Macroeconomic Theory and Stabilization Policy
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Lecture – 20

We are going to start the new topic, the last topic and it is slightly complicated, not much. Essentially, what we do is we add some of the some of the features of an open economy to the I S L A model I S L A model, you know very well now. So, we had the I S L A model, so it will be a fix price model, we will not have the supply side equations, fix price model supply curve will be horizontal. So, the entire economy is based on what happens to demand. And if demand increases output increases, if demand falls, output falls. Prices are not affected.

So, in some sense it is very kind of a short run model, the model title is I S L M B P, B P stands for balance of payments. So, you are adding the open economy characters to the model, so it is an extension of the I S model nothing else, but since you had the third equation. The matrix gets a little bit complicated because you know have a 3 by 3 matrix 3 equations are there, so there will be 3 dependent variables which you have to solve and of host of multiplier possible. This is the I S A model extended to the open economy it is called I S L N B P model, so what I have to do, I have to revise the I S equation.

Now, L M equation is more or less same expect under fixed exchanged system which I would explain later, I will do that at the end. So, L M equation will not change initially it will remain the same more or less I S equation will change and there will be a new equation the B P equation. Now, what did we learn in the previous class, we learned that balance of payments account as two broads of account, current account, capital account. Current account has again 2, 3 sub account, the trade most important export and import of goods then you have the services account export and import of services.

Then you have the transfer payments account where you had the remittances grant gift etcetera, so if I have to define the balance of payment equation I should be paying attention to this accounts. So, that these variable are reflected in that equation, so that is how we would know what the times to go in to be included in the balance of payments accounts. Let us explain the I S curve, what is the I S curve, I S curve represents all

equilibrium points, where equilibrium is defined in terms of supply of goods equal to demand for goods.

Now, it export and import you have traded goods coming in, so you have two more items essentially the demand function, it is coming. The total output also consist of some extra item which you export those are part of total output, so in the demand function essentially what you have. So, much demand which is called assumption demand you have the investors demand which is called investment demand your government expenditures which we said is part of demand. When government is spending means government people are demanding, public goods, so government as spending and that spending represent indirectly the demand.

That is this is how we have explained government expenditure, now you have demand for your goods by outsiders, which is called exports, when you export this essentially reflecting the foreigners demanding your goods. So, you will have export demand then you have an item which will be deducted from all this because the total amount when you collect data on total goods. Now, you have with the open economy you have some goods produced some goods not produced in the country, some goods are produced abroad.

So, you have to minus, therefore from the demand that people have for goods the goods that are imported because those goods are not produced by you they are produced by some other country. They have come into your country you buy them it may be car it may be even electric shaver it can be a long whatever. But when you look at the demand in India, now when you are talking about Indian goods they have to be deducted because the total demand values are mixed. Some of them are your own goods that you are demanding some are foreign goods that you are demanding, so essentially what happens in the I S curve is you modify.

The I S function on the right hand side, where on the on the right hand side you have an exports of goods and services and import of goods and services. So, let us begin that last topic the algebra is a little bit complicated conceptually this not much.

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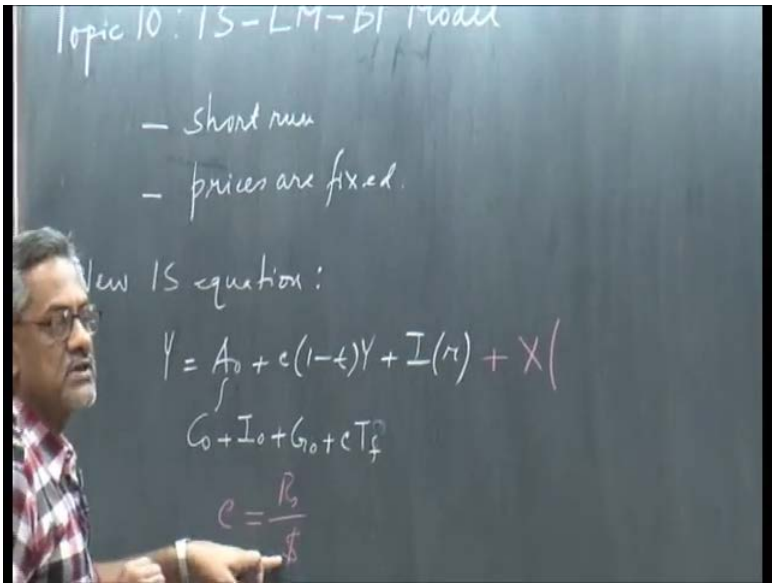

So, topic 10, I S L M B P model, it is a short run model precise are fixed this is what you have that the I S equation, the new I S equation. The new I S equation will be as before the autonomous component of demand consumption demand is there, autonomous component may whatever the things.

But, autonomous component may you had c naught plus some autonomous investment can be there, plus government expenditure which is also consider to be autonomous means exogenous not dependent upon the model. Then you had the transfer c t f or c t p, whatever I wrote I do not know c t P I forgotten the notation transfer payments t f, c t f or something. So, what else did you have their nothing else these are the things you have autonomous components, now these 2 these 3 items are as before.

But, now you had the export of goods and services, the export of goods and services we have to define the export function. Now, this is how I am going to define export function in very simple logical terms going to any economic theory, if exchange rate measures, the relative price of another countries currency or relative price of your currency. In terms of another countries currency where exchange rate has been defined as rupees over dollar, that means your currency in terms of another countries currency.

How many rupee for dollar, how would the export function of get effected by exchange rate, how will it get effected if more rupees available for dollar when the goods are right there. They can buy more Indian goods because with 1 dollar provided prices accounts

prices are fixed, is a fixed price model. So, they can buy more goods there like I am buying goods from china if prices are same, now the Chinese currency depreciates. That is Chinese Yuan goes up for Indian rupee, so with 1 rupee I get more Chinese currency, so I can buy more Chinese goods.

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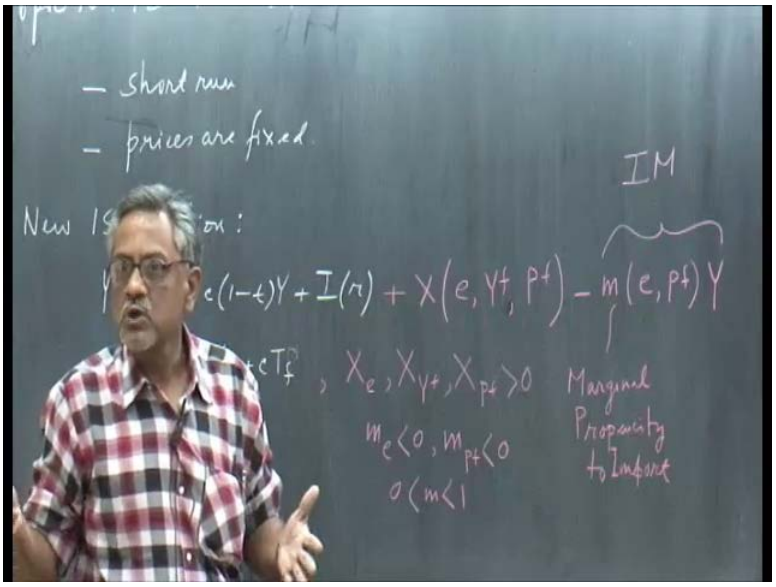

So, X relationship with e would be essentially a positive relationship, if e value goes up more exports are possible, second which is often consider to be a important variable. Suppose, now foreign income U S A is doing well no more decision, Europe is doing well no more decision, what do you expect it may not be true. But, what do you expect the relationship will be with the goods that you are exporting you are trying to sell there if there more income, they would buy of your goods then can spend more. So, with foreign income let us call foreign income Y f, so X will have a positive relationship with foreign income.

Finally, ago up a variable which I am going to just put it here is that if now domestic price are constable foreign prices of goods go up and they might find imported goods cheaper. If imported goods prices do not change and exchange rate do not change, so this is called under a fix assumption that other variable remaining constant. So, with foreign prices also our export can have a positive relationship because if foreign price goes up Indian price do not, they may find which is happening in India of an Indian prices are more than Chinese goods.

How is china selling more goods in India, one of the reasons why it is selling if you go to a toy shop you realize that because I have kids at home I realize it. This is the reason why Chinese goods are sold more is that although qualitatively there inferior is amazing qualitatively there inferior, Chinese goods are cheaper than Indian goods. So, this is an example here what I am trying to say P f export of china to India is going up as foreign price which is Indian price is high. So, P f so what do you expect here is that the partial derivatives X e X Y f and X P f are greater than 0.

These are partial derivatives means keeping other things constant other variable do not change a relationship, partial derivative not the total derivative when all variables is change not at all partial is when X with respect to e. What is the relationship with e value changes holding Y f P f constant, now this is the export function, next the import function I am going to do. So, the import functions very traditionally like a consumption function I would assume a linear import function where m is like margin and propensity. It will import which is the function of some variables, this is called marginal propensity to import, now this marginal propensity to import.

Now, this marginal propensity to import is like out of the income I have what is the propensity in India to import one thing is obvious. It is a positive function of import because a positive function of income if our income goes up we would be importing more just a way the foreigners when their incomes we would be exporting more. We would be exporting more means they are importing more, similarly margin propensity import would be a linear function positive function of the income of course. But, marginal propensity import itself will depend upon the exchange rate, what is the exchange rate is it will go up and down depending upon the exchange rate.

One more variable would be the foreign prices of foreign goods into Y, so m is a function of e P f into Y, a linear function and assuming without constant term not Y is equal to m s plus c, I am just making a function. Here, Y would m s, where m is the function of 2 variables e and P f. Now, exchange rate, if exchange rate goes up means to get 1 dollar from reserve bank I have to give more Indian rupee to buy. Then I buy the foreign goods this kind of a situation discourages import, so my assumption there will be, m will be negative as e value goes up I would import less just.

Now, for instant exchange is with respect to dollar is depreciating a lot in the free market and which means more Indian rupee. If dollars every day you hear that if you open T V, the other day I saw which you know 57 something, so from 48, 49 it has become 57. So, more rupee per dollar every day re value is going up which is going up means in not value increasing, in fact the currency Indian currency is falling value in terms of U S value. It is called depreciation of the exchange rate, so e value going up, so marginal propulsive import with respect to e would be negative.

If e value goes up we have a tendency to import less we have propensity, to import less naturally or imports. Similarly, foreign prices what will it be foreign prices if they go up foreign price if they increase we would import less, if Chinese goods values go up suddenly prices. So, they will, so m P f will also have are negative partial derivatives, otherwise m is a positive number m would lay between 0 and 1 just like marginal propensity consume marginal propensity to save, they all lay between 0 and 1. Now, 0 1 because you understand the total import if this is total import, this whole thing is total import then what it is saying is that the import goes up as income increases.

But, the change in import compare to the change in income is less than 1, the ratio we when income increases by 100 more rupees. We do not spend 150 on import, we spend may be if my import goes up a 100 more rupees I may spend 10 more rupees extra on imported goods. So, marginal propulsive import is one if you, if this is import this whole function could be delta m, delta Y which will be m, that is less than one just like margin and propulsive consume and marginal. Propensity save is less than one out of my income I spend a part on consumption I save apart, similarly I spend apart on imported goods it is not that I spend the entire amount.

So, these propensities are assume to be less than 1, this part, now in a naught I should not be in a naught you can assume even tax is to be an autonomous tax is to come here c T naught also. So, there are autonomous components that can be added to a function just like a linear function can have an intersect which does not depend upon the income there is an investment component.

We can assume that to be autonomous which will not change with up and down in income, but there is an induced part it will change with rate of interest or whatever. So, an autonomous component can always be added even with respect to taxes, even if

income is 0 some taxes are paid that kind of a shame, which really does not make much sense. But, you can put an auto enormous part, now these are therefore, now the question is what the slope of the I S function is.

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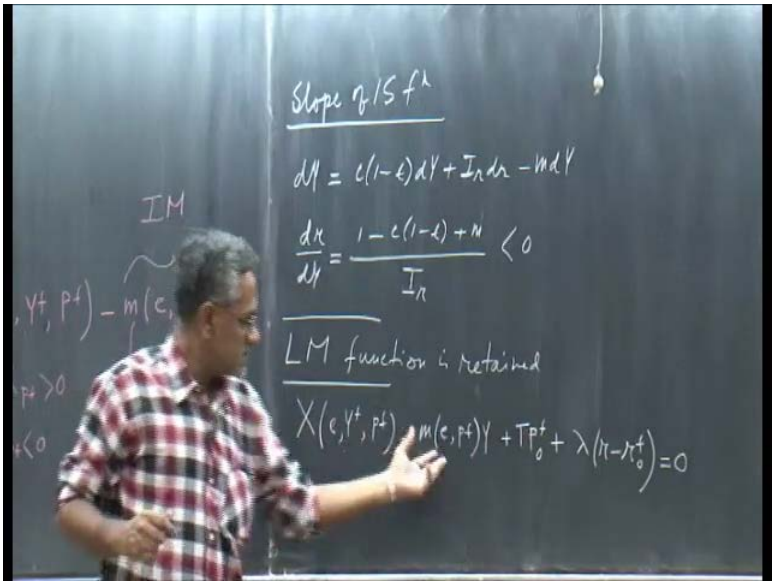

What is the slope of the I S function, how would it look like a new I S function, so what is the slope of the I S function, the slope of the I S function will be divide everything else is 0, is equal to c into 1 minus t d Y plus I r d r export function. So, nothing will come out from here, from the export function nothing will come out very differentiate, but import function something will come because it is the Y term there. The slope is r Y plane I draw it on r Y plane, so it will be minus m d Y, so what you have is therefore if you club terms.

So, what you have is a d r d Y is equal to 1 minus c into 1 minus t plus m divided by I r, well m is a positive term, so this numerate is this numerate is negative. So, it is still negative, so it is a down ward sloping line except if you compare that with a closed economy I S where m was not there. Then you clearly see that the I S curve has become steeper is simple reason I S curve represents the demand for goods and services.

So, if you if part of you demand is for imported goods the demand for the output in the country would be following, therefore in some sense it is some leakage because every time you earn something you not only spend domestic goods. There is a leakage apart in spend on foreign goods where the income goes out of the country foreigners earn them.

So, the leakage is making the I S curve much steeper, so effectiveness of fiscal policy will go down further I can see that right away effectiveness of fiscal policy will go down in future.

So, with this leakage in this system which is calling import when you are importing you are having fun here, but your income does not remain within the country, it goes out of the country. So, the multiply gets weaken is a otherwise without the imported goods the multiplied would have been stronger because the economy, the money is circulating within the economy and creating the expenditures. So, other income every round, but now apart goes out foreigners happily go back from and down could money in their account.

Therefore, the effect of that money which leaks out on the multiplier in the country goes down in your country, so I can clearly see the effectiveness of fiscal policy going down, we will have to check the d Y d g multiplier later. But, I can clearly see this is going to happen I S curve is much more steeper, now I come to the balance of payments function, I would assume just like the goods market. The money market by the way L M function remains same, the L M function remains the same, I am going to remain the L M function, L M function is retained, L M function is retained.

So, I am not going to change the L M function, I may I will have to change that when I talk about fixed exchange rate system but, L M function. Now, it will not change [FL], next thing is the B P function luck what we have done with I S L M function there all are showing equilibrium conditions market. So, clearing conditions supply is equal to demand in the goods market you have t supply of goods, here equal to the demand for the goods that new demands for goods are indicated with this pink color L M function. Now, also you have the supply the money on the left hand side matching with the demand from money on the right hand side and in the Keynesian model I S L A model and Keynesian model.

This is the Keynesian model you have the 2 components of the band for money, one is a transaction demand for money the other one is a scapular demand [FL]. Well in the d P function what I would do I would impose which need not be the case, I would impose an equilibrium condition and what will be a balance of payment equilibrium conditions. So, balance of payment condition would only be 0, balance this is neither deficit nor surplus,

so that whatever foreign exchange you earn by exporting through remittances gifts grants loans.

Capital account or current account is exactly matched by the drain of foreign currency from the country, so equilibrium in the balance of payment would be in a 0 balance. But, the balance of payments equation is neither surplus nor deficit that what it would be, now what are the items in the balance of payments. Let us put them first the export and import of goods and services, so it will be X which is the function of e Y f P f minus import which is the function of e and P f into Y. Therefore, this is export and import of goods and services of current account 2 sub accounts as been taken care of classes, your fixed amount of transfer payments.

So, fixed amount of transfer payments t P f fixed amount of transfer payments, t P f the transfer payment accounts some balance plus or minus whatever the number is. I told you about in India in the 70s of every funny thing happened in India was really under the cries with all price shop economy was not doing well suddenly it is a huge amount of remittances. So, this account which save the balance, in fact at one point also there was the positive surplus here in the trade account which is the goods account. Now, there comes the last part capital account, it is the very interesting how economist are at least the text books writers have described the capital account balance.

What they write is the following put the 0 value to indicate the put the constant value lambda into r minus r f, now this whole thing, this is the capital account, this whole thing is now going to be 0. So, there is any surplus, here will be matched by a deficit elsewhere or any deficit here is exactly matched by surplus I am imposing an equilibrium condition. But, balance of payment is did not been equilibrium there may be surplus or there may be deficit at any point of time just a the way it is happening in India It is happening anywhere, any other country. And impose equilibrium condition to make the model consistence because the goods market this equilibrium I had the goods market clearing condition.

Money market along some money is equal to demand for the money in the balance of payments equation I am term also laying the balance of payment balance the final number next number is 0. That means the surplus is having exactly matched with the deficit items, but why is this capital account balance, so funny these things I have

understood you may ask what is this capital account balance. Well lambda is in rupee or dollar terms in this model it will be in rupee terms and it is the function of r minus r s the gap this is called this thing this thing is called interest rate differential.

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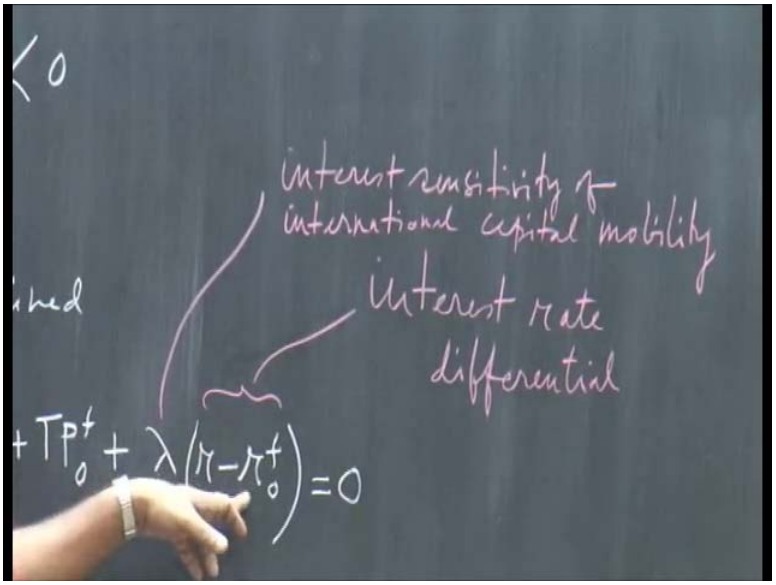

This is the simplest way that the capital account is described capital account balance interest rate differential is difference differential essentially means difference. So, what this is saying and lambda is called the interest sensitivity of international capital movement or capital mobility interest sensitivity of international capital mobility. So, what is this saying is very simple terms this is how it is described when rate off origin rate of interest is some rate of interest 4 percent, 5 percent.

Our interest rate is say above that 6 percent what will happen in very free market very free world were capital can move from Europe to Asia, Asia to Europe, U S A to India, India to U S, Germany to France, France to Germany, Germany to England, England to Germany, Germany to U S, U S to Germany this kind of the world capital can move freely to it. So, people are free to put money wherever they want as if in the words of Will Clinton, when he came here I remember he use that expression I remember that it is the global village.

Now, I mean world is getting connected through internet and flexible exchanged systems and free markets in such a way particularly. After the break down of the block and which was and even china today a line foreign investment coming in fact it has one of the

highest f d I among newly born or newly developing countries. That he was using to that expression global village see if you exist in global village were capable to move you can put your money in Hong Kong bank any time Hong Kong, in fact exist this in India. Within India, today you can put the money in Hong Kong in U S, in Europe if you have this freedom, then this kind of the thing make sense.

But, expect what you saying with interest rate is higher in India then r f naught, so this value interest rate definitely is positive interest rate definitely is positive. People are attracted more given the other things constant from an outside to put money into India, 2 reasons, one is money to bank accounts. Here, second the inverse relationship interest rate is therefore sayings top prizes would be lower in India than abroad because interest rate is higher stop prizes are lower, there is a inverse relationship. So, money would also come into portfolio investment that means in our stock markets, how much money comes that sensitive mobility that amount for 1 percentage interested rate differential.

Now, 1 percent rate interested differential means on point interested differential would be in the interest rate here the domestic interest rates are minus the foreign interest. Any foreign interest you can take any country was that differential is difference is would create this much of capital moving into the country and that much of capital which is moving out a net balance of lambda. So, lambda is the interest sensitivity of international capital mobility measured in volume 100 cores, 1000 cores, 50 cores that may change from time to time they may be other factor which effected.

So, the lambda measures the amount of money in dollar coming, but converted in to Indian currency, how much that it is, so this is how the capital account balances is described in the B P equation in a B P equation. In a very standard macro model lambda into r minus r f, you clearly see one thing if r is equal to r f what would be the capital account balance 0. Now, the capital moving out from India, no capital into India study the balance have turned out to be 0, exactly matched or whatever. So, there is no incentive also it means to capital move out to capital move in this period in the current period.

If it is positive if it is negative the capital account balance will become capital account balance would become negative more capital as g one out then coming in, so this is your balance of payment in equation export and goods and services. So, I put the 2 accounts

together the trade account and the services account import of goods and services transfer payments accounts balances plus capital account balance equal to 0. This is the condition I am imposing need not be in the case in fact the goods market the I S N may not be equilibrium at every point in the equilibrium zone.

But, you may reach equilibrium and equilibrium is the convent way of concluding mathematic exercise if you have an equilibrium on point another point I reach equilibrium point. You start at an n equilibrium point there is a disturbance then you reach another mathematically easy to handle you reaching a equilibrium point. So, but, that need not be the case money market may be at some point in this equilibrium goods market in this equilibrium balance of payments account may be in fact it is in India in this equilibrium.

So, this is your I S L N d p model, now before I go into algebra I want to draw the d P function this will be my job next job to draw the d P function which is not very difficult. So, let me draw the d P function I will have the four diagram thing, but do not draw it first let me draw the diagram first draw the diagram first.

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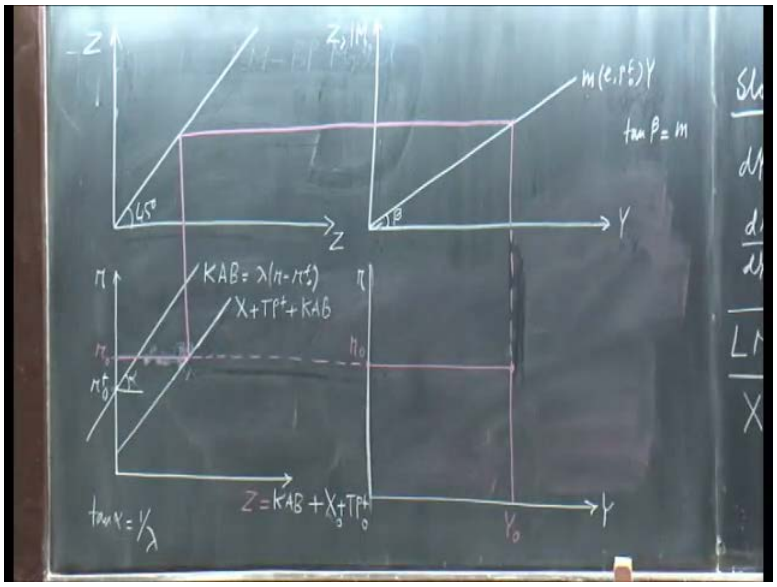

Let this point be r f for an interest rate and then I am drawing the capital account balance lambda into r minus r f naught. Suppose this is r f naught it is the linear line it will go like this is capital account balance k, a b which is equal to lambda into r s naught capital. Account balance were the slope alpha, 10 alpha is equal to capital account balance, 10

alpha would be equal to the capital account balance is t r is equal to lambda am I correct now not lambda capital account balance is equal to this, so differentiate this with respect to r k b is equal to lambda r minus l f d k b d r is equal to lambda.

So, d r over d k b, the slope will be the slope will be 1, the slope will be one over lambda the slope will be 1 over lambda the slope will be 1 over lambda, capital account balance. Now, add for a given value of exchange rate, for a given value of e and a given transfer balance you add the exports and exchange rates. So, add export to a given value of e naught and other parameters and transfer payments account t P f for a given value some export.

If you add call that X naught for a given value what you have is you have the what you have is if you add the items have a parallel line coming in which is exports plus transfer payments plus capital account balance 3 items. So, may be this alpha 10 alpha remove it from here I have this I as continuous line here and this 10 alpha I can write it l square I can write it here 10 alpha is equal to 1 over lambda. So, that is an export so let me draw this first, now what I need to what I done is I have taken this fellow here I have taken this fellow here, I have taken this fellow here together in one diagram.

Now, that has to match with the imports then it will be a 0 value because import has the minus number. So, in that 2 with the import first I do this translation from this translation to a 45 degree line to the Y axis, let us call variable, let us call this variable of this axis at some Z. So, I translate this from this Z this Z from X axis to Y axis, so that I can now match with the imports were I have, now Y and I have Z and imports and on Y axis. If you draw the import line on y axis it will be slope will be d Y, d import d Y import is better on the axis will be m. So, let us m be this is the import function m into m into m is a function e P f into y and this data tan data is equal to m.

Now, I have here the final diagram I have the final diagram, now what do I have here r and can check out what is happening check out what is happening tack rate of interest give me the rate of interest value. Let us take the interest rate of value r naught at this rate of the interest this is the total value given the exports and transfer this is the total value of the Z variables. So, Z variable is capital account balance plus export plus transport transfer payments now this line need to go up like this and I get this value transferred to Y axis which need to match with the imports.

So, that is match with this imports on this axis, here they become equal to imports and this import in India or anywhere is possible with this kind output level. So, even that commit the output level this is the amount of this is r naught this is Y naught, now take another value of r, now take another value of r, shall I take upper value of r it will becoming too far away.

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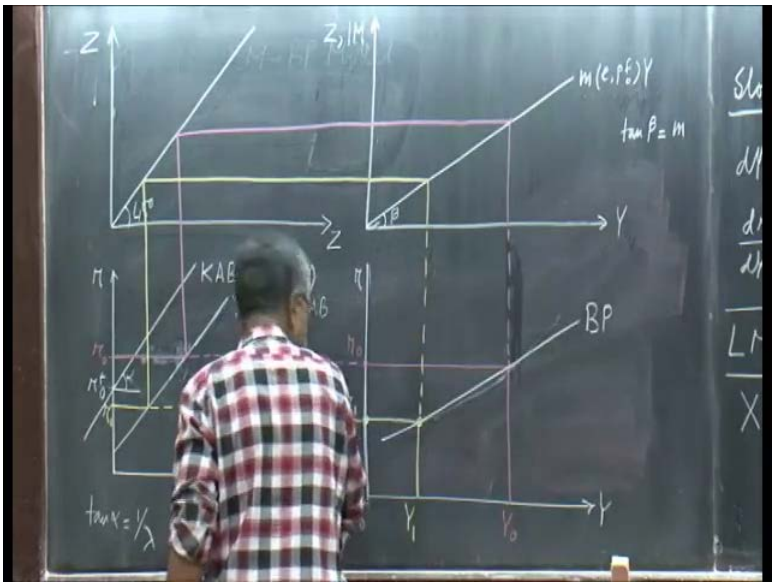

So, take a lower value of r, take a lower value of r, call that r 1 at r one this is Z value, this Z value will go there, this z value is match with the imports which import requires. So, income in the country to this amount, so this is z value and this is r one and this is y one and you have another coordinate. Now, essentially what you have you have the, now what you have is the B P line, now you have the B P line balance the payment line were always balance of payment balance is 0. So, the question will be what is the slope of the balance of payments balance of payment slope line you can look this equation.

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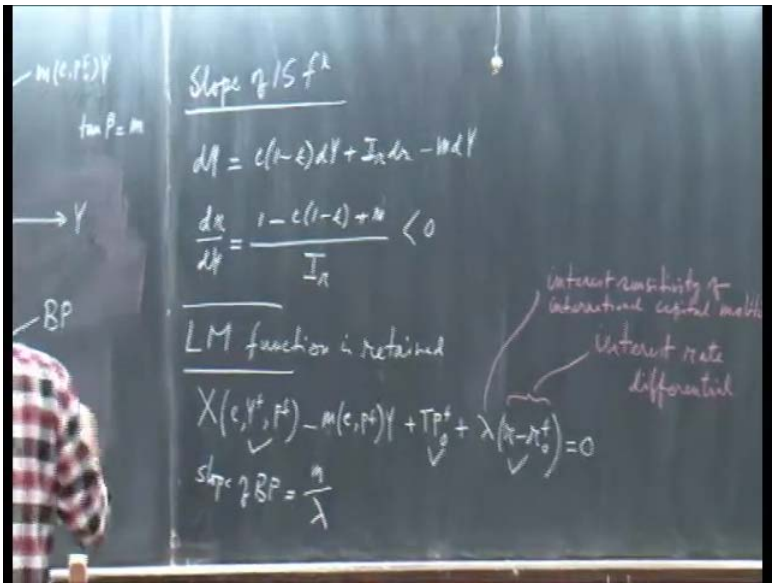

Here, the slope of B P is d Y d r, d Y which is equal to, here will be a minus m d Y and lambda with d r, so d r over d Y would be essentially slope will be m over lambda I think it could be m over lambda. So, slope is m over lambda this slope if you measure the slope of this line a linear line is m over lambda line slope will be m over lambda. This is very important to appreciate this line B P line r y plane because s L M is in r y plane, I have to draw this on r y plane. So, assume for exports the value e, otherwise I do not know what exports are and other parameter values here and then I have drawn it.

So, any time have exchanged this line will shift anytime exchanger changes line will shift because this is capital account balance k b is equal lambda d r. So, k b r is equal to lambda, so d r over d t, 1 over lambda alright in this model I S M d P model 1 is a two polar cases. One the whole world or what India used to have about 20 years back kind of fixes exchange system, no capital mobility between the countries, nobody was interested in investing in India.

So, Indians never had the money to invest abroad they say ancient economy it was like a ancient economy you know like 100 of years old that case is turned has perfect capitalism. But, mobility capital is completely mobile between countries were algebraically speaking lambda value is set equal to 0, what will happen to the B P line lambda value Z equal to 0. Perfect capital immobility lambda value is z equal to 0 vertical line vertical line the word the western country is believe in and India is

approaching getting somewhere and India also believes that today is the country doors should be open.

So, anybody can come in anybody can go out whenever they wish they are getting into trouble because of this also you know if you keep your house door anybody can come in. Open anybody can come in anybody can go out this is like great charity work you are doing but, your house will be mess one day. So, people are getting countries are getting in to trouble, but philosophy speaking this capitalist system free enterprises free to moves and all that give rise to perfect capital mobility which is expressed in algebraic terms as lambda going to infinity what would happen to the slope of the B P line horizontal.

So, the two polar cases perfect capital in mobility and perfect capital mobility or completely imperfect, capital immobility that means no capital mobility. So, vertical line and perfect capital mobility horizontal line will come number 1, you have to see second has is happening in India marginal propose import may be going up because we are getting exports to foreign goods. We will love foreign goods this is the greeter this is glamour associated with it food test good may be they come from rod whatever. So, margin if they go up what will happen to the B P line you can see that it will become steeper because the slope is m over lambda, last point I want to mention which is very important.

If exchange rate depreciate what will happen think carefully look at that equation then you would know what will happen to the B P line if exchange depreciate as is happening in India, e value going up what will happen to the B P line slope will decrease, very good. The line will become flatter because the margin propose import which fall and it will shift downwards very good which is right ward shift to be called that downward is acutely for a given value Y axis value. It goes to the right even then value comes up down even the Y axis value is a outward shift you will call that out ward shift.

The right shape is always the outward shift the left shift we call that inward shift, this is the language these books use probably output shift and inward shift. That means inward is left upward as he said and down wards in this line is the right ward shift see you can see what is happening export will increase. So, this line here will shift to the right value of r, you will higher value of z higher value of z means higher value import, but again

margin import will fall that line would go flatter. So, this line d P will shift to right and because flatter d P will shift to the right outward shift and become flatter it is not a parallel shift.

Now, m and e are inversely related exchangers depreciates, I said exchanger depreciate means e value going up remember we use the word depreciation. But, e value is going up means foreign currency is becoming more expensive more rupee or dollar you require more rupee to go to the bank to buy 1 dollar, suppose you are going aboard. You are now carrying more rupee to buy U S dollar, 500 U S dollars you need to do to abroad you are carrying more India rupee to buy it. That is exchanger depreciation because your rupee is cheaper compare to U S dollar, 1 U S dollar can buy more India rupee [FL] which is like not good [FL] it is very bad news [FL].

This is very bad news that is why called depreciation of the currency or a exchange rate depreciation means losing value something depreciating means I am losing value. But, buy a car becomes old means the card value as depreciated I have lost value car is no longer new car which has been become an old car and an old car if you sell in the market will be cheaper. This is not good news, now you have understood this let us do one or two multiplier not more we will do it tomorrow flexible exchange system.

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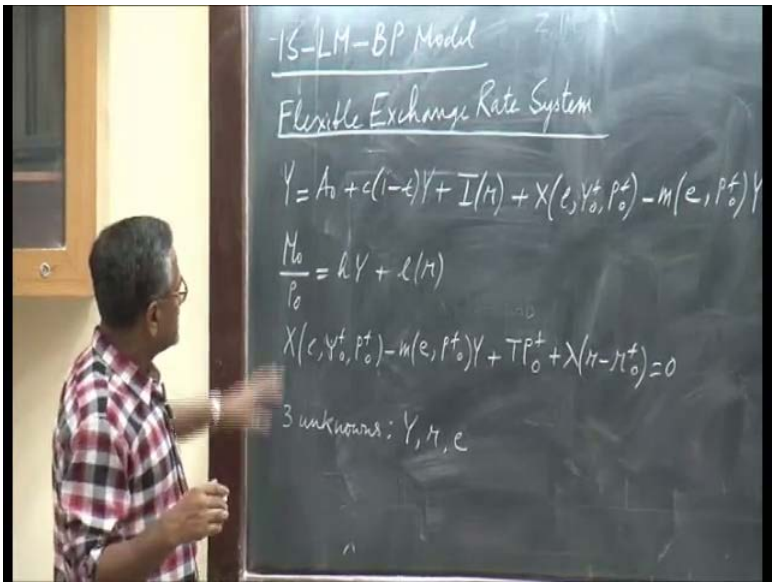

So, 3 equations flexible exchange system, 3 unknowns what are the three unknowns that I have to solve Y and r as before I S l M in the third. For the third equation exchanger

itself is marked determine what you have in India today market determine exchange rate Y r l e. Now, first thing first I will do the algebra first then try to explain e that diagonal what is happing material and we would typically look into physical policy multiply, money supply, monetary policy multiplier. This kind of the thing and many more multiply we can have let us totally differentiate the system 3 equations I would keep three equations or substitute them interested becomes sub point of interest.

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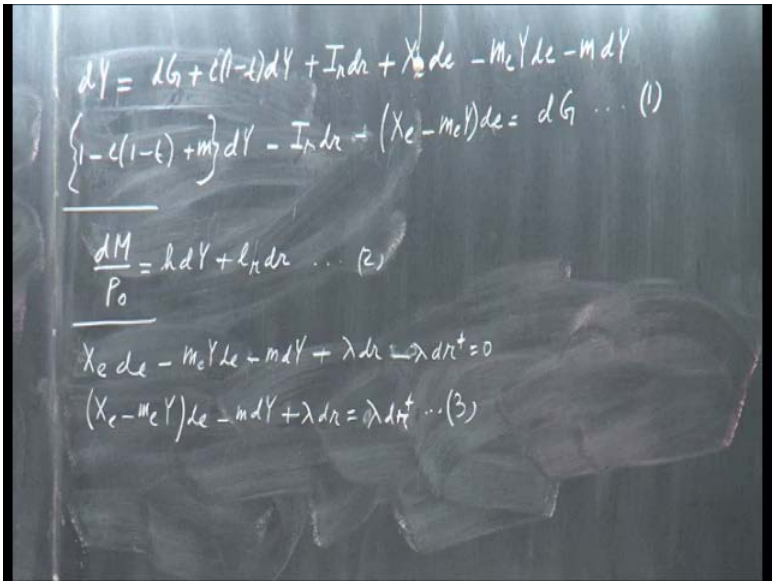

Now, d y will be equal to say d G plus c into 1 minus t d Y plus I r d r plus x e d I can have more here, I am not going to do that x y s d Y s x d P f, you can do that yourself I am not going to do that, it is no need to doing an extra multiplier here. Now, then minus m e y d e minus m d Y this is the I S equation. Now, if you club the terms t Y etcetera variables what you have you have 1 minus c into one minus t and there is Y there which will become plus m this is d Y and then r minus I r d rand.

Then you have plus, you have the term X e which will go on the right hand side, it will be minus X e minus m e Y d e is equal to d P. This is the I S curve with three dependent variables which will solve are on the left hand side because I will set up the model matrix format. So, 3 dependent variables 1 minus t into 1 minus m d v minus I r and minus x e minus m e y d e this is d e is equal to d G [FL]. This is the I S equations, let us call this one then the L M equation is d m over P naught is equal to h d Y plus l r d r, how did I write it.

Now, if you transfer this entire thing on the left hand side and this entire on the right hand side minus sign will come which will cancel out in matrix it will remain more or less. So, I am not going to change this I am going to use the plus sign then if I write them on the left side it is a same thing and then, finally I have the export the balance of payments balance of payment equation which will be the last equation. So, it will be x e d e minus m e Y d e minus m d Y plus lambda d r equal to 0 which will become x e minus m e y d e minus m d Y plus lambda d r equal to 0.

So, this is equation 3 and I can have one more foreign that interest a lot lambda d r minus lambda d r f is equal to 0 minus lambda d r f can go to right hand f side it will become lambda d r. That is not a bad idea foreign interest rate is discussed in this model how will affect our country, so lambda will go left hand side three equations. So, these are three equation one two three will put them in matrix cannot be this 3 equations, now if you are in arrange them in matrix format now what you see here is that on the y column on the first equation.

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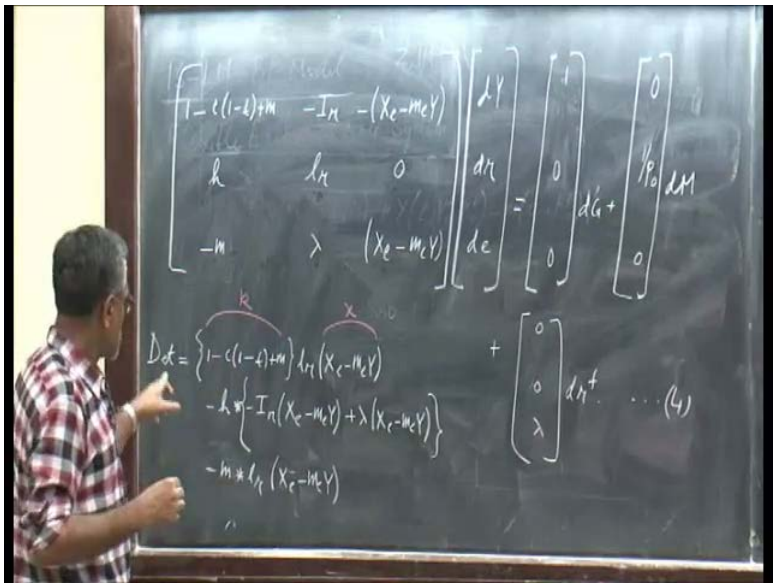

You have 1 minus c into you have 1 minus t plus m the r column will be minus I r and the e column is X e minus m e y second equation y column is x is l r nothing. There in the e column last equation it is minus m r column is lambda and this one is by the way X e minus X e, this will be X e minus m e Y this is your matrix multiplied by d Y d r d e. On the right hand side I have from the first equation G. So, 1, 0, 0 d G plus from the

second equation you have 0, 1 over P naught 0 d m and from the last equation you have 0, 0 lambda d r f.

In order to use this is the system in order to use the multiplier the famous rule you require the termination in the matrix always in the, of the ratio. In order to use the matrix, famous rule and the multiplier you require to terminate of this matrix, so first find out what is the determinant of this matrix it will be 1 minus t. So, it will be 1 minus 1 minus t plus m multiplied with l r into this and this into minus this is 0, so l r into X e minus m e y l r into x e minus m e y first component. Second, suppose I multiply by this minus h, so minus h into minus h into minus I r into this I r into h c minus m e Y then minus plus lambda into X e minus m e y put it in the second bracket.

Then minus m plus m into minus I r into 0 is 0 minus m into minus into minus plus l r I minus m into l r into x e minus m e Y. Then one thing we notice x e minus m e y is a common factor in the three components of determinate one thing is common x e minus m e y I can factor that out, take that out. Now, X e is positive the sign here the X e is positive this sign m e is negative, I said with the minus sign is positive why the positive number this whole thing is the positive quantity which is great news.

So, this thing if you factor out and then simplify, since it will appear reappear all the time let us call this whole thing. Let us call this whole thing x and this is the large term again, let us call this large term k, so that we do not have to write again and again k we know what it means.

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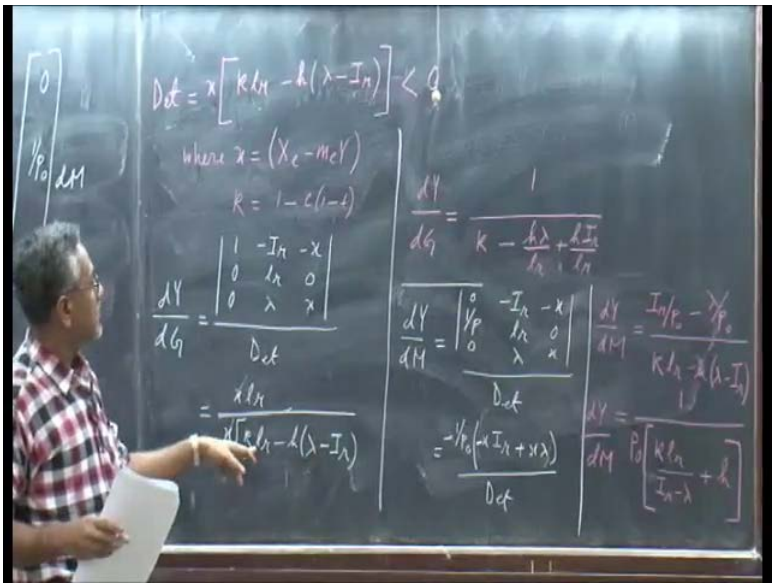

So, determent becomes d t if you factor out X, so X bracket l r into k or k l r from the second you have minus plus h I r or h into I r minus what do you have plus minus h into I r minus lambda. So, minus into lambda minus I r and from the third you have minus m l r m l r [FL], now there is the problem you look at this 1 minus t into 1 minus c plus m into l r. Here, it is the minus m l r, so they would cancel out, so I would not call this whole thing m k I rather would call only this part k because this and this m I l r would cancel out.

So, this will be this item were X is equal to X e minus m e Y and k is equal to 1 minus c into 1 minus c the Keynesian cross model multiply expenditure. Now, multiply the denominator I here 1 over 1 minus c into 1 minus c, so k is that, so this is the determinant. Now, x is positive l r is negative minus eight is negative lambda is positive minus I r is positive because I S I r negative.

So, it is the negative and a positive clearly the sign is less than 0 of the determinant an ambiguously the sign is less than 0, an ambiguously sign is less than 0. You can see that no problem what is so ever, now let us works out what get a multiply d Y and d G d V, d G would essentially say using tools. The d Y column would replace get replaced by the d G column it will become 1 0, 0 minus I r and minus x you know what x is when l r, 0 lambda x very simple matrix by d t, very simple matrix. Once you have the determinant

that in the matrixes are not complicated anymore 1 0, 0 one into l r into X this is 0 already and all are 0.

So, it will be X l r divided by this thing what is this thing X into k l r minus h into lambda minus I r this is what you have and you can x, x is cancels out, so the multiplier is if you divide by l r it will become 1. Let us write it there d Y d G the multiplier is d Y d G the multiplier is one divided by k minus h lambda over l r plus h I r over I am correct or not [FL]. You see that because there recording for online studies etcetera at y d t is one over k minus h lambda over l r plus h I r over l r do you see similarity with your closed economy.

So, multiply that h lambda l r was not there another wise k is 1 minus t, so 1 minus t h over I r which was I S L M divide multiplier. Now, with the open economy you have h lambda when will be the 2 multiply will become I S, a multiplier open economy multiplier under one assumption perfect in mobility of capital which was the case with India. Once upon a time no capital mobility lambda 0 you will get the closed economy multiplier second with l r goes to infinity what happens to the L M curve horizontal l r goes to infinity.

This multiplier becomes the Keynesian model multiplier because l r goes to infinity means both the two terms are 0 only k remains. So, the multiplier becomes one over 1 minus t the same case which you have in effectiveness of the physical policy that I shock you in the keynesian model same case [FL]. Now, here comes the very interesting thing what happens in the free world that we talk about perfect flexible exchanger system with perfect capital mobility lambda going to infinity what happens to the multiplier. So, 0 you are going back to the classical result physical policy is in effectives government as nothing to do with economy cannot do anything.

So, free world right wing person like a republican or somebody who does not believe in the government intervention in the economy would prescribe have the flexible exchange. But, with the system, with perfect capital mobility government has nothing to do because d Y d t becomes 0, now watch this multiplier I mean this is very obvious to you all this is happening. So, as capital mobility increases affect less of physical remain as lambda is increases as lambda fall towards 0 values the affect less becomes more because you with the Keynesian model expenditure multiplier with a normal lambda range 0 and infinity.

Some large number since it is in the denominator and you are adding the term minus h lambda over because l r is minus negative number with the minus is the plus number. If you are adding the term in the denominator means the ratio value falls, so the physical policy as become more in effectives less effectives with the open economy flexible exchanges it system with some capital mobility between the countries. So, physical policy is becoming more and more in effective with more capital mobility as capital mobility increases, physical policy can become even completely in effective supply d G can be 0.

As he said, as lambda increases because a very large number the ratio value can diminished to be 0 number which is hardly effective mathematically not exactly 0. It is still very ineffective because this is a small number the multiplier is very weak does not work you see this alright you see this [FL], now if you have seen this can you just do the d Y d m multiplier a little bit. Then we can call it of the money supplier multiplier here [FL] d Y d m, so the first equation will have 1 0, 1 over 1 P naught over the determinant it is 0, 1 over P naught 0.

Then you have this same thing minus I r minus x l r 0 lambda x determinant of this divided by d t how much is this 0 minus 1 over P naught into minus plus x I r. This minus will go minus I r x I r minus one over P naught minus I r into minus x minus here a minus sign X into I r minus plus x into lambda divided by determinant. So, this is becoming quite interesting this is minus X is common, again x will factor out, so d Y d n, so look x is common in a numerator both the terms. In the denominator, you had a x term is not it had a X term they will cancel out, so in the numerator you have minus into minus plus I r divided by P naught.

But, minus x has gone lambda over P naught and then denominator you have k l r m h minus h into lambda minus I r lambda h into lambda I r. So, what you have I made a mistake, minus I P naught I am looking at d Y d m d Y column is the first column, so the first column is replaced by the m vector if I am looking for d r the second variable, d r d n. Then the second column would get replaced we are looking for d e d m, then the third column will get replaced because that is the d e column. That is the d r column and that is the d Y column, now this can be simplified I r minus lambda, lambda minus I r is here you can divided.

So, it will become plus h I r minus you can write I r minus is this you can write this as 1 P naught can be multiplied into this is k, which is k l r [FL] divided by I r minus lambda k divided by I r minus lambda plus [FL]. If I write the factor of minus and minus plus this is your d Y d m multiplier this is your d Y multiplier note here, now note here this is very important d Y d m multiplier. Note here what is happening, note here if lambda becomes 0 it becomes k l r over I r plus h this is the I S L A multiplier money supply multiplier the lambda is 0 in physical policy when we had lambda is equal to 0.

We had the lambda is equal to 0 we had the I S L A multiplier one of the policy lambda is 0, now lambda goes to infinity large number this term is 0. Then it becomes one over P naught 1 over h P naught which is quaintly theory multiply same thing we had a quaintly theory multiply under the different assumption. Well, lambda goes to 0, there we had that l r was 0 same result also have here if l r is 0 this term is 0 you have 1 over P naught h quaintly theory multiplier. So, quaintly theory multiplier you have under two conditions, now one lambda goes to infinity or l r goes to 0 in the I S L M we had only I r goes to 0.

But, now you have lambda going to infinity l r becoming 0 alright quaintly theory multiplier, so quaintly theory multiplier the classical position. You have in this model I S n d P model either when speculative demand money is completely in sensitive in rate of interest or you have perfect capital. International capital mobility, perfect international capital mobility when you have perfect capital international lambda going to infinity then you have this term raided 0. So, 1 over P naught h overt I u I o d I which if you integrate then you will get m b is equal to P y, because one over h it would be quaintly theory multiplier.

So, that the result are obvious the question is diagrammatically we need to see there, so the first task tomorrow is and you see diagrammatically and you can work out many multipliers which should this your task. Now, I did not do them I have some of them here in my notes which you can check you can see you can one have to check. Here, sir what will happen if government adopted the expansion physical policy which they doing now and to the exchange rate. So, what is d over d t over d e what you have to do is the d e column is the last column that one gets replaced by the vector here, so it will become 1 0, 0 and the less remains.

You can find out d e o d G what I have found is that the d e over d G multipliers very important maybe we should do it tomorrow. It very important d e over d G I cannot sing may be greater than 0 may be less than 0 [FL], I cannot be sign. So, we should check tomorrow first thing after the diagrams what will be d over d g because right now it is very important issue to exchange to depreciating. So, what I have found is that it is depends upon the relative slope of L M r B P curves d over d g it may go up it may go down check that.

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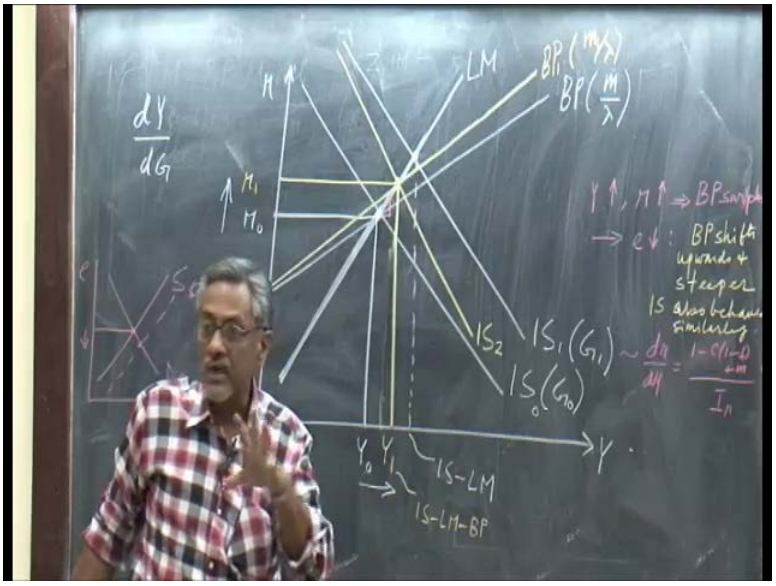

Now, I S shift through the right very good news I S is shifted to the right, I S 1 because G value is gone up to G naught to G 1 very good news. In a normal I S l n diagram what will happen is the economy would move there, but now assuming the money market clears quickly your of the cross I S curve. So, what will happen is as the money market star there including rate of interest adjustment and the demand would increases and output will increase. That means some in output and the rate of interest would go fast if you have if you notice one thing you notice one thing going above the B P line.

So, when you are going above the B P line, what happens to the balance of payment it is disequilibrium what kind of the disequilibrium for a given value of y here rate of interest is a gone a further. So, more creating and it is creating a balance of a surplus and its creating the balance of surplus, so as rate of interest lines Y increases rate of interest increases it creates a b o P surplus or B P surplus. So, temporary surplus what happens

with the surplus in the exchange market in the exchange market what is happening supply of foreign exchange demand for foreign exchange suddenly.

This is dollar, this is e supply income has shifted surplus supply has shifted, so what happens to the exchange rate it falls which means appreciation. So, this give rise to e value falling, when e value is falls what happens exports increase or falls export increases e value falls export falls and what happens to import [FL] increases appreciating. Now, from 57 it is coming down to 55, 54 U S India currency with respectability is in with respect to U S currency exports are falling a little bit import going up.

So, B P line shifts backwards and become steeper B P line shift backwards and become steeper [FL] and the I S line what happen to the slope of the I S line what is the slope of I S line. So, what is the slope d r d Y 1 minus c into 1 minus t plus m divided by I r, so m value goes up the line is becoming steeper as he falls it has 2 thing coming into the picture one B P shifts upwards shifts upward or inwards. So, whatever and steeper because m value increases and what happens to the I S, I S also behaves, similarly that means it will shift backwards and become steeper.

So, I S curve and B P curve will shift upwards, so B P line will become like a line it is like this B P one with the new m value, m 1 divided by lambda which is constant and I S will finally shift backwards and will become steeper. So, this is I S 2 steeper and a new equilibrium will reached at higher rate of interest r 1 and a higher level of output Y 1 compare to the initial compared to what you had initially Y naught and r naught. So, rate of the interest will go up output would increases, but not as much as I S L M this point this point output is the I S L M output result.

This is Y output, Y 1 output is the I S L M B P output less multiplier value is less d Y d G less positive term in the denominator because I S shifts backwards later and become steeper B P shifts upwards and become steeper. So, a new equilibrium is reached here not there that is the I S L N equilibrium, that is the I S L N B P equilibrium, the yellow line this is the d Y d g multiplier and a exchange rate looks like appreciate. But, we need to check that out later because d Y d G multiplier algebra more algebra is required to get the real in site into what happens to the exchange rate, L M does not get affected at all in this model.

So, both the I S L N strings basically and become steeper P goes upwards stinking basically inwards shift I S also inward shift and steeper they go steep line and the parallel [FL]. I thought I drew a incorrect line its complicated a little bit in that sense your three lines deal with, but I hope you have understood what is happening is the for the sake of understanding. It is that multiplier is smaller diagrammatically I have told you because above B P line you have a surplus line and below B P line which I forgot to tell you.

You have deficits in the balance of payment that is disequilibrium the two kinds of disequilibrium that you have with I S L N, I remember the d is equilibrium zones X is supply X is demand I did in the d P line. You have disequilibrium zones one above B P line one below B P line above B P line is a surplus zone then it is very easy to understand that and below B P line you have the deficits in balance of payment surplus deficits. So, as interested to pay such it creates a temporary surplus, but that is confusing a little bit becomes exchanged effect becomes different.