war.

So, the huge loss that can happen to a country is loss of capital stock. So, these are part of investment activities, part of there a portion is replacement investment and a portion will be new investment like new building. At IIT recently we had new capital stock acquired at IIT Kanpur, we have seen that towards in the city many office, buildings, labs, etcetera have come off new cold lab building, etcetera, etcetera, alright?

So, business fixed investment is something that usually connects people, connect when they talk about investment, but there are other kinds of investments. The one I talked about in the previous class is the inventory investment and the inventory investments are unfortunately both, just not finished goods. It can also be goods, it can be raw materials, everything part of inventory investment.

So, here the word capital stock becomes very thin are raw materials essentially part of capital stock, no finished goods of a company jam, jelly, butter, part of capital stock of a of a company. No, but in a macro sense inventories are part of the investment activities of a country. So, if a company is putting in more into inventory either purchasing raw materials or producing finished goods, keeping them there incase future there is more demand. They can bring it out, they all come under investment activities in macro sense, not in the strict micro sense, but in a macro sense. They are part of investment activities and I told you about inventories there some cost, you put in money, you create a go down, you construct a storage, cold storage depending upon the products you have.

So, you borrow money from the bank, there will be an interest cost, than you have the running cost, the refrigeration cost, the labor cost involve with it. So, inventory investments are associated with their number of other cost associated with inventory

investments, alright? The final investment that I need to talk today, but before that I need to talk about rather things, is it the residential buildings are also not company buildings, not plants factories residential buildings are part of the capital stock of a country.

So, any new building coming up means adding a capital stock. So, it is essential investment activity, someday sent a mail to me before exam is it part of GDP, essential is it part of GDP infrastructure expenditures. Then the services you get from that building year after year after year are also put in part of the GDP of the any future year services. It may be your own house, it may be your rented flat it does not matter. So, residential buildings are also part of investment activities constructive buildings, you see apartment buildings coming up multi storied buildings. You go to any city today you will see that that is essentially creating capital stock of India called residential investment, alright?

Now, before I talk about residential investment I just wanted to make one or two quick points. That which you know in case of inventory investment, costs of various types I told you in case of business investment. There are very specific models and often these models are micro economic models and one of the micro economics exercises I did I said. Let us assume a company minimizes cost and objective function is to minimize cost subject to an output it wants to produce. Now, as soon as it wants to produce an output it has planned that output. Now, the question is how to organize its production process to produce it.

So, it has to select the raw materials and the other inputs labor etcetera and machine. So, it has to also select a technology that it will use to produce it and you can set up a micro economic problem, which is called constraint cost minimization problem where you minimize cost total cost subject to an output. It wishes to produce and through that exercise I told you that you can get a capital demand function and labor demand function, any input you may have you can get a fact demand function. The demand function is essentially what are algebraic equation I wrote where on the left hand side you have k and on the right hand side you have bunch of parameters and variables of the module. In the previous class I did that is the capital demand function.

So, the best way to conceptualize to see the capital demand function is to put k is the function of the cost of capital R. I put rental cost of capital and put all other variables under one club, one gross variables say Z know, you can see K and R are inversely

related. If you look at that algebraic equation you will see K and R are inversely related, meaning it is telling you there is inverse relationship which we called demand function. Demand function are inverse relationship between price and the item concerned.

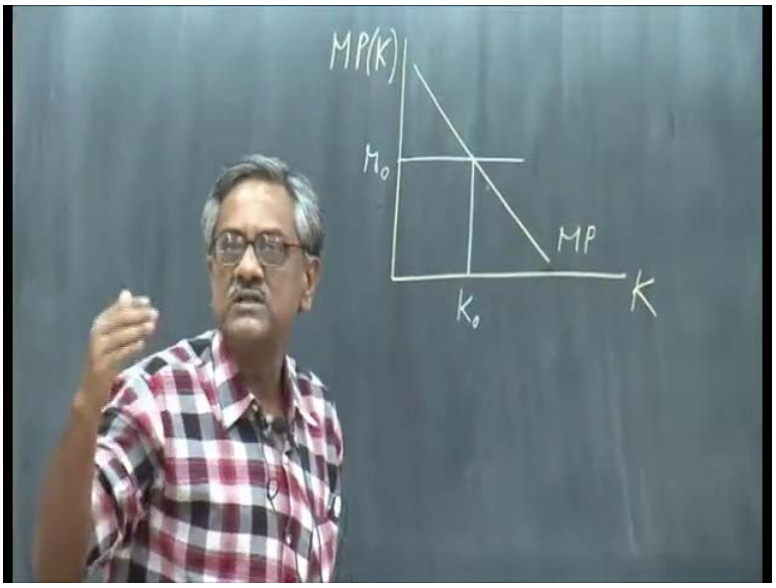
So, more capital would be demanded if rate of interest falls than I told you the idea behind that is there is something called diminishing marginal pro activity of capital. If you hire machine in this room, after a point machine will give you, giving a increasing output, after that it will give an extra output, but a smaller amount. Next time you have other machine it will give an extra output, it contributes to total output and there is a extra that you get from hiring that machine. Combining it, but that extra is becoming smaller which is called diminishing marginal pro activity of capital.

So, capital becomes less and less pro active as you hire them, reason is capital you are hiring keeping all other factors of production constant. So, there is an optimum that you can have number of chairs, see in this room an optimum numbers of student you can teach in this room. You go beyond that the pro activity of the education that you have imparting on students would go down, some would not see my face, some would be if too many people are there, some would be standing in front of somebody because there is not a chair there, alright?

So, all these pro activity business is also in relation to other factors you know. If you increase the class size I have a better amplifying system or whatever microphones, etcetera lights class to increases. Yes, I can accommodate 200 students here. I teach efficiently, but given the size given other factors like the size of the room and other features that you have. It is not possible to increase pro activity by just employing more and more amount of some other factor. This is diminishing marginal pro activity.

So, if R is the cost of capital and diminishing marginal, pro activity is downward sloping line. It will be a obtain when R is called to diminishing marginal pro activity because beyond that what you are saying the pro activity is less than the cost of buying a machine or renting a machine. So, the return is less than the cost, alright? Pre prior to that the return is greater than the cost prior unit of extra machine. So, you keep on employing machine. So, you get an equilibrium condition there, R is called to marginal pro activity of capital of labor, what I am saying is if you are not following me.

(Refer Slide Time: 12:16)



If you have diminishing marginal pro activity of capital, essentially what you are saying is that suppose, I have capital here. I have marginal pro activity of capital here and it is a downward sloping line, marginal pro activity of capital which is diminishing marginal pro activity of capital as you have more capital.

If the rental cost of capital is given said the rental cost of capital is somewhere here or not. Then clearly you would hire only up to that point where it marginal pro activity is called to rental cost of capital. Because the rental cost of capital is saying that this is the cost you pay to hire an extra machine or per unit cost when you purchase a machine, alright? Per unit cost can be calculated like if a machine has a life of ten years, total amount say 1 lakh rupees you pay. Then per year it is 10000 rupees plus some servicing cost, it can be rental cost of capital, alright?

So, is this rental cost of capital marginal is diminishing. Of course, you would not go beyond that point to hand more. Let us say this is some K naught, you would not go beyond K naught because the marginal product which is the return to the company from extra unit of capital. That you employ of rent is less than the cost which is here. So, it gives you an equilibrium condition.

So, what do you essentially have is therefore given the parameters of the model, in that micro model if you know the rental cost of capital, alright? A company can decide what would be the desired amount of capital wish to have to produce 5000 units of an output

per year. This is the amount of capitalize required, it can be worked out like an arithmetic problem from that capital demand function that I showed you once. You have that once, you have that desired capital. Then the question is how long the company will take to obtain that amount of capital, because capital is an expensive item. It may not have all the money initially to buy it.

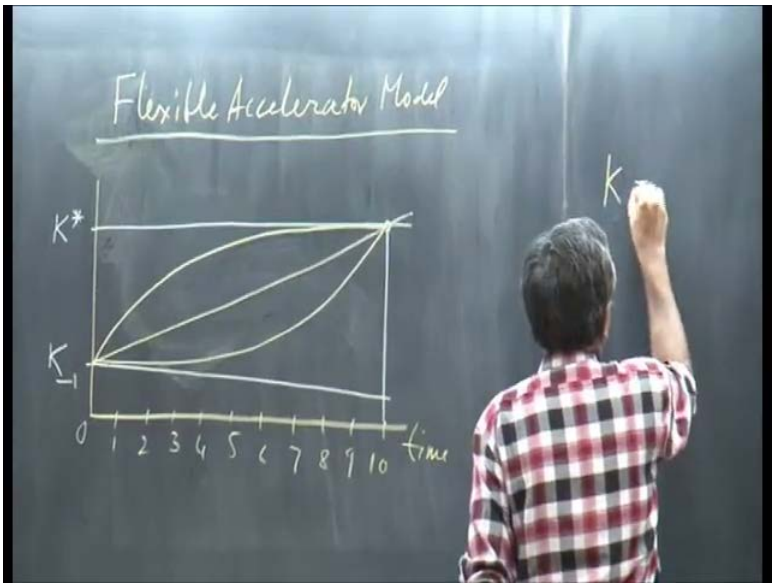
So, it may gradually purchase capital stock and reach that optimum level. So, the micro economic theory with this diminishing marginal pro activity of capital and rental cost of capital and other parameters like the labor cost, etcetera. What you essentially obtain is if a company wants to produce this amount of output, than the company can also find out what is the amount of capital I required. Now, the question is how I reach that capital stock that is called the desired capital stock.

So, essentially if from the capital demand function, you have the desired capital stock. The question is now how will it take to reach that desired capital stock and you have how much investment activities that you will take place in very cruel terms. If number of machine today is 5, I desired 10 machines. My physical investment is roughly equal to 5 machines in real terms in money terms. You can multiply that with price desired, capital stock is 10 machines, the investment that I would undertake is equal to 5 machines, very simple. In physical terms, in money terms you multiply that with price, job done.

If you rent that you multiply that with the rental cost per unit of time. One year rental cost you can get a cost total investment activities, you can say in some sense that well in some sense, yes, alright? Now, as soon as I raised this issue that there is a desired capital stock and the company will now have to reach the desired capital stock, because it wishes to also produce desired level of output which is a target output. Then there are also many models I tell you investment literature is just full of models. Lots of models are there, I need not talk about that, I am just giving you the broad concepts.

There is the one that I have found out in your textbook mentioned is called the flexible accelerator model of investment flexible. Accelerator model of investment, what it is very interesting thing, this is the conceptualization as to how a company reaches a desired capital stock. The flexible accelerator model of investment essentially says.

(Refer Slide Time: 17:09)



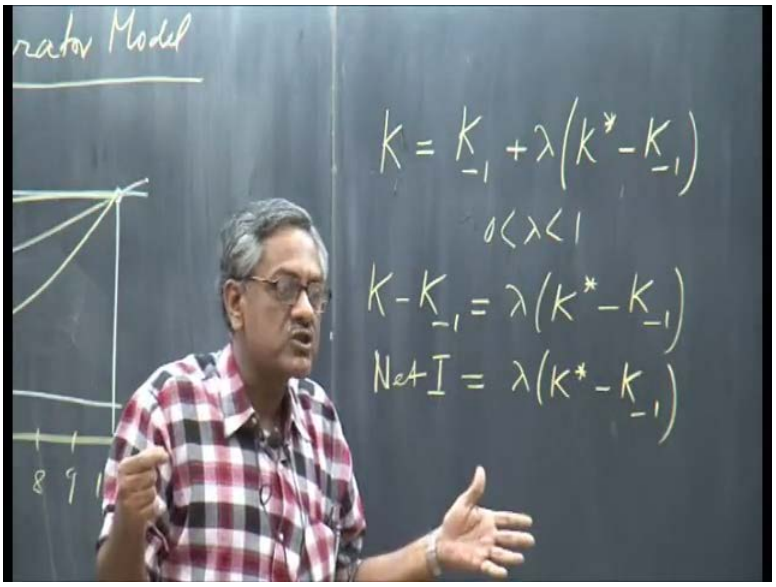
Flexible accelerator model of investment, what it says a company adjust towards the desired capital stock, only gradually, slowly it does not acquire the capital stock overnight. So, it basically sets of a model which is in this kind of a time frame. There is a time say 1 period, 2 period, 3 period, 4 period, 5 period, 6, 7, 8, 9, 10. Suppose, the capital stock right now is somewhere at the 0 period is somewhere here. This is the K lag one period, the capital I have from the last period, alright? Suppose, the desired capital stock k start is suppose here. Now, you can draw a line here saying said this is the height I want to reach and I am at a height here, alright?

So, what path should I take? Many people suggests various things, one can say that at the end of the tenth period I will reach this point. So, one can conceptualize a path like this, a linear path, every period I undertake and in a honor at on the linear line some amount of investment that one can think about a path like this. It increases initially very much and gradually tapers off. One can have a very slow beginning and then rapidly concludes investment, who knows it is the company's decision.

It depends upon a number of issues, how much money it has, how much it can get, what is the availability of machines, alright? In the first period it may not acquire any machine, in the second period it acquires, it starts working with old machine, only second period acquires one unit. In the third period it may not have enough money, again

in the fourth period it acquires the second unit. So, it can be a very much step function, it can very much be a step function.

(Refer Slide Time: 19:55)

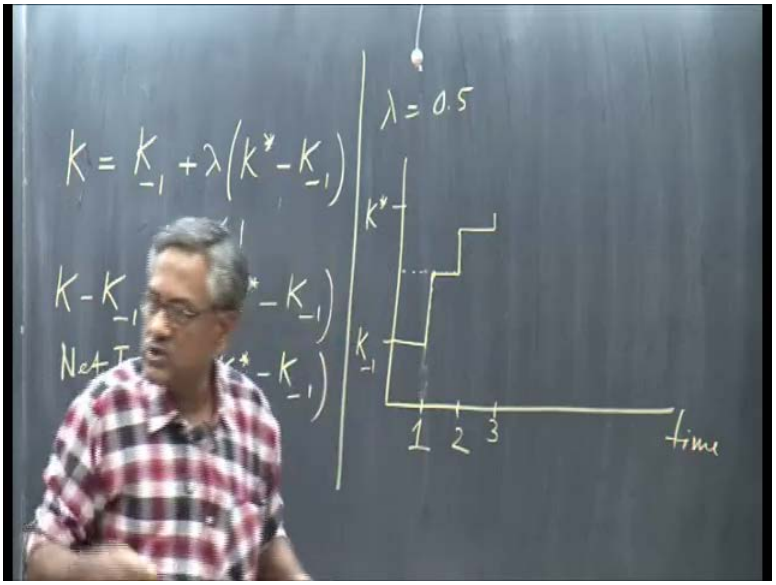


Now, the flexible accelerator model essentially saying that the capital stock or what you call that the net investment, I think yeah essentially the capital stock today will be what I had yesterday plus only a lambda fraction of K star minus K lag, one period will be undertaken, well lambda lies between 0 and 1. Therefore, I can rewrite this as K, K minus 1 is equal to lambda k star minus k lag. One period this is net investment, this K minus, K minus 1 is net investment. Essentially, this is Net I is equal to lambda K star minus K lag 1 period. This is Net I actual capital stock that I have today, minus the capital stock I had yesterday is my net investment today.

Now, that today and yesterday and tomorrow can be any time period on 11th of July. I can calculate that again on 11th of August. I can go and calculate that number, than 11th of July number will be yesterday, it can be anything, alright? So, do you saying there is a gap between desired capital stock, 10 machines and current capital stocks said. Today 5 machines, how much investment do I undertake in any period? I only add fraction lambda of the gap, that fraction can be anything, 10 percent, 5 percent, some machines takes time bring parts and bolted down. It requires a whole lot of cost and then it is ready to be used, alright?

It comes in parts and therefore, you can in fractions of investment undertaken. Therefore, what I am saying is that any amount that the gap you bridge, you what used you feel can be only a fraction in any one period and therefore, suppose you take lambda to be half.

(Refer Slide Time: 22:20)



Suppose, take an example lambda is equal to half, 0.5. Now, what will happen to this line? This is K lag one period, this is K star. So, in the very first period by the end of the first period, period one half of that is met. You are already here half of the gap in the second period, whatever remains between these two you can, you can meet half of that. So, essentially what is happening is you go here from here, from here you go here, then here, here. In this way step function can be emerged which is a little bit more and then in a continuous time period it will become smaller and smaller, but it may require say four periods to conclude it. Last one is you ignore lambda is equal to half, you just jump to the end.

So, lambda value can change, so the a step function path, a step function like path the company can follow to reach the desired level. So, this is actually what happens in real life company decide how much to produce in the coming 5 years, 4 years, 2 years. Than it decides how to organize that production and therefore, what other things required. Then it gets a desired capital stock and then the question is how it gets the desired capital stock realized? Actually it is there in the company in the plant on the short flow, it

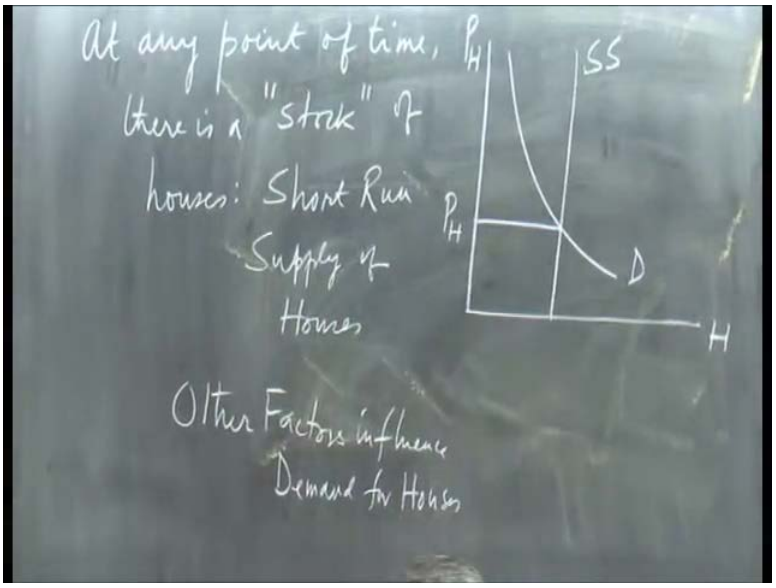
cannot have various approach. So, this is one thing which is you may find in your textbooks to talk about this desired capital stock, etcetera, business, alright? Okay?

Having said that what I would do, I need not going to there are so many issues related to investment and that is the big issue in a country. Now, they are also talking about how to pick up investment because Indian GDP growth industrial output growth is falling negative quarter. After quarter GDP growth rate is falling somebody is predicting, it will be only 5 plus percentage point. So, these are the basic issues one gets into. So, I need not get into many more issues, if anybody has interest can pursue that. There is enormous amount of literature on investment, what I need to tell you now is a little bit about residential investment, alright?

Now, residential investment as you know can be broadly of two types, owner's house only. The one you see abroad for instance if you watch a Hollywood film, a lane and than one side there is one storied houses. On both sides each of the house is owned by a person, owner's house like IIT Kanpur type, four houses single storied buildings or you can have essential complex and apartment complex, where in one building many people can live.

So, there can be various types of residential buildings, there all together called the housing industry all called housing industry in any country, alright? Now, at any point of time when you look at the residential buildings or house is this part cleared, the flexible accelerator model what they say this kind of conceptualization is there. So, the residential investment essentially talks about houses.

(Refer Slide Time: 26:35)



So, at any point of time there is a stock of houses, there is a stock of houses that exist in a country, where you can go and live. You can ask somebody to live, you can rent it out, you your self can rent it, purchase it, whatever a stock of houses are there, this is called the short run. The short run supply of houses, this is the short run supply of houses at any point of time.

So, essentially what you have at any point of time if this is housing market and suppose this is price of housing. You have a supply of houses which is essentially the short run supply of houses which is very inelastic, perfectly fixed, very inelastic. It would not change because why because houses take time to construct. At any point of time the number of flats you can have in a city and houses, own your own houses will be fixed and but there can be lot under construction.

But I am not taking the data on under construction, I am only talking of complete houses where I can go and live if I want, if I have the money, alright? That stock of house is essentially a very inelastic line is called in economics and inelastic line is perfectly inelastic, vertical line inelastic means if price is change supply does not change at all, complete inelastic insensitive. You can say a human being is insensitive, you scold him he does not respond, you give him punishment he does not respond, anything happen he does not respond. Like in inelastic line is perfectly insensitive to price changes, but there

is a demand curve for houses which can be a normal demand curve which can be a downward sloping line, alright?

So, depends upon how much demand you have for residences in a city, say Kanpur city in the year 2012. Number of houses that is available you can get a market price of houses which can be thought about, if it is owner house than entire price, it is an apartment entire price. If it a rented flat what is the rent per period, say per annum or something, alright?

Now, so the price of house P H can be interoperated various ways, it was vary from type of houses, you have it is the owner house is the price. You pay is the flat, the price apartment cost 12 lakhs, 20 lakhs, 30 lakhs, 40 lakhs, whatever. Depends upon the area and if it is a rented flat, what is the rent per month which multiply by 12 will give you the rent per annum. Now, at a point of time I want to tell something, the supply and the demand for houses are also influenced by particular demand for houses, are often influenced by a number of other factors. There are number of other factors which influenced the demand for houses, not so much supply, supply does, but I will talk about that.

There are other factors that influenced just not the price, just not the price there are other factors which influenced the demand influence, the demand for houses. Of course, demand is a function of price, if the price is low, more demand for houses would be there. There price is less demand for houses would be there, but there are other factors. So, matter can anybody tell me what are the other factors which can also matter, when it comes to a demand for houses in a society, in a country as a matter in a macro economics sense houses are part of something.

We call property sometimes, it is essential I do not have a house up to live, but it is still also part of your wealth because normally what happens buying a house, buying a flat or an apartment requires a lot of money. The money magnitude and in the current scenario where property price is going up every day is also considered to be part of your wealth, an individual side I live there, but also it a part of my wealth tomorrow if necessary. Hopefully, nothing will happen if any on forcing thing happens I can sell of this property at a reasonable price, have the cash go and live in a smaller flat rented flat somewhere by sell it off and get the money.

So, it is like wealth like gold, like jewelry, like share certificates, houses also have a dimension which is it is part of wealth. Now, here comes the complication if it is part of wealth than if an individual, when its basic needs are met he has more money. There can be a question in his mind whether to put the extra in another property or whether to put the money in a fixed deposited account in a bank, buy share certificates bonds of governments or what jewelry gold. There are alternative forms of wealth in which an individual can put money in put his savings. What I am trying to say is after point, this property is also a necessary thing for my existence, because I have to have a place to live place to stay, but after a point when more money is there more saving is there with me.

I can think about a business, than alternative forms of property come in to the picture, should I go for a property. Two things will matter there, what is the current price at which I would buy it and what are my expectations about future property prices, because now I am businessman, I have my essentials. This is extra I am doing for further gain.

So, if future prices are very prospective in this city, see in Delhi, Noida, Bombay, Calcutta, Madras, Bangalore, etcetera. Oh I should buy a property, it becomes an investment activity a different kind of investment, a personal investment activity where I put money in like in the share market, I make money out of it, alright? Now, you see this is a problem there are other factors which are coming into the picture which can influence the demand for houses or property. Now, I do not called it houses, maybe I call it property, it can be land also which can come into property, but here let us concentrate on residential houses. Many people buy flats and rent them out, you know is called sub renting like you people when you go to a city.

Suppose, I buy tomorrow I become rich one day which would never happen, IIT Kanpur, but suppose I become rich, I can dream about it, I go and buy a couple of flats in Bangalore. I know IIT Kanpur students go there and students know me, I know the students. I said you do not worry, you pay me a rent we will have a contractual agreement for 4 years, 2 years whatever and this flat in a good location in Bangalore and I make money on that. I invest that is my investment, I am not living there IIT Kanpur has provided me a house, I live here.

So, it is not essential, but that is a form of kind of personal investment activity and therefore in order to do that what I would count. What is important in economics is that

whenever I do check a choice, there are alternatives that are important to be taken into consideration. If the returned from the share market, if the return from the bank if the returned from the bonds, if the returned from the gold, if the returned from the something else an alternative form of wealth is comparable to a returned to a property. And I find the returned form of property like a house if I owned is higher, I would choose that is like maximizing profit in economics. What we called we maximize profit at a personal level, we can say maximizing returned, alright?

So, the housing market is now getting quite complicated, it is not just to live there, it also to make money and if my demand for houses go up what will happen? If the demand curve shifts in the short run suddenly demand depends upon a very slow variable like people. Suddenly there is a migration where I have seen that happening in Calcutta, suddenly there is influx of Bihari people. In 1971 with the Bangladesh war, you would not believe me how many people cross the border into Calcutta and West Bengal, you were not born there, but I have seen that myself.

The demand in the short run also is a very fluid variable I tell you, it can be suppose the metro just opened. It was getting under construction, but this year the metro open immediately property prices demand for housing will change, which direction it will change I cannot predict, but immediately very short run phenomenon or short run situations variables starts effecting property prices. I tell you influx of people, I told you my goodness Calcutta housing rents starts going up. Therefore, alternatives forms of wealth, what kind of return they have matter, what happens in the property market or residential housing market also, alright?

So, I am inter changing using property market and residential housing remember, but property is much more than that people can buy land and call it property also. Property is just not housing property, can be other things to just a plot of land can also be part of that, I hope you are enjoying it a little bit too and following it. This is how it gets complicated, social science there are too many variables that starts coming not like physical science. You know the number of variables and then you play with it and find out experiment social science. Suddenly other variable you never thought of variable.

Now, it has become important world recession property price, but India’s globalize and world recession has becoming important. Now, I have fund now how to model it what

kind of relationship which can have, you think about it test them. Social science is very very open, in some sense you cannot close it and say I have done enough, tomorrow something crops up, alright? Therefore, the various kinds of and then in the western world you have mortgage, etcetera. The interest cost are very important, western world do you know what happens which is becoming popular in India?

You do not buy property from your savings, you start earning, get married. I have seen young couples, my classmates who did not go for PhD got married and the first they did was they just started earning, may be husband and wife both are earning. They bought a house, how did you manage? I cannot imagine in India, my father never had house.

So, I cannot imagine either. So, I said how did you manage [FL] under mortgage [FL], not in Hindi. They did not tell me, but this is all under mortgage. Mortgage means what [FL] you go to the bank, mortgage your house, you take a loan against that house. It house becomes yours except conditional, you have to pay the interest cost, the mortgage cost. Once the interest cost and the loan has been repaid, the house become fully your house, you owned it. Until you do that it is under the mortgage scheme of the bank, the financial institution.

So, bank can confiscate that. That is it, yeah and how what guarantee do you have that you would repay the loan? It is thousands of dollars you talking about. Oh my goodness and those days I was very naïve, whenever they used to talk about dollar I think my goodness convert that into Indian rupee, which you never do. You live in a country which has dollar. Why would you convert that Indian rupee unless you are in India and I am see my goodness, that amount of money and then I was very naïve. I would say that amount loan you have taken from the bank, they saying yeah we do that all the time and you have every guarantee to repay. Usually we do, but then the country is get into recession. They do not repay, house get mortgaged, banks confiscate that, but economy is very down there. Then what will the bank do? Sell the house to whom, which is happening in the western world.

So, banks are in trouble, they give it out these loans credit, that is the system functions the economy is floating on credit, which means what future promises payments. If it does not go through fine you kick out that person [FL], whatever they can sell, resell, rather they sell sold off. Suppose, they went, but what will the bank do in the economy,

recession, bank cannot just sell it off to anybody. There is no buyer, but banks money are all tired up. This is precisely what has happened in the western world. The credit system has put them into trouble which is part of their culture in India.

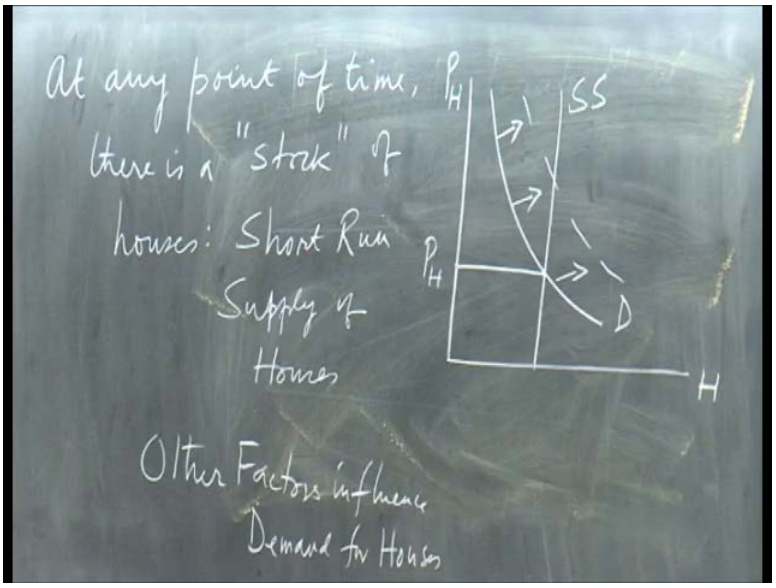
We did not have a credit system, I remember whoever my friends and friends families parents, whenever earlier I am talking about what a flat, what a house, bank never came into the picture is there savings when they retired. The provident fund income, the personal savings saved in banks, they used to bought a flat, but now it is changing.

Now, it is changing, a lot of bank loans are involved, we are become westerner. Now, be careful it looks very nice if the economy is doing well, if you have a job, but if you lose your job [FL], but so it becomes part of the cultural thing in a country. How you know what kind of food, when you get a what kind of clothes you wear, how you talk to people, how you treat your relatives and friends. What you do if you have to purchase, do you go to the bank and take the loan all the time? Or use your savings in a poor country like India? Certain habits are very good, it is not a credit base system.

If you have money in your bank than you buy, if you cannot afford it, you do not have money, you do not buy it, but aboard is not like that. The western world is very much credit system, credit based, you take a loan every time and bank is always willing to give you loan. My goodness and if the loan is not repaid, this what has happened, Europe, North America, this is precisely what has happened, the financial nothing more than that and some cheating going on.

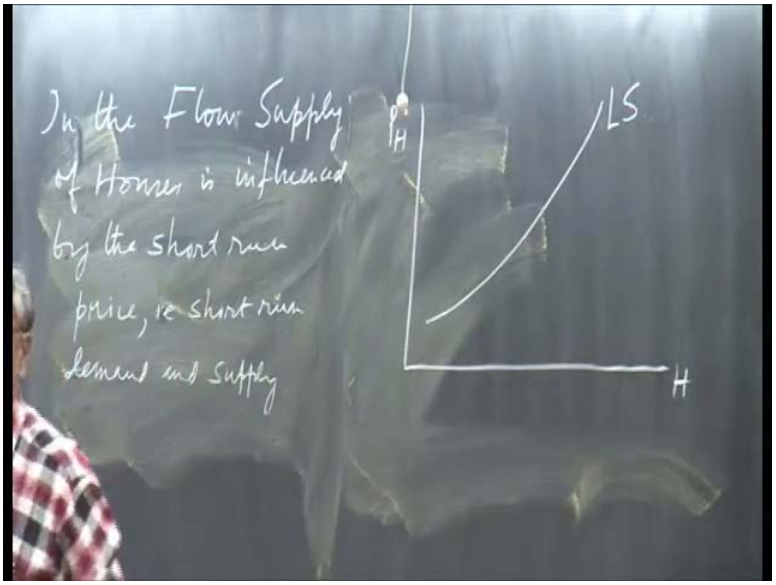
Now, what has happened I tell you, suppose in Noida suddenly there is an influx highway constructed, [FL] metro, [FL] property pirates are shooting off, everybody wants to buy a property. There is no problem to travel from Noida to Connaught place and work because the metro is there and highway, new highways is there.

(Refer Slide Time: 44:29)



The demand for houses will shoot up. What was happen to the price of in the housing market, in the short run is not flexible, will shoot up [FL]. This will give rise, the short run to one very interesting thing. The long run supply of houses in a particular area in a particular economy depends upon the short prices. If the short run prices are good from the point of view of the builder, more builders will be encouraged to construct houses. So, in the long run what you have the supply of houses, which is the flow of supply called the long run.

(Refer Slide Time: 45:16)



The flow supply of house is influenced by the short run price and short run demand and supply, essentially that is short run demand and supply and in the long run what you have the flow, supply of houses will be an upward, sloping line is a long run supply. That is the short run supply and there is a long run supply that will be upward sloping as prices increase in the short run. In the long run builders, more builders will come and produce more, but it will take time. That long run quite a bit of long run, for an apartment building I think about 2 years it takes, if not more to completed these days. So, the long run sometimes the calendar time period can be quite long, but do you understand what I am saying, the short run tells the builders how much return is there.

So, they go into a long run how much more they would supply. So, the long supply is more elastic, if the price is high they will supply more, if the return is low in a place, the place is dying, industries are dying, people are moving out, the supply would shrink, no more supply. So, there is a flow of supply in the long run and a very stock supply in the short run. Stock means stock of cash, pocket, I can count taking all the people, how much cash I have, that does not mean that is the cash. You can only have this number of people if you go to bank. If you give us time, we can have a flow supply of cash which can be much more, but the stock supply I want to take.

So, everybody takes out the cash they have in their pocket, somebody have 5 rupees, somebody has 100 rupees, somebody has 50 rupees, somebody has none and I can calculate the stock of supply, because I have to do something with the stock today, right? Now, slow flow might determine the kind of target oriented. It can be how much cash we need and give us time ourselves to reach the target. So, in the short run therefore, when there is influx of people, what happens in a place like Bangalore? Do you think the market price is the price that the renters pay? Just one question before I go for a break, is the market price the only price that the renters pay?

The tenants pay, there is one more price which is not shown there, which they pay is the under the table payment, 2 months, 6 months, advance rent, no receipt is required in India, it is very general practice. In foreign country it is never a practice and this practice is primarily because of shortage of houses, shortage of housing.

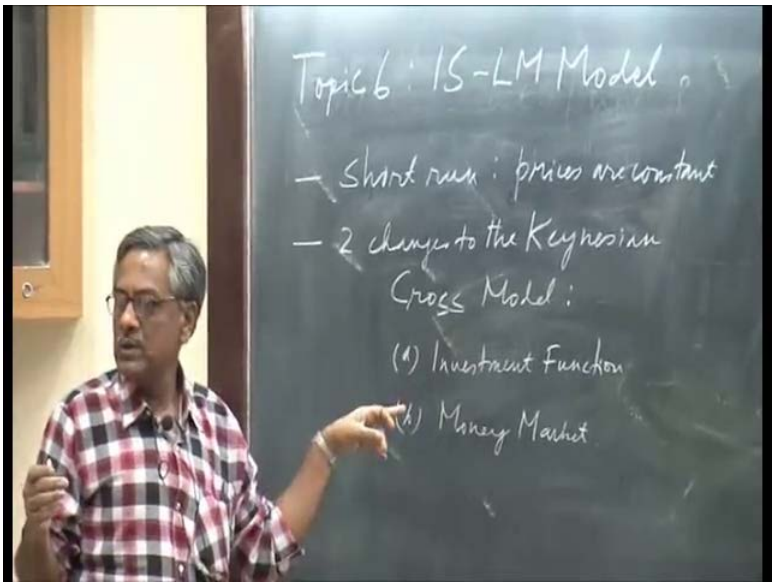
So, that demand pressure is so much that the owner of the house makes an extra profit which is not shown in the diagram, which is more than the market price. Market price is

something they pay every month, may be additional thing called [FL] in Bengali and Hindi and other languages, which they make under the table payment for which no receipt is given. It precisely depends upon the demand supply relationship in the short run. In the long run it may ease [FL] may go down. If more houses coming to the picture, because the return is high market is a very funny situation, market is so high price today, but high may attract more producer tomorrow.

The price high price may become a low price tomorrow, but always in relation to how much demand you have. If the demand is multiply more than the houses at any given time frame, given time period than God help you. The prices would never come down, prices would keep on rising if the demand increases more than supply, clear? So, this is roughly the investment story I wanted to tell you.

So, next thing what I do is I will gradually get into more algebraic model and more interesting models, in fact the most famous topic. Now, I will get into topic number 6, the IS LM model, this IS LM model is originally due to a famous paper written by a noble orate in economics and since then it has been there, important part of macro economics theory. The IS LM model I will begin today, topic 6 and I will continue with this few days.

(Refer Slide Time: 50:55)



IS LM model. Now, you have seen in the Keynesian cross model, the first Keynesian model that the money market was ignored. We had a very simple supply relationship

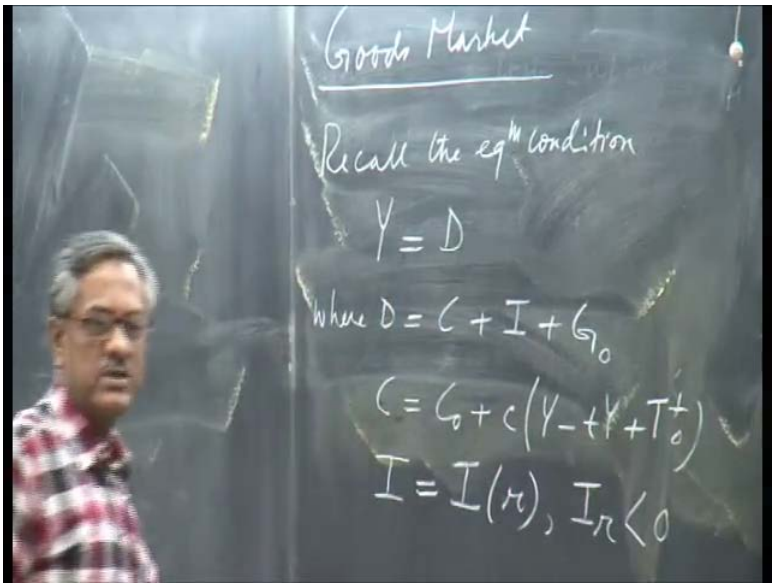
with the aggregate supply was horizontal and the demand curve. Determine the output level in the economy and the demand was also very simple, there was no investment function.

Investment was autonomous then there were other autonomous components, government expenditure, consumption, transfer, payments, they were all autonomous. So, that a naught terms was trying to proxy for that represent that and the important role that was played was that role of the consumption function, because consumption was a function of income. So, any income produce in economy would be affected by consumption and consumption affected by income, because consumption is function of income.

So, that was the key factor there in the Keynesian cross model. The consumption function the in the IS LM model, essentially I extend that short run frame work to include two things, one investment will love be a function of something and I will bring in money market. Otherwise, it is just like the Keynesian cross model. So, two changes there are coming. So, in topic 6, I will still assume a short run model where the supply side will be glued, prices are constant, but I will make two changes to the existing Keynesian cross model, one I will think about an investment function. Now, two I will consider money market.

So, money market will play a role now. So, after that what do you think will happen to complete the modeling macro modeling? I need to bring in only labor market at some stage, than the Keynesian model is complete like the classical model. If you open your note will you see there is a goods market, there is a money market, there is a labor market. In the Keynesian model is much more cumbersome, I am doing it step by step, not together. So, I will still have a short run model, where price are constant and I will have two changes to the Keynesian cross model, one an investment function, two the money market I will bring in. So, let us do one by one.

(Refer Slide Time: 54:30)



So, the changes in the goods market, let us focus on the goods market, the goods market now if you recall the goods market clearing condition, recall the clearing condition or equilibrium condition. Here in the goods market what was that, it was output is equal to demand or supply is equal to demand and where demand had three components, consumption plus investment plus government expenditure.

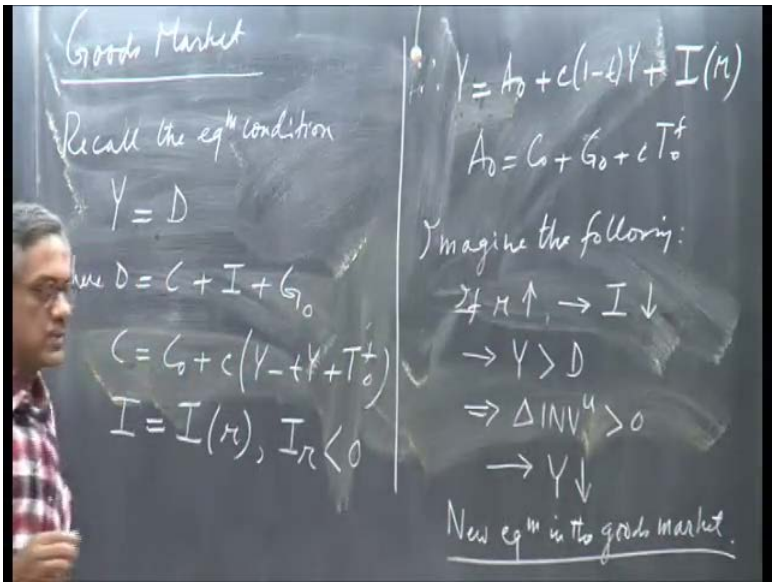
Now, I am not going to have I naught, I am going to have an investment function. So, I would retain the government expenditure thing as autonomous, but I will have an investment function. As I said there on that part of the world and C as before, plus C into Y minus t Y plus T f as before consumption function, but I will assume to be a function of r, where I r the first derivative is negative.

That means real rate of interest goes up, investment would fall in a country you saw that from marginal productive of capital etcetera, because if real interest rate goes up that is the rental cost of capital is going up, real rental cost of capital. Than is more costly for company to investment.

So, they would stop investment at a high level of marginal productivity, where marginal product from capital after investing matches with the cost. So, returned match is the cost, otherwise it will not. So, it has a universal relationship, r goes up investment falls in a country, r goes down investment goes up in a country. I was talking about the capital demand function and all that marginal productivity of capital, all that explains that. So,

this is the goods market clearing condition, if that is true than I have the following thing also.

(Refer Slide Time: 57:05)



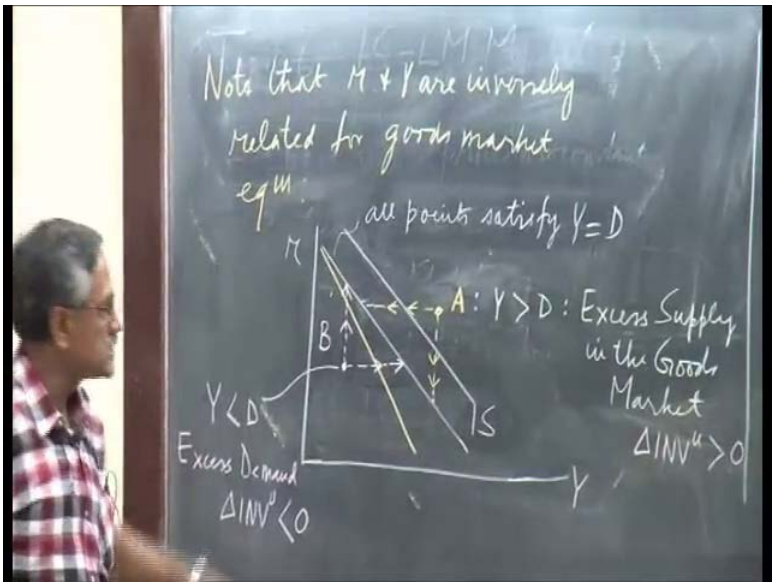
Therefore, Y is equal to sum a naught plus C into 1 minus t Y plus I r, where A naught is equal to C naught plus G naught plus, I think c T f naught, these are the three components. Now, you are in this equation, the left hand side is supply, the right hand side is demand. This is what I am writing, D contains these things. On the right hand side equilibrium is supply is equal to demand. Now, you can imagine, just imagine the following. Suppose, real rate of interest goes up what will happen? I r will fall, I r is negative. So, I will fall, not I r, I will fall if r goes up [FL]. Therefore, the output the economy is producing is now greater than demand, because the demand will fall given other things remaining same. If I falls, I is on the right hand side.

So, the equation does not match, no more equilibrium Y is greater than demand. Demand has fallen what do the company see in terms of unintended changes in inventories, positive pick [FL], demand [FL], economy [FL] this all. Therefore, implies that delta I N V U are inter inventory changes are positive. So, what would companies do? What would companies do then lower output. This means companies would have to lower output, [FL] they are not being able to sell what they are producing until now.

So, they have to adjust their production plans, if this persists they have to lower their output right and if Y is load. Therefore, economy reaches a new equilibrium, so the new

equilibrium will be reached with the lower level of demand and lower level of output, new equilibrium in the economy. In the goods market there will be a new equilibrium in the goods market, there will be a new equilibrium. In the goods market have you understood this, is it clear now? So, when r has gone up a lower level of Y.

(Refer Slide Time: 01:00:41)



Therefore, note that r and Y are inversely related for goods market equilibrium. Hence, I can draw a diagram where I can have Y here and r here and will have a downwards sloping line, where on this line all points satisfy goods market equilibrium. If r goes up Y should go down and reach goods market. If r falls, Y can go up and we reach goods market equilibrium. This is known as the IS curve, I stands for investment, S for savings, I is equal to S in the classical model, you have seen after that it changed.

So, when professor Hix was writing, this paper he essential had the classical goods market and what changes it has taken place when you shift to over to the Keynesian frame work. In the classical frame work what was the goods market saving is equal to investment. So, you called that IS curve and in the IS curve it was not meant for the classical market. It was meant for the Keynesian market, Keynesian goods market because these equation are not there in the classical model, but still use the word IS because the corresponding part in the classical model had INS equality as an important algebraic description of the goods market. Clearing condition I is equal to S, if you open your classical economics note that is the macro model you will find that.

So, he called it IS although this is not the classical saving is equal to investment is much more complex. It is the goods market clearing condition with consumption function, investment function, government which was not there in the classical mode. Therefore, on this model now if I ask you a question, you will understand these things very well. If I take a point like a what is the problem with point a point A is a disequilibrium point is not on the goods market clearing on IS curve.

So, what kind of a disequilibrium you have if you look at it from the point of you. How far away the Y is? You see the Y is very much, if you take a IS point equilibrium Y is very much in the access. If you take the rate the of interest than you come down and you see the rate of interest is too high compared to where it should be for goods market. Clearing goods market equilibrium rate of interest should come down and output should reduce, you are too far away.

So, that point a what kind of disequilibrium you have, you have too much of output or too little of demand because rate of interest is too high. So, investment demand is very low rate of interest should come down and investment demand should go up. So, you are here you have a typical situation where Y is greater than D, which means there is excess D supply in the goods market, too much is supply in the goods market. Demand is down, excess supply in the goods market. Furthermore, if there is excess supply in the goods market you can also conclude that delta I N V U is positive, companies are stock piling increasing their inventory stock because they cannot sell it excess supply [FL].

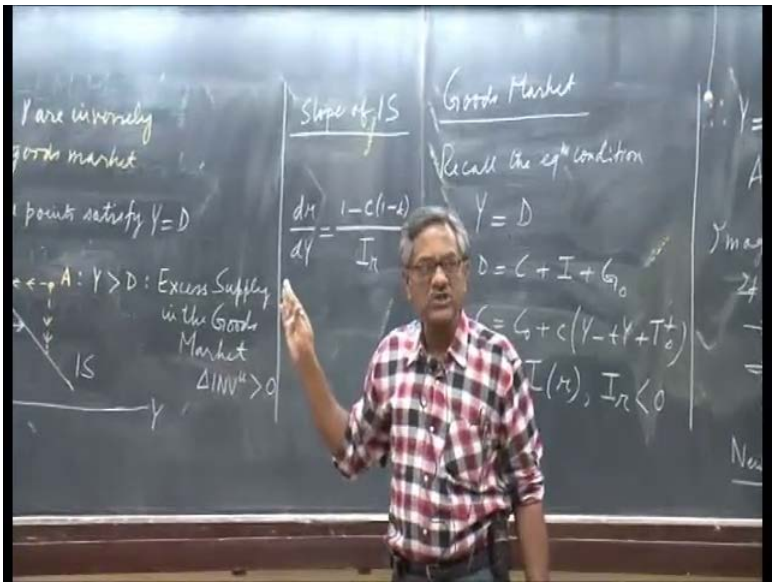
Similarly, if you have a point like B what is it saying either output should increase towards IS curve, when you reach equilibrium or rate of interest should increase to reach IS curve and reach equilibrium, Y is equal to D. That means at this point B, you have too little output compared to demand, demand is too high should go up. So, investment demand would fall and demand should shrink, demand is too high.

Now, compared to output, so you have here an excess demand situation so that B what you have is essentially Y is less than D, which means excess demand in the goods market and delta I N V companies inventories because of excess demand is all continuously declining because it has to take the stock out from the inventory and meet the market demand bringing it out and bringing it in market demand just offers it.

So, delta I N V is less than 0. So, above the IS curve to the right, you have excess supply below the IS curve on the left, you have excess demand situation. These are both disequilibrium regions. The equilibrium region is only along the IS curve where at every point the goods market is clear. Clear means in equilibrium no excess supply of demand, no excess supply of goods, no excess demand for goods, Y is equal to D exactly match [FL].

Y minus D is 0 along the IS curve, above the IS curve you have excess demand for goods, excess supply of goods below the IS curve you have excess demand for goods, remember? But this is a topic on IS LM. So, I have to bring in LM now, before I bring LM excuse me before I bring LM, what I need to check is the slope of the IS curve. Can anybody find out from the equation what is the slope of the IS curve? What is the slope of the IS curve?

(Refer Slide Time: 01:08:48)



Besides function what is it slope, what will be the slope in terms of the using calculus. What will be the slope of the function, what will be the slope of the function if we use calculus, what is the expression D r D Y? So, what is D r D Y? Please find out D r D Y, the slope of the function, what is D r D Y, how much is D r D Y in this function from those algebra that you have on the board. You can easily find out D r D Y, how much is it autonomous variables are when you differentiate their O, assume them to be 0. What is

D r D Y [FL], D r D Y, 1 minus 1 minus C into 1 into minus T divided by I r, will it be positive or negative? Negative because I r is negative.

So, the IS line is downward sloping, tell me a couple of more things, what would happen if G increases? Government expenditure increases what will happen to IS curve? The discussion should begin with this equilibrium equation, if G increases A naught increases, if a naught increases what you have a disequilibrium in the market. What kind of disequilibrium supply, more than demand or demand more than supply, demand more than supply. If demand is more than supply, how would you cure that disequilibrium by increasing output.

So, how would the IS curve get effected if G increases? You have a disequilibrium, you have a point on the new IS. It will shift a point on the new IS where demand is more. So, you will have more output, also how would it shift right. It will shift to the right, will it shift parallel or will it shift with the slope change parallel, very good. So, if G increases the slope of the IS will not get affected, but it will shift parallel, same thing will happen if autonomous consumption increases or trans of payments increase [FL].

Now, you tell if tax rate changes how would the slope of the IS will get affected, will it shift parallel, say tax rate has increased what will happen to the IS curve? How will it increase? How will it change if tax rate changes? How would the IS curve shift, there will be an alteration, but how will it shift? It will become flatter, it will shift parallel, say tax rate has increased. I am saying tax rate has increased, tax rate increases 1 minus T false C into 1 minus T false, 1 minus C into 1 minus C increases.

So, how will it affect the IS curve? It will become steeper. So, the IS curve will become like this. This orange or yellow line is the new IS curve, when tax rate increases it will become steeper. If government expenditure increases it will shift parallel, if tax rate increases than the IS curve will become steeper, right? Do you agree with me or not?

This is the parallel shift and the parallel shift is only when the tax rate increases and when, sorry when government expenditure increases when tax rate increases. It become backward shift, with slope change it will become steeper, agreed or not? Did you agree? [FL] If you follow you would enjoy because now it becomes algebraic logical and very can very interest, you would understand our macro economy world. The most useful part

is just beginning, this paper is a starting point of the, yes you have a question which one you have not been able to understand, right? Backward shift [FL].

Now, it is alright [FL] line [FL] output movement steep [FL] backward, inverse movement [FL], alright? I walk like this, now I am have an inward movement, alright? I become like this, I bent tax rate [FL] [FL], tax rate [FL]. So, the may way a person walks you can tell whether he is probably happy or not, you can say, alright? These are nonsensical things, but what I am trying to say is have you understood. If the tax rate is increase, it is become steeper means it has gone inwards and the slope has increased. In absolute terms, in absolute terms the mode value has gone up, the mode value.