Macroeconomic Theory and Stabilization Policy
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Lecture – 11

The next thing is a little bit embarrassing, I was not in the greatest of shape probably in the previous class I made another radar, which you did not point out. Look at the last diagram the saving function intercept, what will it be? When I drew just a savings function at the end of the class, what did I write minus C minus C naught, I write the intercept y axis intercept minus C naught. I wrote just the savings function in the last diagram, what will it be the intercept minus C naught.

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That is s plus T minus T f by, but just the savings function I drew at the end of the class.

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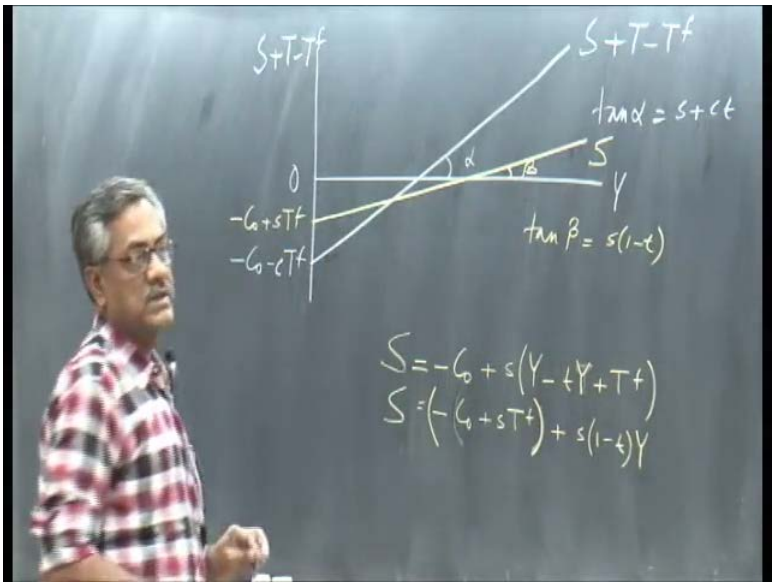

Let me draw the diagram again I have the savings function. Initially, I have the S plus T minus T f line. The line goes like this and the alpha is how much this slope tan alpha. It is S plus C t very good small S plus C t, but at the end of the class. I was trying to tell you if you draw the whole savings function, just the savings function, it will be a line like this. If you start somewhere here and it will go like this, this is the savings function.

Now, the intercept here I think it was from the consumption line above the this dioramic walls. So, it was for the minus C naught minus C t f am I correct, but this intercept I have put wrong what will it be the savings function intercept savings. Function is what S is equal to minus C naught, which is s naught this savings plus small s y minus small t y. This possibly income, this whole thing, this is the taxes. So, it will be minus C naught plus small s into T f. These are the constant terms plus small s into 1 minus t y, this is the savings function.

So, what will be the intercept here? I just wrote minus C naught that is incorrect. minus C naught plus small s f alright and the slope here beta tan beta is equal to s into 1 minus t. That will be the slope am I correct or not? So, this was an error I add nobody noticed the savings function intercept is just not C naught minus C naught C naught plus s t f I can see that from here minus C naught plus S T f. This will whole thing is in bracket plus S into 1 minus t 1 small error I made.

I am now coming to the end of the Kinchen gross model a few more things I need to tell you. Then the job will be over, basically what I take obtain two very important having shown the equilibrium point and diagram. Two important results one the expenditure multiplied is falling strength. It is becoming weaker. Because, it is 1 over 1 minus C into 1 minus T 1 minus C is a positive term multiplied with another fraction c is even a smaller term. So, the denominator is increasing, so a ratio value fall. So, the multiplied is becoming weaker and a new multiplied came, which is the tax multiplied. So, essentially I had two results in the previous class.

One the d Y d G multiplied expenditure multiply, became 1 over 1 minus C into 1 minus t. Two the tax multiplied is minus C into Y naught divided by 1 minus C into 1 minus t 1. These two multiplies I had c into Y naught over 1 minus C into 1 minus t 1. I told you it as this tax multiplied. If you cross multiply, there are two effects on output. When tax is changed one a direct effect one an indirect effect I told you that.

The direct effect is whatever income I am earning. If I have to pay less tax I govern with more money, so I spent direct effect on income and output. I spend and demand goods companies produce more goods, more income generated typical ancient model indirect effect. This output increase one time is not one time, because of multiplied. It will have a chain of increasing multiplies on that the new tax rate will be applied. People will keep

on spending something for a subsequent time periods, that is the induced effect or indirect effect. The effect induces further effect and initial effect further effects.

So, particularly there will be an output change, income change if taxes are increased. It is a reverse direction output fall income fall, if tax is cut minus sign minus C negative number inverse relationship. If tax is fall output income increases if tax is go up output income falls, this is one.

Now, I am going to introduce a government budget surplus more formally. You can see this in this model as from the disposable income and the expenditure function. If they had the demand function, there are three government related items three government related items. One is government expenditure g 1 is transfer payment with government makes to you. P people when we retire every year somebody retires and gets transfer payment. Already, retired people are there from the past, who unless they expire they will keep on receiving say pension or whatever and taxes.

So, government budget surplus budget relates to government. Let us call that will essentially be taxes minus all the expenditures in this model g minus t f. I guess you agree with me that will be the budget surplus. We have a positive surplus positive revenue with government. If this is greater than zero that means tax will be deduced more than the expenditure g and t f. The budget will be in desiccative budget surplus is negative. That means the tax will be anyways less than government expenditure and transfer payments. So, a negative number means budget deficit a positive number means budget surplus. I guess this is clear alright, is this clear with you?

Now, what I am going to talk about is may even draw these lines. I mean they if you know that taxes are usually what we do is t y and tax these are constants. Suppose, I Make or say we make b s is equal to this, you can you draw a possessive line. You can easily see that, you know at zero y is minus g naught minus t f naught that is the deficit. So, it is in the negative quadrant somewhere here minus g naught minus t f naught. Then this linear line, which goes up like this, when it crosses this is the budget surplus line. When it crosses it is a positive surplus, so at that point it is zero zero budget deficit neither surplus nor deficit.

What will be the angle of this line tan alpha? What is the slope t government? The budget surplus will come at the lower level of the, but the output will also decrease. We

have seen that from the multiplier output also declines, government and if they lower t then at a higher output level, the surplus will begin, because the line would be intercept at y axis x axis at the point to the right. So, at higher output level the surplus will begin problem government has problem you see that clearly.

Now, one thing, which is not discussed is that suppose government at any point. Suppose, government increase g, such that d G is equal to d T tax is also increase, government expenditure also increase, taxes are increased to final expenditure. So, when taxes are increased the government expenditure is increased or increased government expenditure is financed through taxes increase taxes, what will happen to y? What will happen to d Y d y? So, this question is often asked that d G is equal to d t. Then what happens you can see from here d G id equal to d T at d T f is zero suppose, so budget surplus does not change.

Whatever it is the amount budget surplus or budget deficit does not change. Because, d if you truly differentiate this d B S is equal to d T minus d G minus d T f minus d T f is zero. Already, I mean I am assuming that, suppose d G is equal to d T assuming d T f is zero. Suppose, I that assuming d T f is 0 the d B S does not change, because the increase in tax revenue matches with the increasing government expenditure, the way government manipulates. So, that budget surplus does not change. Whatever, deficit or surplus it was having it is not going to change.

What happens to d Y in this kind of a restricted government expenditure policy? A very restrictive government expenditure policy, government makes sure the budget surplus or deficit position. Whatever, it is presently there currently there is not going to get affected, although I will spend more, but I will also finance that with the increase tax revenue. Question that people ask tax if it increase it can only increase by increasing tax rate and also it increase.

So, increasing income, now the question is g increase at low increases the output the expenditure multiply tax rate increased lowers output, what is the net effect on output? This is what people want to know, what is the net effect on output? In this case I understand budget surplus government has important affect, but what happens to the economics output, when the income taxes, so as the issue an important issue. So, let us work that out.

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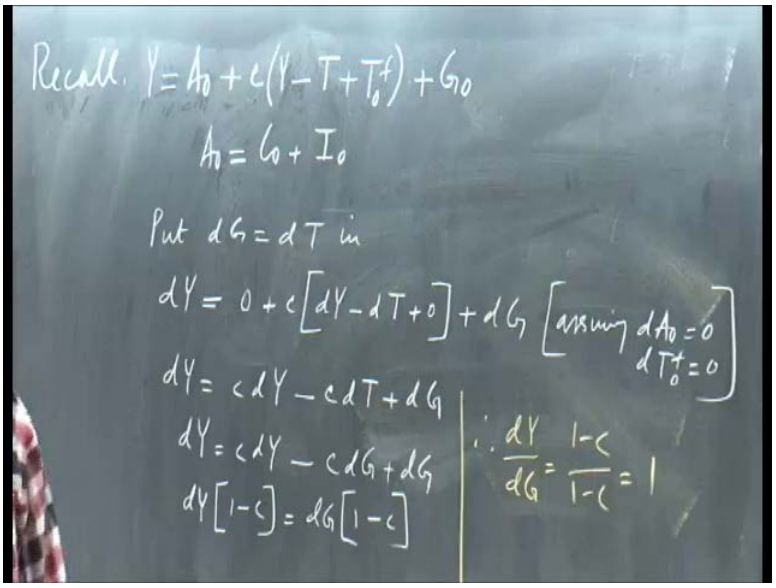

Next is [FL] recall, we have only goods market equation in the Kinchen gross model. We do not have money market, we did not assume lever market has become very simple prices constant, we have no lever market. So, all the money market issue only goods market is there. So, recall that equation Y is equal to A naught plus c into what to I write Y minus T plus T f. For the sake of this particular multiplier I am going to bring d G naught outside a naught. So, the a naught contains only in this case a naught contains only C naught plus I naught t f naught and g naught are outside. Sometimes, in notes you will find A naught contains all items unless I write them specifically outside

I am keeping them outside for a very specific reason. So, on this case A naught is this, but other cases in notes you will find, search you have written A naught, but you do not have T f naught g naught outside means, a naught contains plus t f naught c t f naught c into T f naught plus g naught. So, a naught contains autonomous terms except the ones who are outside. In this case I have written a naught in a way, which is different from the earlier ones you will find. Because, t f naught and g naught are outsides. So, this a naught is slightly different a naught essentially implies autonomous terms, which I do not need immediately for any purpose.

Now, I am talking about, what is I am talking about? I am talking about d G is equal to d T. If government does what will be d Y? It is simple arithmetic go through that equation. Now, put d G is equal to d T in this equation d Y is equal to d a naught is zero plus c d Y

minus d T plus 0. Because, d T f is 0 in this I am considered only d G and d T and the indigenous variable y. I am not considered with other variables plus d G. Assuming d a naught is equal to 0 and d T f is equal to 0 assuming that, so what you have is d Y is equal to c d Y minus d T c d T plus d G. Now, put this condition here d Y is equal to c d Y minus C d T will be c d G plus d G, because d T is equal to d G.

So, I can put d G in place of d T, so what you have d Y 1 minus C is equal to d G 1 minus C giver a very result, gives a very funny result. Therefore, d Y over d G is equal to 1 over 1 minus C over 1 minus C is equal to 1 very funny result, d Y over d G becomes 1 minus C over 1 minus C, which is equal to 1. So, in this case in this model, when government decides to increase the expenditure, it matches that increase expenditure to increase tax revenue. Then net effect on output is equal to the amount of government expenditure. There is no multiplied effect multiply value is one either negative or positive. No, net multiplied effect, multiplied value is what? A very interesting result a very special case multiply does not work.

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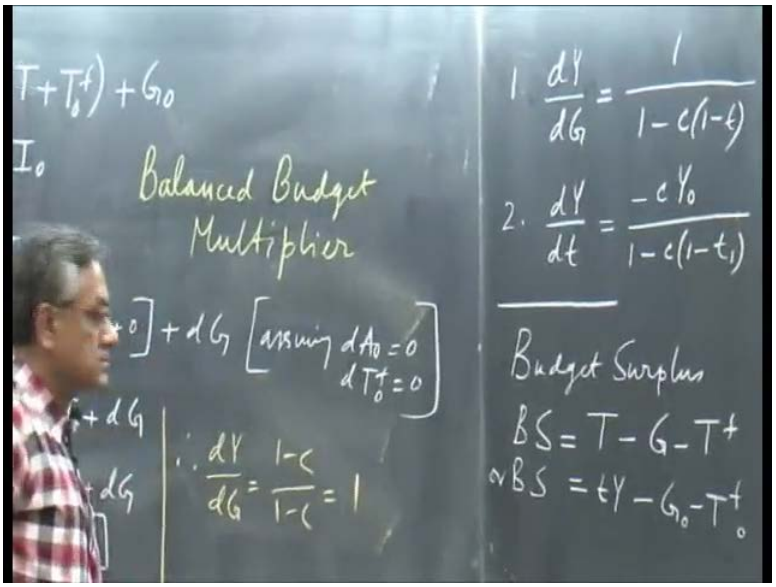

This has a name this has a name in the literature d Y over d G is equal to 1 is known as balanced budget, multiplier balanced budget is balanced. Because, the increase in government expenditure is matched by an increasing tax revenue. So, the budget surplus does not change there is no addition no subtraction from the existing surplus. So, that is why it is called a balanced budget and balanced budget multiplier, because I am talking

about these ratios. These ratios I have already told you, these are all multipliers expenditure, multiplier government expenditure, multiplier tax rate, multiplier or tax multiplier whatever you call that.

So, these are called multipliers the ratios alright and balanced budget, because when you increase g and match by the increase tax revenue the net effect in budget balance. In an accounting sense is 0, in this model it is 1 happens to be 1. In another it may not be one I will show you I am coming to other model, where balanced budget multiplier is not even one. So, the multiplier essentially does not work one round increase in government expenditure increases output income by that amount. There is no multiplier effects of sequent effects. I will show you a dangerous thing in balance budget multiplier in other models. I am coming to that other short run models is not even one that in affectivities are you clear on this?

The next topic is investment theory. Well, I would not get much into investment theory to be honest with you, I will talk about investment a little bit. Because, this is a topic that bothers something they do not understand capital goods etcetera. Now, little bit on that d Y d G if I want to discuss that on that diagram d Y by d G. That one I showed here does not change, the surplus for a given level of output that it produces. So, how will it look? Like there on that diagram very difficult question, good question.

How will it look like? Well, minus g naught will become minus G 1. So, this intercept value will increase downwards negative direction tax rate will increase. So, this line will become stepper. So, for a given level of output I have to draw a line, which will show the same surplus, basically for a given level of output. So, the question is where the economy is right now, we do not know? It will show the same surplus in budget surplus. We have four then it will become again four it should remain four. So, this is the budget surplus minus G it will come here tax rate will increase, it will be exactly.

So, you take the original output level or whatever or at the new output level y would increase. It should have the same amount, so the budget surplus will begin there. It will be a stepper land and it should though show the same amount that is all. Any output that is now produced should have the same surplus.

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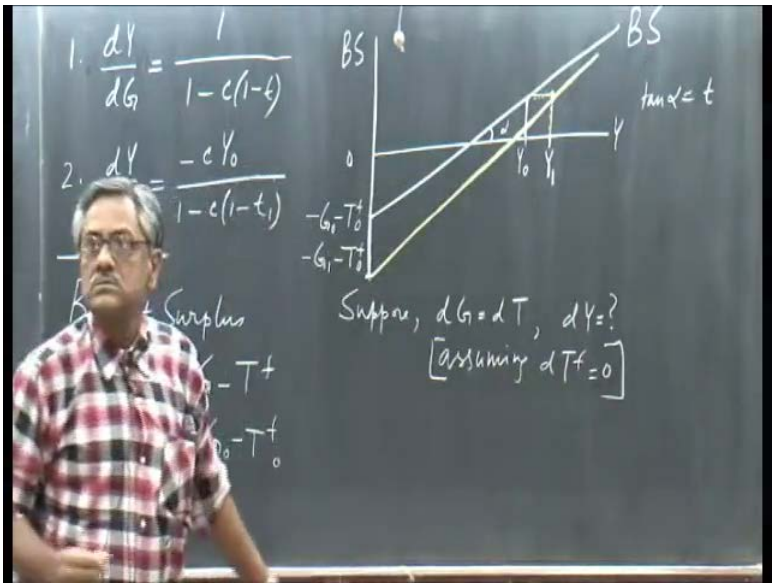

So, suppose the original output original output was here y naught. It has this amount of surplus original output is here and has this amount of surplus. Now, when g increases it goes somewhere here it will be minus g 1 minus T f 1 alright minus g 1 minus T f naught. Now, it goes to a different output level, since g has increased. Suppose, it has gone to y 1 and I have to show the same amount of surplus. So, it is should be a point here and suppose this is the point taxes have increased. So, the new line would be I do not have a ruler something like this. So, that the new output level the budget surplus remains the same. This is the height of the budget surplus it remains the same at the new line, is this your question?

That what I am trying to say the height at the new output level, there is an output increased d Y, d G. Suppose, that is the amount to g, also that is the amount of change should also be here. My diagram is not exactly the same as the amount of change also required here. It will show the same amount of surplus remaining. The line will be stepper remember, because taxes are also increasing, which means tax rate. What is a tax rate function?

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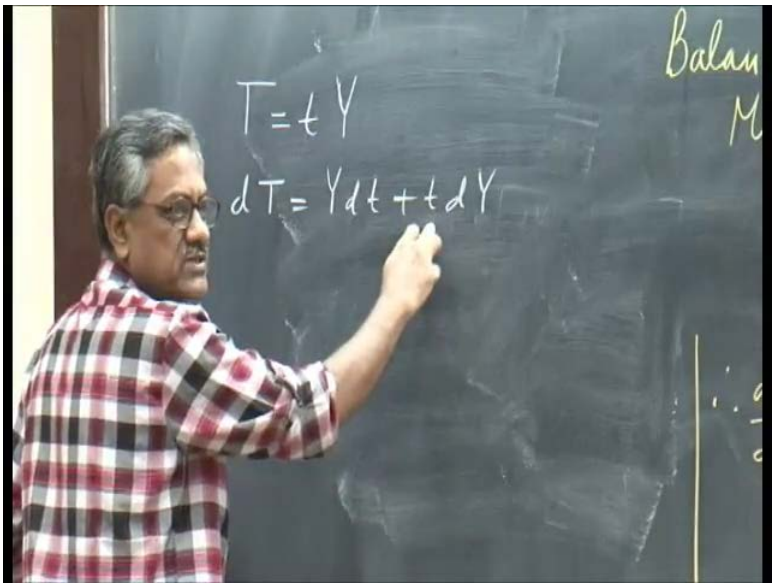

The tax rate function is what is a tax rate function tax rate function is T is equal to small t Y, which means if you totally differentiate if d T has to be d G, which means both Y d T plus t d Y. There is a tax increase coming from increased y with a tax rate and an increasing tax rate also, that takes place tax rate also increases. The amount that it dips on the x y at y axis there my diagram is not perfect, but that will be the case, I would have is should have drawn the diagram.

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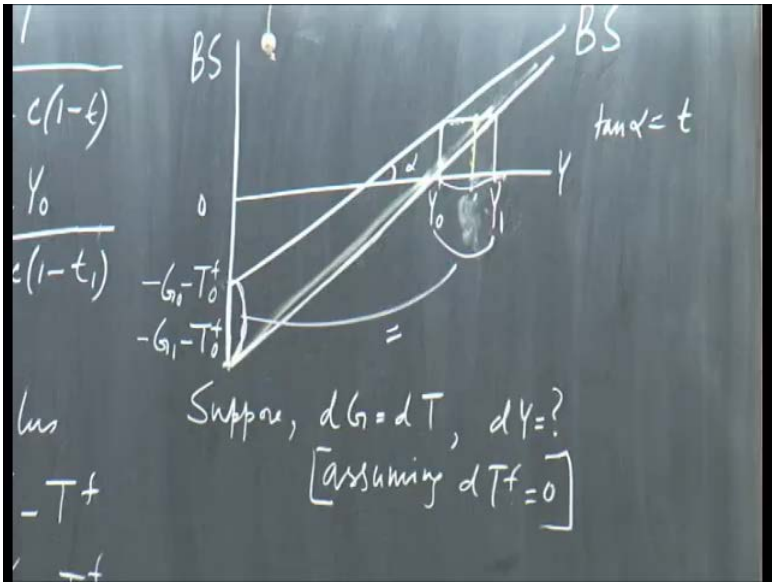

Where, this dip will also be the change here from here to here wherever. As a matter of fact that should be here and there where the line should come and absolutely collect. The thing is it should be like this, this is y 1 this and this they should be equal, yes absolutely correct, but this is a topic I want to just insert in the whole discussion on macroeconomic theory. This is on investment, because investment consumption assumption function is more common sense thing. Why there is an autonomous consumption? Why there is an induced consumption, which changes with income, because if people have more they will still consume something through border way.

So, autonomous consumption assumption is the savings you borrow money you do not save. Then induced consumption is of course, as your income increases you concede more. So, it is proportion to the income that you spent and consumption is on two types consumer durables consumer, non durables food items are non durables perceivable. Durable goods be bike clothes, Shirts, Fan, Fridge, T V, Washing machine all are consumer non durable, consumer durables. Now, investment is not so institutive, not so common sense. So, I am going to insert a topic on investment, a short topic. So, that what I want to start today, maybe I will finish after the exam complete this first of all in macroeconomics or any economics.

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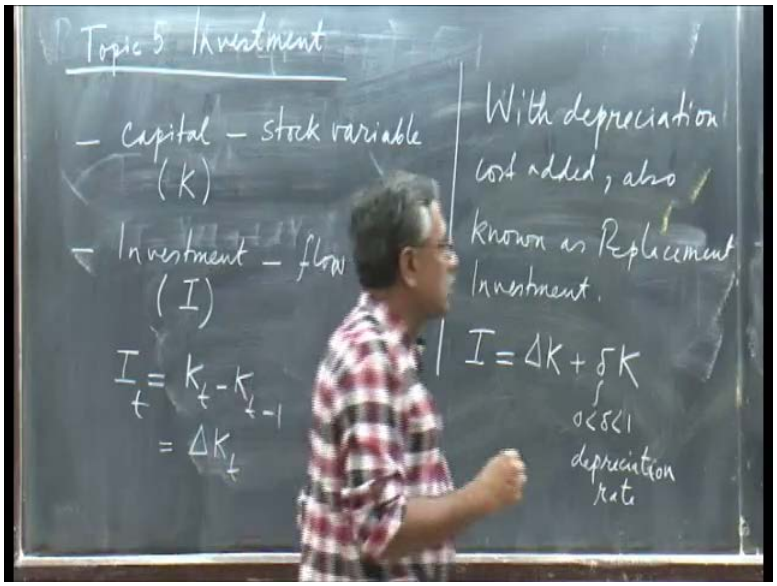

This is topic five think investment topic five is investment. Now, in macroeconomics first of all you have to understand, what investment is? Investment is connected with

something called we call capital. Capital can be of two types physical and money capital I have not talked about money capital.

That kind of or how much capital did you put in your business and you she says well I put 50,000 rupees only. Initially, that is money capital, but here we are talking about physical capital and investment has to do with capital and capital is known as a stock variable. In this room you this is a capital stock a table. Now, how is investment related to table? Well, you must have invested to get the table money investment has been there, but how is physical investment related to table physical investment? If this is a variable called K and investment say is a variable called I. Then the connection between I and K is I is equal to K t minus K t minus 1. That is I t, which is I t is in some sense delta K t.

You say sir, what does it mean? Well, capital stock was saying initially at one table, but now at two tables. So, investment is equal to in physical terms in real terms two table minus one table, which I had in the begging. Now, I have two tables, so 2 table minus 1 table, which is equal to 1 table. So, physical investment or investment in physical terms is equal to 1 table, the new capital that you have acquired.

So, in mathematical terms or algebraic terms investment in this period is capital stock that I have. Now, 2 tables minus capital stock I had in the last period 1 table, which is equal to in my example is 1 table, but this investment, since it is a change in the physical stock. Therefore, is called a stock variable physical stock of capital investment is therefore, flow variable investment is the flow variable. Capital is a stock variable investment is a flow variable. So, I t is equal to K t minus K t minus 1, so delta K t

So, this distinction we also often do investment is a flow variable capital is a stock variable change in stock measures the real investment, but this is a new table. I told you investment is just not only a new machine or a new table. There can be some investment expenditures, which are taking place to repair an old table, because it dot damaged. In case of a machine there is a wear and tear of the machine, as it is used to produce goods. So, there is some servicing in cost that is associated to service the machine to repair the machine to maintain the machine, which is often called the depreciation cost of capital.

So, what essential you have is, this investment is in some sense net investment with depreciation cost added, which is also known as with depreciation cost added, which is also known as replacement investment. This is also known as replacement investment I

becomes delta K plus delta K this delta with this delta lies between zero and one, called the depreciation rate of capital. It is like hard approximation like marginal propensity consumed can vary from individual to individual.

The depreciation rate of capital how quickly a capital stock wears out will changed vary or differed across various types of machines. You are talking about how a fan that also depends upon the brand name, becomes older requires servicing as opposed to say the Usha fan recently the pedaled fan the depreciation risk can vary, but this is a general depreciation rate. For the purpose of telling you about this concept it is called the depreciation rate delta, which is proportional to the capital stock. You have the entire investment function in some sense one can call this investment function. Now, be more precisely.

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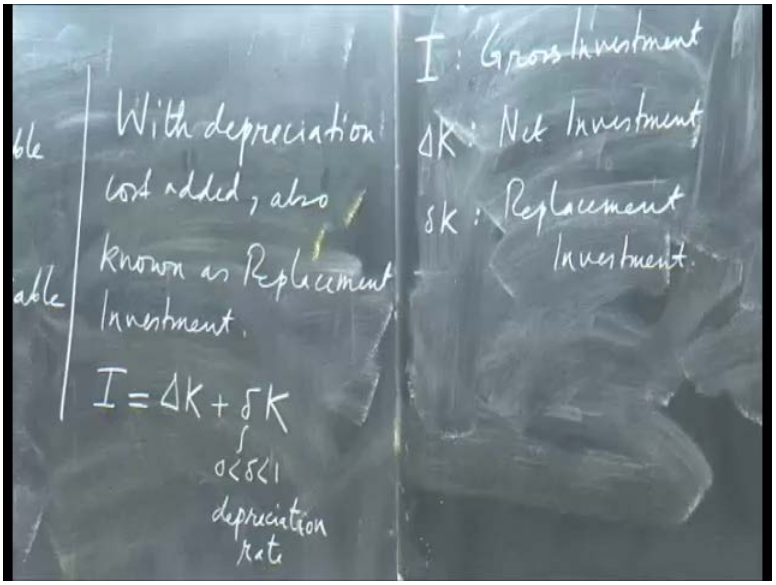

Therefore, I is often referred gross investment I is refer to a gross investment delta K refers to net investment. That delta K is replacement investment. So, this is how investment is defined in economics, not just macroeconomic any economics in micro macro. Any place there is a gross investment in a country or for a company yet I t cannot do existing buildings. Whatever, these lectures rules office buildings, labs, libraries. They all constitute that capital stock at any point of time.

They all have annually a maintenance cost. So, depreciation is going on there is a seepage there one mall broken futures broken. You require them to be replaced in service

all this part of replacement investment, but you look around and see towards the end of nursery a new building coming up. Now, that is the new investment change in the number of buildings is taking place. So, that the numbers of buildings remain the same. You have zero new investment or net investment, you have only replacement investment.

Now, you can ask me one thing, sir is it possible for that net investment to be negative? So, that total number of buildings can go down. Yes, you just start a war between two countries you will see how much is net negative investment. So, net investment can be negative or positive you just you just look at Syria, what is happening? Syrian army bombarding their own country people houses with tax and antennary. Just like what was happening in Bosnia in the nineties. When you were very young I remember the Bosnian crisis was exactly like this what was going on within the country. The main army main traction is bombarding the rest as if there is a war between two countries. Suddenly, this does not happen often this is just like the Bosnian war.

Now, there you have negative that investment, but you can ask me a question also, sir gross investment can it ever be negative? Well, capital stock as Puja was asking me yesterday. Capital stock is an historical accumulation of capital stock does not create creates its created in a country overnight, for hundreds of years buildings factories etcetera come into existence. You cannot just destroy all of them and have zero depreciation cost in a year. As if we are back to the stone age you just going to have that.

Well a new pear war can create that of course, but that is not a regular opponents. So, gross investment never really becomes negative. Just a second gross investment does not become negative net investment can become negative, but delta K is such a large term, because K in at any point of time in a country such a big thing the number of buildings. You have that the maintenance costs of those buildings conceptually at least. Even, if you actually cannot incur, because you do not have the money can be big. So, actual investment expenditure is also even if conceptually. It is very big actual investment expenditure, also show the depreciation cost except or replacement investment not in India.

I do not know the number for U S I have seen its over 85 percent a gross investment. So, net investment is less than guys allowed 10 percent and 10, 12 only the new housing, the new office buildings, the new factories. Do you understand what I am saying? So, gross

investment never becomes negative, but the delta K turn can become negative, but do not think that means I can also become negative. No, because the Greek alphabet delta into K is a huge number massive.

Now you following me to some extent , now I want to tell you a little bit more. Now, tell me in the macroeconomic context, what is capital? Well, capital in the macroeconomic context is there are three types of capital goods. Therefore, there are three types of investments, there can be three types of investment theories. The word of the capital goods well capital goods are definite thing. If in an office kind of a set up everything is a capital good the building itself, the factory itself, the plant itself, even residential housing. The house your father owns, the flat your father has or whatever the flat in, which your parents live they are also part of capital.

You will be surprised to know inventories of companies, which make consists of both raw materials and finished goods. You can keep two types of inventories in a company, because raw materials come from Chennai. So, stock file raw material here. So, though I do not have any production snag, I can keep raw material inventory. At the same time I can keep finished goods inventory. So, that I told you macroeconomics are just at same page. It is excess certain demand certain excess demand from a products I can take out from the go downs finished goods and supply and meet the demand.

If you draw inventories a part of investment. So, the question is, therefore brought there can be three types of investment theories you can have. You can discuss one is called these machines factories offices etcetera, they come under business fixed investment.

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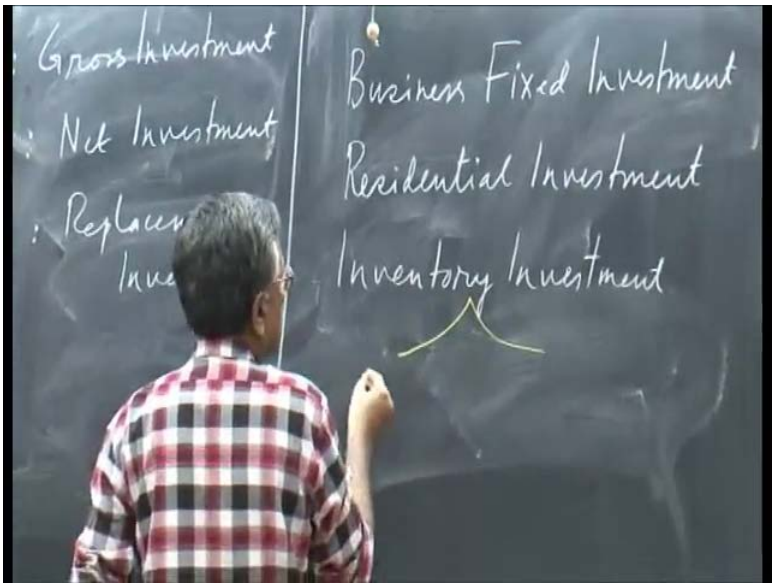

The other one business investment, the other one residential investment .The other one last one inventory investment business basic fixed investment residential investment and inventory investment. You did not know probably that the house in which you live or lived from your childhood is actually a capital good in macroeconomics. Who would know? Nobody knows.

In fact if do not know macroeconomics you would not even know that weather it is called a capital good or not you call that your house. So, in a war what is the maximum damage, you can do to the country one is killing people of course. What is the other one? Destroy capitals beating years centuries to build. The worst damage that you can do in a war to country is destroy capitals

Destroy one year's food product is hardly any damage. Next year it will be grown again, but destroy the buildings in one city is huge damage that you can do. How did Japan stopped second world war? What did U S did? They were not halting second world war. U S had to do something special just destroy two cities in one globe Hiroshima and Nagasaki. Japan said that is it no more second world war. In fact since then Japan has been the best friend of U S. Using the American Hollywood language U S says told Japan do not mess with me. Japan does not want to mess with U S anymore, but you have seen how war has changed, it has no war fear now.

So, U S Nepean bomb or atomic bomb does not work. Now, I do not know what will happen, next what kind of war fear will be there, but this is precise what happen Germany. How was Germany German surrender? It destroyed Germany literally completely wanted the allied forces in Soviet bonded. I was told entire Berlin there was hardly any house standing like every ten thousand one house may be standings all were gone anyway.

Now, so these are the countries, which will be more peace serving I hope so. Because, they had enough of war they have seen Japan, Germany etcetera. They were the notorious ones, now I wonder, which will be notorious ones? Next let us talk about easiest part here and the we would not go into business fixed investment it requires. So, much of micro theory, but I am giving you a story about investment.

So, that it get confused when we talk about investment in macroeconomics, but take the inventory investments as I told you. In inventory investment what you issue they have you have companies holding inventories of raw materials and finished goods. So, why would the inventories are being held they are held for the following reasons one raw materials. They consist of semi finished goods, which if you place an order cannot produced over night.

It is like any good it requires the time to produce in economics, we call that gestation lag, this is a gestation lag. You start a process of producing something it requires well gestation lag is slightly different anyway. So, what you have is goods cannot be instantly manufactured and the cannot be forefoot from a seller. So, you have to have raw material you can have a stock pile of that in your inventories it does not, is not available easily.

Secondly, when you are ordering goods when placing order for goods, if you place bulk orders often the seller gives you a concession, you must have seen it happens at a richer level also if I buy something in excess in substantial amounts, sometimes the seller reduces the price per K G say [FL]. So, there is a concession often you get from bulk buying producers always look for corners to cut in terms of the costs. So, if they can do a bulk buy where the raw material is not perishable. They do not require sophisticated cold storage systems to protect them. They can go for bulk buying provided they low they will use them up. Eventually, there is enough for their goods and can get a concession from their raw material suppliers.

Third, often it is said in the modern production line I happened after the industrial revolution from the of the mid nineteen century. That the production processes have become much more sophisticated much more complex technology is a much more complex. Where, if you program something in a computer language sense that this is the page at, which we will produce output per day. You have a you arrange for the raw materials the sufficient number of machines, the sufficient number of labor. People who would monitor that then production becomes a very smooth process.

Now, if you ask a production line manager a production manager or something. Now, there is a extra order please increase output by feasting more units per day. Somewhat, some product the company produces, it may not be possible for the company to change that production system, which is in some sense in an equilibrium producing and repeating itself. The amount it produces per unit per day to increase the output level to fifty units per day. It may not be possible you see that it may not be possible to do that to increase the output level from that to fifty units, because they have all been put its very smooth.

So, what happens if production smooth's smooth is very smooth, then happens is that the companies who are producing. Suddenly, there is an extra demand they usually ask the inventories to take care of it. So, when production takes place the production is just not for what they will sell in the current period, but also for the inventories. They have a desired level of inventories in companies this is the amount of inventories we want to keep.

Suppose, now there is an extra demand, which is more than what they are producing. Then they go and open the door of inventories and bring out the extra product. Then if it is permanent then what they do is they readjust the production system to produce a higher level of output from now onwards. Like a thing it was not there, but I make a judgment to produce higher level of output. So, this is called the production smoothing models they have, because of which inventories are necessary to be kept both finished goods inventories and raw material products.

Now, in some case for instance you take the case of the baker, who produces bread and cake and wheat and etcetera related products, every day all through the year. Now, imagine if this baker does not stock while enough wheat or does not have a supplier, who

would keep on supplying wheat. Whenever, he needs it whatever he it may be it would not be able to run its business and wheat is not grown every day. It is not that you go to the field and get, wheat is harvested in a particular time of the year for the entire year. So, far I know Wheat harvest is usually once a year, rice. There are two three product output levels two three times they produce various kinds rice, but wheat I have been told is just produced once a year.

So, inventories are necessary without inventories once wheat is grown and come to the market. You do not stock pile them, either the local shop ensures that they continuous supplies there. Though he is doing the stock piling for you from some wholesaler or somebody or you inventory the baker will have to have at least a month. If I were a baker I would have at least a month inventory there.

So, that get into trouble, because every day I need it to produce the items I had produced. So, in some cases inventories are a must in some cases inventories are like safe guarding unfortunate unexpected events in the future. Sometimes, inventories also allows you to save some costs, but the problem is as soon as it start talking about inventories and buying in bulk saves your cost. Because, get a concession we were talking about some resource cost you need a place to stock pile these goods. In India for residence a big problem today is the amount of harvest. If it is good in any particular year food corporation of India does not have enough god owns to stock pile. The harvest say they do not have enough god owns.

So, government of India has to trouble the whole these inventories F C I is having a problem in containing these inventories, where to put them. So, as soon as you were talking about inventories you need a room. If it is that kind of inventory you need the protection, say the temperature. If it is a cold storage you need special ice box or whatever facilities to hold the product you must have seen apples are sold throughout the year. Where do they come from? Apple is not produced harvested throughout the year not even in Kashmir. So, they all come from cold storages essentially are inventories of some business man, whose business is to hold inventories only may be and supply them.

So, there are costs associated with inventories also, because there are material costs. Then if you are borrowing money from the bank there will be interest cost, Then if you employee people to look after the inventories, just the company employees people to

look after accounts to look after the production to look after other managerial functions. If you have inventories and people to look after inventories, then inventories would also become cost related there were labor cost interest cost and everything. Now, I come to the more important part of we had been talking about inventories. There are two kinds of inventories that you have to remember.

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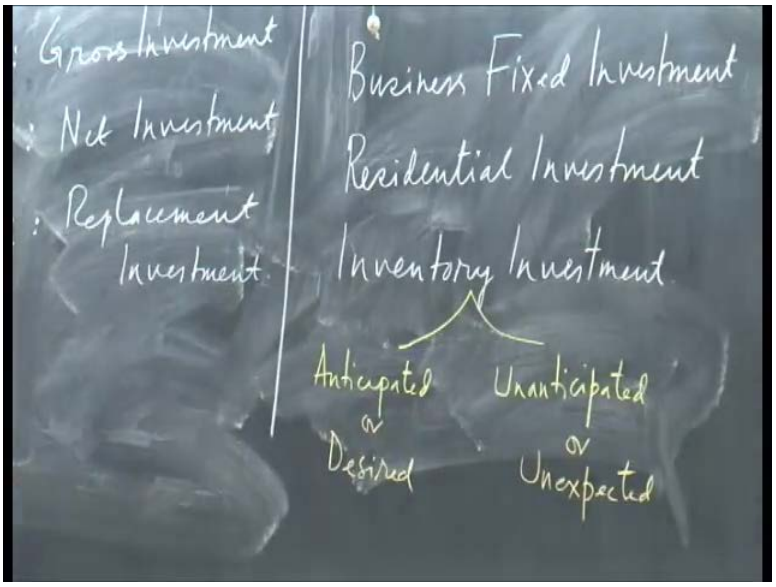

One, two kinds of inventories one is called anticipated inventories and the other one is un anticipated. So, anticipated inventory and unanticipated inventory. Now, anticipated is expected inventory in some sense this anticipated also has another expression, which is not also I am comfortable with. This is also, me times called desired and this is unanticipated is also often called not undesired. It is called unexpected called unexpected inventories.

Now, anticipated or desired inventories are like, let me tell you an example. Suppose, the economy was in a recession, but now is in a recovery what do the companies anticipate seems to increase and increase slowly may be over night. Now, once the confident then the economies under recovery path, that is why I talked taught you business cycles in this kind of a situation. When you are in the absence of business cycle economics recovery from a recession recovery, from a recession, what will be the anticipated inventory? Changes positive, because the companies would like to hold more inventories. Because, they are expecting demand to go up or they do not know how much they will go up.

So, the desired level of inventory are positive they would add thing to inventory raw materials and finished goods, but suppose the economies. Now, what is happening in India? Is going more into recession what will be that? What will be the desired or anticipated inventory? Changes negative every quarter output growth rate is falling. So, we anticipate means we expect lower demand levels in future. If we expect lower level of demand in future, therefore the desired inventory changes would be negative. We would be lowering the amount of inventory, because we do not expect the market demand to go up right now.

Now, comes the unanticipated changes, which we do not know suddenly something happens say the best unanticipated change the example that I can give you is that for instance the economy was on a recovery part, but suddenly a war started in middle east The oil prices sky rockets its already high fight is going on between political parties in India. You have seen regarding what should be the petroleum price and why diesel is subsidized. There is fight literally every alternate day on T V channels I have seen political parties are also fighting in part of it, why Petrol prices are going up? Why Diesel is still subsidized you. Now, understand the word subsidized, now also everyday there is a fighting going on. Why government has such wrong policies?

Now, with high oil prices what approach is the war India is on a recovery path, but there is war which begins in the middle east oil price is shut up even more. This is unanticipated change this can bring down the expectation of a good world economy. Therefore, good prospect for Indian economy in the coming future, then this unexpected change would led to unanticipated change in inventories. In this case it will be negative, in this case it is negative. In another case for instance say Afghanistan [FL] Taliban [FL] U S [FL] friendship [FL] [FL] Pakistan [FL] civil war [FL] Pakistan sometimes is on the verge on a civil war literally not civil war. [FL] [FL] I know about this moment from sixties when I was even younger than you. [FL]

Now, there is an unexpected sudden confidence boost among economies in south east Asia. Everybody has become very friendly with each other and people started spending and demanding more goods more output is produced, lesser military goods are produced. So, this unanticipated change would led to you can see unanticipated changes in inventories. So, there are two kinds of inventory changes possible anticipated change in inventories and unanticipated change in inventories.

The unanticipated change and anticipated change usually operates in the opposite. Like if there is a sudden increase in demand unanticipated change in inventory would be negative. Because, you will be taking goods out, but if there is a consistent change in demand, where you have anticipated change in demand, when it is increasing when the market demand is continuously increasing. Your anticipated inventory increase will be positive, but sudden increase in market demand would have negative unanticipated change in inventory. I told you why, because goods are taken out from the inventory to meet the sudden increase in demand remember that.

Now, this part is the most complex and difficult one for you to understand, but what I could do is. I would try to demonstrate that with a very simple example as to how business fixed investment, where microeconomics is used is obtained through algebraic formulations. Just one simple microeconomic theory I will do a very simple one, which I have already done.

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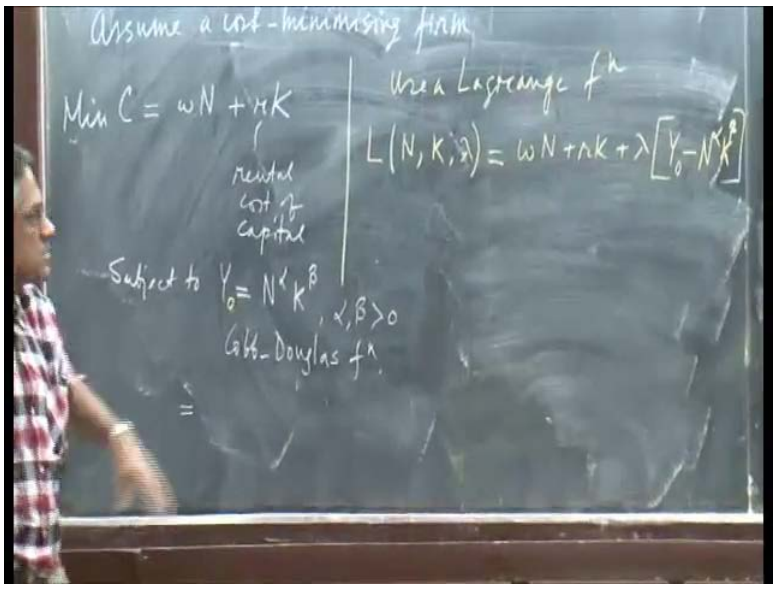

Now, assume let us say what I have first is the cost minimizing firm assume a cost minimizing firm. So, what is a cost to offer is said w into m the amount of labor it uses plus r into some amount of capital. Say, a retrial r it said like retrial cost of capital r times capital that it uses per period. You can look at r, which is the rental cost of capital in the following way and in the following manner.

Say, a company does not purchase capital, but rents all its machines it pays a rental a rent every month. Every year in India famous companies, which rent machines, which smaller companies cannot buy some of them are like I D B I industry development bank of India. I do not know about I C I C I whether it does it or not the rent machines, which are much more expensive machines imported machines, to medium size small size companies. Because, they going to purchase them. So, this is an cost function you pay labor wage W is wage per labor. You pay rental per rate of capital you use this is the cost function.

Now, this cost minimization program in mathematics is usually done under a constant based minimization kind of a hypothesis. So, assume a cost minimizing firm is the company is minimizing c subject to an output level y is equal to some function. You can assume say a functional firm is like N alpha and K beta where alpha and beta are positive This is the common functional firm output, this is called a production function a common functional firm. This is known as a Coff Douglas function. Coff Douglas function you need not know this is just a functional firm. So, the company is saying I want to minimize my cost to produce, this the how much what will be my labor demand and capital demand basically.

Now, the weight is set up is using something called a Lagrange function. So, you use a Lagrange function to obtain the results and the Lagrange function is like L, which is of two the choice variables are N k. There is something called a Lagrange multiply, which is w N plus r K plus a Lagrange multiplier into y. That you want to produce of suffix amount of Y say Y naught minus N alpha K beta. That you want to produce Y naught is the output that company want to produce.

So, subject to S is equal N K alpha subject to some say y naught some output level, which is produced using a functional firm N alpha K beta. It is a Lagrange function have you seen Lagrange function like this subject to a Lagrange. This is called the Lagrange multiplier. So, you have three choice variables N K, company wants to produce Y naught. In the process mathematically there is an optimum value on lambda also, which is called the Lagrange multiplier.

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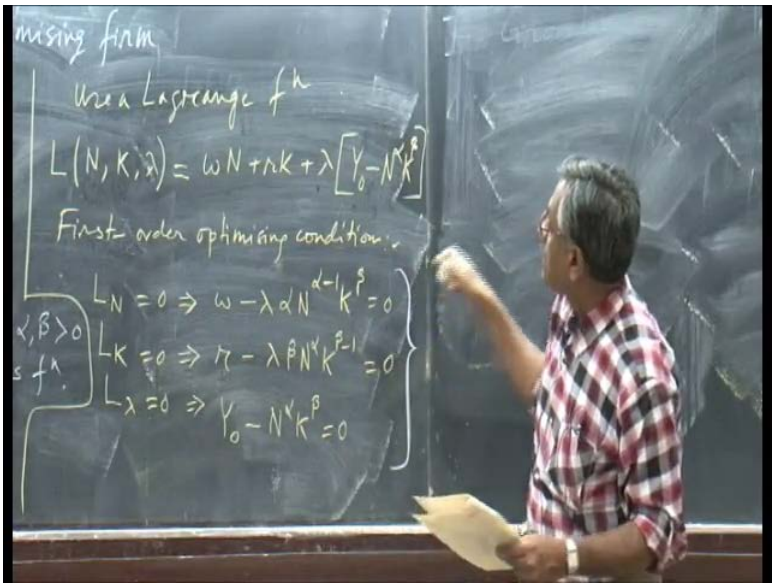

So, what you have essentially on the first order conditions. That I require the first order optimizing conditions are the first order optimizing conditions are one is L m equal to 0. Another one is L K equal to 0, another one is L lambda, which is equal to zero L N, L K, L lambda is equal to 0. So, L N is equal to omega then it will be minus lambda alpha N alpha minus 1 K beta is equal to 0. L K is equal to 0 would give you r minus lambda beta N alpha K beta minus 1 equal to 0 and L lambda would give me y naught minus N alpha K beta equal to 0. So, essentially you have these three first order conditions your first order conditions.

Now, the thing is what you get now please you can check how you this is very simple. If you divide the first two one by the other what you get is lambda, lambda cancels out and you get alpha over beta N alpha. So, N minus alpha and one an K minus beta K 1. So, from the first two conditions L N divide by L K, will be equal to omega over r is equal to lambda, lambda cancels out alpha K.

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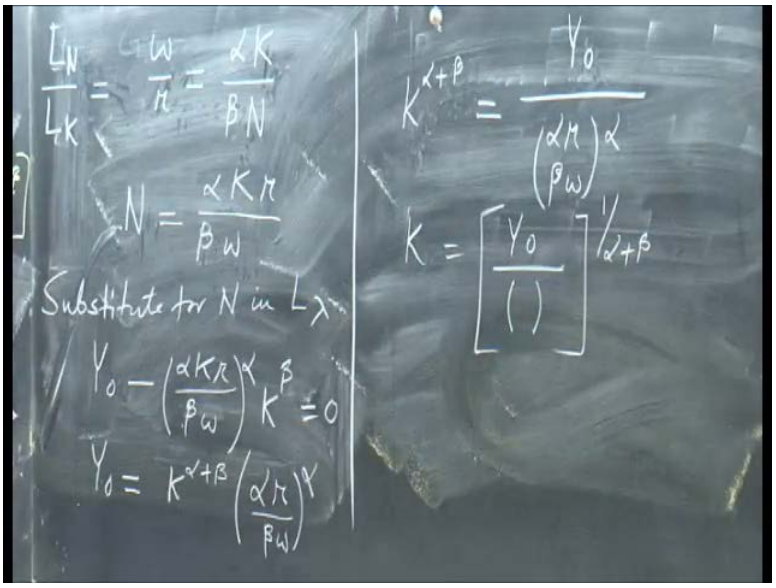

Beta N L, N o, L K is equal to omega over beta is equal to alpha K over beta N. now, from here you solve for N, N will be how much if N goes up. Then you have alpha K over beta remains omega, am I correct? Now, substitute that N here the last one. So, when you substitute that N in L lambda substitute for N in L lambda. What you get is y naught minus N will be alpha K r over beta omega to the power alpha K beta is equal to 0. Now, from here I can see y naught is equal to therefore, K alpha K beta. So, it will be K alpha plus beta into alpha r over beta omega to the power alpha, am I correct or not?

So, you have solve K, therefore K alpha plus beta is equal to y naught divided by this business alpha r beta omega to the power alpha. Therefore, K is equal to Y naught divided by that bracketed term the whole thing to the power one over alpha plus beta. Now, this simple algebra that I have done, gives you what is called a capital demand function. The company demands capital in the following manner, this is called Capital demand function.

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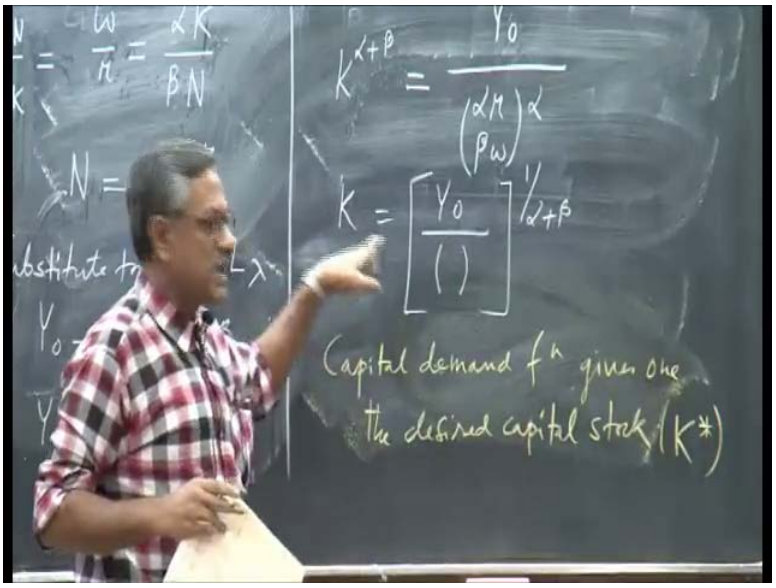

If I am correct this business r here is in the denominator. So, you can clearly see K and r are inversely related. So, if the rental cost of capital goes up demand for capital would fall. So, from this now if you have a demand for a capital function. You now can easily go into an investment function depending upon by changing r value K value would change.

So, the companies investment would also change you can demand because investment is nothing but difference in the K value. It is a business a model I am doing a company's an hypothetical exercise here and optimizing exercise. When saying the company wishes to produce some output, which you think it can sells, but in order to produce that, it wants to know what is the minimum cost of producing it.

So, it implies the technology, which is the functional Coff Douglas function a production function implies a particular type of technology. I can change the function firm and I can easily say another technology is being used and given a technology and the factor prices. It requires to know what is my labor demand I can obtain a labor demand function N is equal to something. I can solve that too the way I have solved K is equal to something. So, I can obtain a capital demand labor demand function and from that I would know how much we have missed.

So, this essentially capital demand function gives the company gives one, what is known the desired capital stock value. It gives you the company the desired capital stock well,

which is known as sometimes the K star .More I want to have given the parameter values I can get a K value, which I call K star is my desired capital stock, which I should have in order to produce y naught.

All other parameters given the technology and the wage cost and everything the alpha and the beta the W r all values given and y naught given. I can get a K star value from this I am solving one equation one unknown nothing else. In general it is a demand function with r being an inverse relationship, r is a price of capital. You can get a inverse function here if you want to draw that a demand function, but one point on the demand function is my desired capital value given.

All the parameter values once the desired capital I have I compare that with my K. Now, if my K, which I have is less that K star. What you are saying is K star minus K that I have is a positive number means I require physical investment, which is business fixed investment. Because, it is the company doing it how much more machine, what big plant size I need, what good office base I need, whatever.

So, this is business fixed investment a simple I will try to give you using microeconomic theory, where microeconomic theory saying a company. Assume a company a cost minimizing firm, now does it approaches in microeconomic theory. We algebraically approach the problem we say cost minimizing firm to define, what is cost function? Then it should define the technology. It should use what is the output it should produce. Then I get a capital demand function and get the desired capital stock. Once I have the desired capital stock I compare that with the number of capital. I have like I need fifty chairs my desired chair capital stock in this lecture room to teach your class.

Then I look at how many chairs do I have, I have thirty only. So, what is the physical investment required fifty minus four forty ten chairs more that the company seek. I need ten more machines to produce what I want to produce. This is a business fixed investment model, this is how microeconomics is after macroeconomics. It should have been before that someday you get an opportunity to learn some microeconomics. It is a fascinating subject it goes algebraically at every step conceptually and algebraically with small hypothesis and models try to find the solutions. So, this is a business fixed investment model.

Now, I am nearly running out of time I wish I could have told you a little bit more, but this is how we go into you can go into various inter cases. Various things that you can do, but I need not go into that what I would do I require. May be half the hour, half the time next class to wind it up to tell you a little bit more about residential investment. What kind of a theoretical progress it has business investment. You know the theoretical progress inventory investment. You know some of the conceptual things involved unanticipated inventories, anticipatory inventories , what do they mean? Why inventories are held? Why companies? You know that stuff a little bit.

So, I will tell you a little bit more about this whatever remains in the next class first half Then I will go into again the game I play in this course is that I will tell you the next higher level of macro model Kinchen gross model is over. The next model is the famous model called I s L m model. I will talk about the I S L M model, but I will wind up that. I will do the precursor to that the background the investment theory a little bit. Because, many people do not understand what investment is. Many people think it is the money they are talking about putting in their business. It is not just money it is something more and you have seen that lot more is involved in investment in a country and I gave so many stories also.