Lecture – 9

Today I plan to begin, the fourth topic that you have tension cross model, this is the straight forward Keynesian model not much complication, the simplest Keynesian model and I think you would enjoy this not going to be difficult at all. So, let us begin with the simplest Keynesian model today, as you can imagine in comparison to classical model, Keynesian model would have a rule for the government to play in the economic, in the word, in the sense, that policy is will matter. So, the model will be very different quite different from what you have seen earlier.

(Refer Slide Time: 01:12)
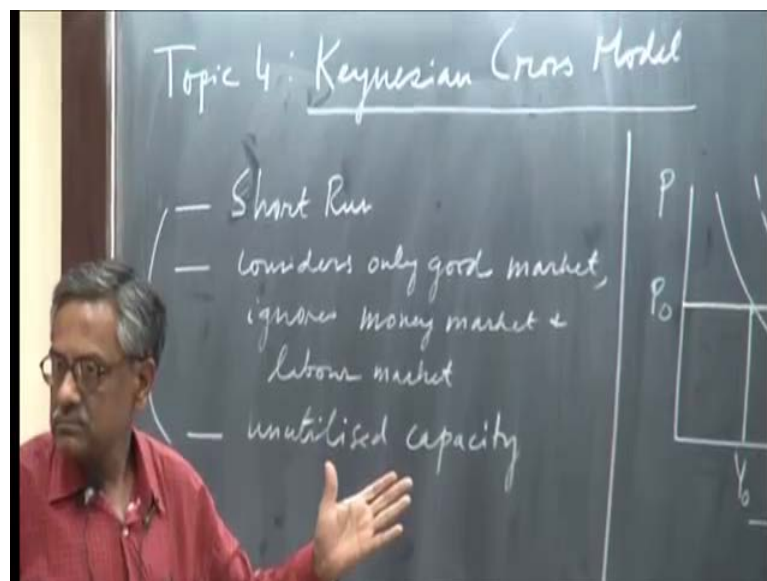
So, topic 4, the Keynesian cross model is something, which that I begin today topic 4 however writing, this is however writing topic 4, topic 3 that is why I have written Keynesian cross model. This Keynesian cross model the first thing that I should mention is that, it has sense it has simple models it ignores a number of things, which we will consider later. So, the first thing to note is that is a short run model, second it considers only good market and ignores money market and labour market.

And it ignores, the labor market quite cleverly what it does is that, it makes that some assumption in the short run which makes the supply curve in some sense passive not active. In a classical model what you have seen, because the supplies vertical and so reason that, it becomes the most important function and demand does have role to play; because demand shift will only change prices will not change output, supply curve employment output etcetera all determine by the labour market.

In the Keynesian cross model you will seeing just opposite you are making a assumptions, which will render the supply curve in effective depravities and the demand curves, becomes most effective. What you think the aggregate demand supply diagram would look like, where demand is most effective and supply is an find of end effective in determining output how the supply diagonal diagram look like common sense answer.

Student: Demand line is vertical.

Demand line is vertical very good and supply line is upward sloping not bad suggestion, now we have slightly different things that also would good give you the result, that I talk to you slightly different what is assumes is that in the short run, there is arm utilize capacity. In fact, a vast amount of non utilize capacity, so if companies have built in capacity to produce more which they are not using, because the demand does not exist.

So, the company are not producing it can has construct various class levels and faculty office places, but if you do not have students enough students, if you do not have enough faculty these spaces would remain un utilize. So, tomorrow if you do fine students and you do find faculty, who can come to IIT Kanpur, it does not increase the cost in a marginal sense to put, because this building already exist some variable cost will increase like the fan and light switch on etcetera, largely they are all built in created capacity which are remaining un utilize.

 So, what happens in this short run this un utilize capacity and short run they are all connected this is the essentially, I am saying a feature that exist in a short run in long run it may not be the case at all, that unutilized capacity in the long run or medium run out to be insufficient, you need more class room more faculty offices. But, what that would be we do not know, but at least at the short run in the coming year or 6 month, there are enough spaces and for teaching class room spaces and enough faculty offices at IIT Kanpur.

Therefore, un utilize capacity and short run would run like this they are connected, having set this therefore, the mode that I am going to construct is unutilized capacity follows from a kind of microeconomics, on the certain few mode assumptions may be that what effectively we are doing is that.

(Refer Slide Time: 07:25)
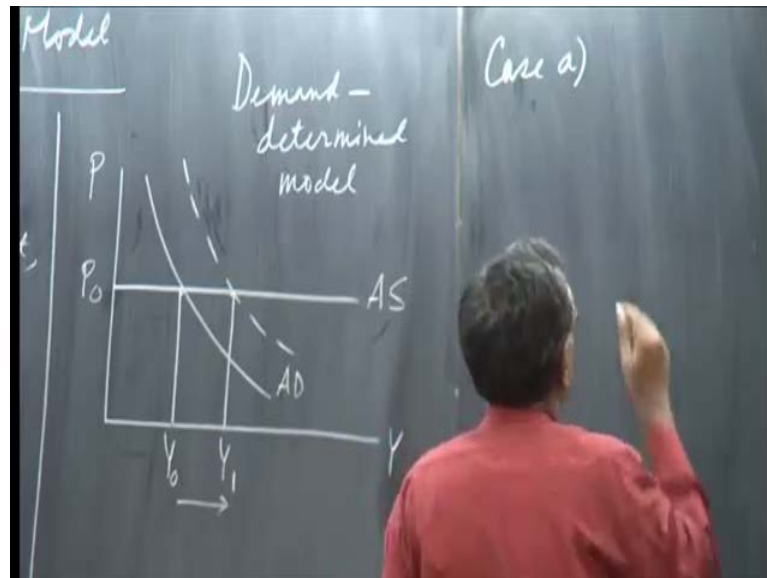
We are creating a word or an economy, where output can be supplied to the economy as soon as there is demand, the capacity already ready you tell me how much you need, I will produce that for you. So, the ordinary supplier is kind of horizontal, that what you will bring, we become very passive in that does not determine output level, what determines output level is that the demand position aggregate, demand position if for any reason aggregate demand shift out, no problem supply capacities there company would just meet you demand, supply the extra output.

Suppose, the aggregative demand shift out to another place, all that will happen is that output level from y naught, it can easily change to y 1. Now, in the process companies are not required to change the prices or aggregate prices economy do not change, such a short run period you have un utilize capacity economic, aggregate supplies horizontal that is it can meet any demand, you tell me how much demand you have.

So, becomes essentially a demand determine mode just opposite of the classical model, where it was entire supplying determine model, the supplier of I told you how much output, the economic would produce demand had a passive role, it only determine price.

In this case, the supply curve is determining the price is keep in cost in the short run, in the demand would tell you how much output go produce, the demand string goes back wards output in the economic go backwards output fall demand increases, output increase.

So, it essentially becomes at demanding determine model, just opposite of the classical model demand determine model, that kind of short run I am talking about there is no problem in supply what you need, question is whether you need that or not this no supply constraint. Now, as I said that we would ignore the money market, we would ignore the labor market labor market is ignore, because the labor market gives you the supply curve, the supply curves horizontal what happens labor market is not important to us.

So, it is rendered on important, because supply like horizontal curve who can what happens in the labor supply that means, they must e access labor waiting to be employed. As soon us companies are produce ore they would just hire, the implement and produce this no wage increase, there no price increase in the economy in the short run all you require to produce and meet to demand. So, we would consider only the goods market, so we got to know there for only the goods market in a Keynesian models, the goods market we will model them under two simplest assumption.

(Refer Slide Time: 11:15)
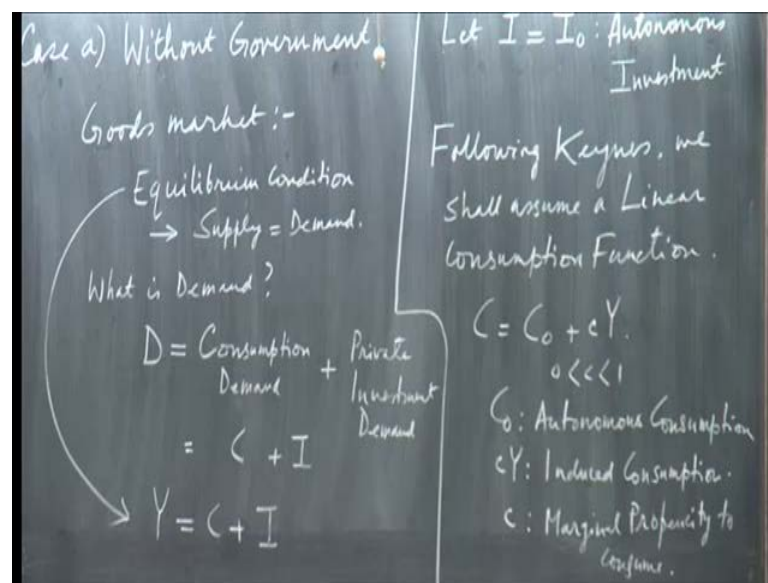
I would first consider case a, where there is no government, so I would consider the model without government, now look write from the beginning I am taking about

government, we are the Keynesian model government has role to play the always saying, unlike the classical models. So, you are talking about government, it occupies an important place in the model, so without government I would model, now the goods market we got the model the goods market.

Now, how do we model the goods market, we model the goods market in terms of demand and supply, so suppose we would again impose equilibrium condition or market layering conditions, equilibrium conditions will be supply equal to demand. Now, supply and demand will be what is demand, now what is demand go back to the expenditure of approach, under national income accounting methods, what did I say there the total value of goods.

And services produce in the economic is indirect measure in terms of the expenditure incurred on silver goods, investments goods, government goods export minus import, take a simple case by the way I may also like to add one more assumption, which we will forget these are all close this economy models, this is no export and import this is close economy models, that I should also add this no export or import is the lower economy.

When you have a export and import which call open economy, we have not going to open economy is entirely close economy, so in the close economy what is demand which no government, while the man say called that d is equal to consumption demand, which is expenditure you will consumer goods measure the demands for consumer goods. So, this is consumption demand plus in private investment demand, that is called that c plus I this two notation with you obvious, seen this notation earlier see for consumption demand.

Which is essentially the program like expenditure in the consumer goods plus investment demand is total expenditure incurred on investment goods, that can measure investment demand. Now, therefore what you are essentially saying this equilibrium conditions will be therefore, total output produce in the economy, supply output should be equal to c plus I, that equilibrium condition you have y equal to c plus I, that is the good smart clearing conditions.

Clearing means there is no access supply goods, no access demand for goods, you have talking about equilibrium conditions then the equilibrium condition essential say supply equal to demand. The equilibrium condition says supply equal to demand, the supply of

output we always measure into terms of y that notation, which also means nearly income I told you why total supply value of output measure.

The total income generated when the economy I told you why, so it is called to c plus I demands for consumer goods or consumption demand, plus private investment demand. Now, we are going to make a furthest assumption couple of more assumption we wore to be get going that are very essential or one is Keynesian, one is not, so Keynesian, but for the sake of this very simple model.

We are going to make it assumption rigid assumption, but we are going to it drop it later it is a very over signify assumption, we needed now we do not needed later, we will it drop it. So, what are the two assumption that we are going to make, the two assumption we are going to make are following, let I be equal sum I naught, which means autonomous investment, it does not depends on any economic variable autonomous investment.

Autonomous means independent, it is not affected by a variable from the macro model, that we are leveling we are constructing, autonomous means x depends upon y, y depends upon x, these are endogenous variables. So, one effect other that suppose there is the variable z, which is not a conjunction of x y any other variable, it is an autonomous variables which we often called a hexagonal variable, which is like outsides the system.

Now, investment is not a autonomous variable, investment is not exogenous variable in the real life, it depends upon what happens in the economy. But, we will make that realistic assumption later for the time being, we will have investment is equal to I naught which is autonomous investment, this is the first one just for the sake of this model second, we would follow Keynes following Keynes.

We will assume we shall assume a linear consumption function, you will assume a linear consumption function, consumption is equal to some autonomous component plus small c, which is the slope of the function into y, c lies between 0 and 1, c naught is called autonomous consumption, small c y is effective by y, consumption effective by y, multiply with y, there was small c and y known as induce consumption not autonomous, but called induce consumption. And small c is known as marginal propensity to consume this called marginal propensity consume small c.

So, we assume the linear consummation function final like y is equal to m x plus c, m the gradient of the line which measure the slope. In this cases small c and y is equal to m x plus c, that c constraint term of a liner function here is autonomous consumption, c naught and the gradient is telling you that consumption in this world, the one we are going to assume changes with the income level.

It make sense Keynes certain elaborate the discussion one of the chapter in his book, these are the changes logs cane john manner Keynes is making, after having learn classical mach economics, economic model from his feature imagine. Now, you slowly realize the change is brought about in one book in the entire macro model, by the timing conclude this course you would realize, how much contribute in one book only people writes hundred of books, you do not talk about it in one book.

The fist important thing, that I bringing in as the Keynesian elements in a macro model is this consumption function, it is saying that human beings psychologically behave in the following way, even they do not have income they cannot leave without assuming. So, they will have a autonomous consumption component, which will not depend upon income or anything else and how you can a ask me sir, how its consume it does have income.

Because, you require income to purchase the goods, while it is very simple and unemployed person, either uses his passed income or one who has use the passing income would borrowed from brothers, sisters, friends and consume, otherwise you would start to this, which can also happen. So, this consumption function is not main for people, whose start to death this assumption function is main for people, who would assume something.

So, the consumption function is basically saying at the macro level, even if are the does not have income, imagine this is the private only, this is the entire country assumption function. So, what saying is that even if the country does not have any income, it still consume something and you consume, the bases of borrowing or aid which often happens confuse do receive aids help from other countries, in real in good system, real terms, in money terms also.

I give them add world banks give them aids, another country gives them aids in terms of wheat rice other grains etcetera, so it can aid can be in physical terms the aid can be in

money terms. So, a country will always have a autonomous consumption part, the second part which is more interesting, which is said human being psychologically has a propensity to consume out of any income it receives, which is true if it his is income it does not put a entire income in the bank it expanse something.
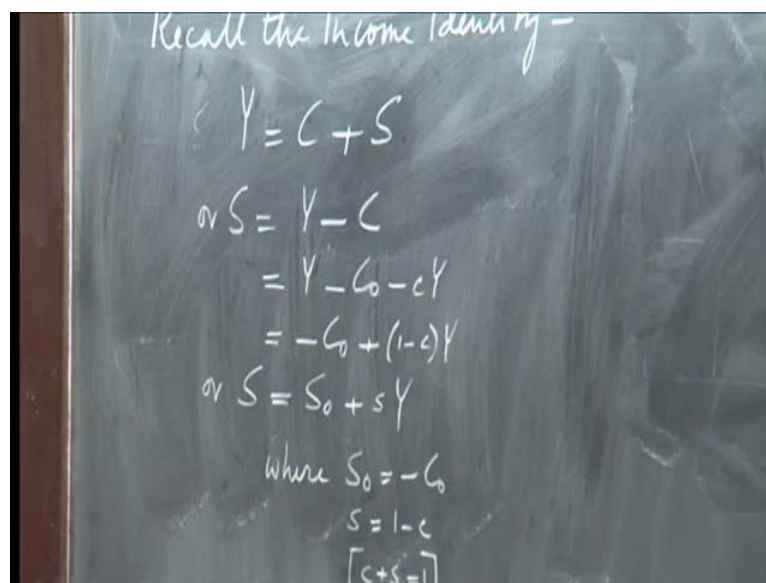
But, the marginal profession to consume if you do at calculus, if you differentiate this d c d y is small c you can see from the function. So, d c d y is marginal propensity to consumes small c, the small c is less than one positive, but less than one. So, another thing can said which is very normal, very logical is that when you get a extra hundred rupees, you do not spent the extra hundred rupees at least as a family man.

As I child you can do that, you will immediately as a family man what you do the talking about address some sense, you spent the part of it and part of it what will you do, the small c is less than 1, you are not consuming that entire money is small c less than 1 small c was 1, then the induce consumption would have any y is equal to c. So, small c less than 1 means any extra hundred rupees, 2 hundred rupees 5 hundred rupees, 1 thousand rupees you may gets as a income today, suppose it use when extra income of course, I will go with family and spent some away, but a part psychologically speaking what human being is do this events.

So, what is doing essentially writing, this assumption function he also telling you the that is the saving function that background, which is becoming effective and important the what did you have the savings function in a classical model. It depends upon real interested, the bank interested and this saving function is going to be very different, you can see the changes happening, now in compares to the classical model. So, this is the famous consumption for function that it talk about, now you may ask me sir, if that is true in the background there is a saving functions.

So, why use the income identity to know the saving function, so recall the income identity y equal to c plus s. Therefore, s is equal to y minus c which is y minus c naught minus small c y, which is minus c naught plus one minus small c y or s is equal to s naught plus smallest y, where s naught is equal to minus c naught and small s is equal to 1 minus 1 c implying that c plus s is equal to 1 is very simple this algebra it make sense.

So, what you have in the saving functions you have also linear saving function, because you had a linear consumption function. So, you have a linear saving function and in the linear saving function, there is the constraint part which is a negative term it is minus c naught this very important, when it is minus c naught what it is saying that when there is no income in the country, if the country does not save the country dissave, the negative of saving dissaves, which means the country lives on borrowed money, borrowed goods which she does not produce, did borrows then a human being, who does not they leaves on borrowed money.

So, the saving functions is saying autonomous component of the savings functions is the flips sides, of the autonomous consumption component. Since it is fresh side it has a minus sign, the inverse of the way the opposite of way and the minus sign is telling you that 0 income the country dissaves and then also you have a induce part of the saving function, which is function of y.

And that induce part you also have the marginal propensity to save, just like the marginal propones consume this small s is nothing but you can call that the marginal prepensely to save, like small c is marginal propulsive to consume small s is marginal propulsive to save this part is marginal propulsive to save. And marginal propulsive consume plus marginal propulsive to save will be equal to 1 from this identity the s is equal to 1 minus c s plus is equal to 1.

So, what the story is trying to tell you, which is everybody knows that income we bring home with spent of a part of it and we save a part of it for future that is the human psychology. And we calls that the psychological law, when we starts a describing and talking about consumption function imagine 1930, no body heard about assumption function, they have only seen the classical model role around the time, his teacher also talk him and writing a revolutionary book.

So he uses the word like the psychological law, so he borrows terms from psychology, so the human psychology say if you earn something you do not spent everything, while a gambler and added who do that one thing about the feature. But, the human psychology is that you also thing about a future, when you do not have a any term you need something to live, so you have a savings aspect.

So, in his saving function which also consumption function as attach to it, they are flip sides of each other like the coin has a head and tail is part of the same thing, if you have consume you have savings the sum which was not there the classical models. And the classical models consumption did never function consumption was procedure if the economy as say this much given the interest rate, which matches the investment, now from the income identity you can find out how much is the consumption demand.

So, consumption would the very passive variable in the classical models we said residual model residual is what I have a k, I distribute that k some people and tell the person, who is sitting beside me and helping to make the k, which may be truth in many cases I shall whatever remains you can have it residual. So, after having safe whatever remains you can consume that kind of thing is there in classical model, there is no consumption function Keynes for the first time brought assumption function.

And therefore, you see there are difference in the savings function if you write a savings function or a assumption function they are not saving functions is not a saving function

infrastructure anymore you can say that kind of I do in save the depending upon written get from the saving also. So, some sense consumption does become the virtual, but Keynes is taken a in a direction, where it may be opposite to the classical imagine a complete reveal in some sense, what teachers thought him is rejecting them and taking a different part the subject of course, it can have draw backs.

But, it does open up new things which may be able to scene until them, think about it and part of that make sense human beings do safe for future depending upon income. So, when the income apart there consume, depending upon every value remember that m p c value small c or margin assume or margin province to save is not same number for every individual, who loves to spent would have I c value and miser who may called miser does not want to spent, would have a small c value when higher value.

And there are various studies done there are very interesting done, when you go to the poor income roof the demand is, so high and most of demand has not been made whenever, they got the next income that then to spent nearly the whole away, they do not have sell then need saving. So, what happening is in a poor income group family is in a country you will see marginal consume is very high.

Because, they have not seen the t v and the mobile phones and good food, good clothes, good education, the get some money immediately spent. When you come to rich family where we have seen most of it there income levels are, so high all they basic needs a mad you have seen margin province much lower number. So, margin province you consume became a issue of a Keynesians books and I developing the model I am developing the earlier, the dark thing it will slowly develop.

But, are you following are you enjoying it may not be all the time at least you are following it o, so this how canes start developing the new micro models. We have very simple one to deal with first then we get to more complex. Now, imagine just one consumption introduction, one consumption function work more indeed, now you watch I am going to show that you just watch the algebra just I am going to conclude this part have you follow this. So, now, the equilibrium condition please write the equilibrium condition in terms of using the consumption functions, what will it become the equilibrium condition using the consumption function, what will become.
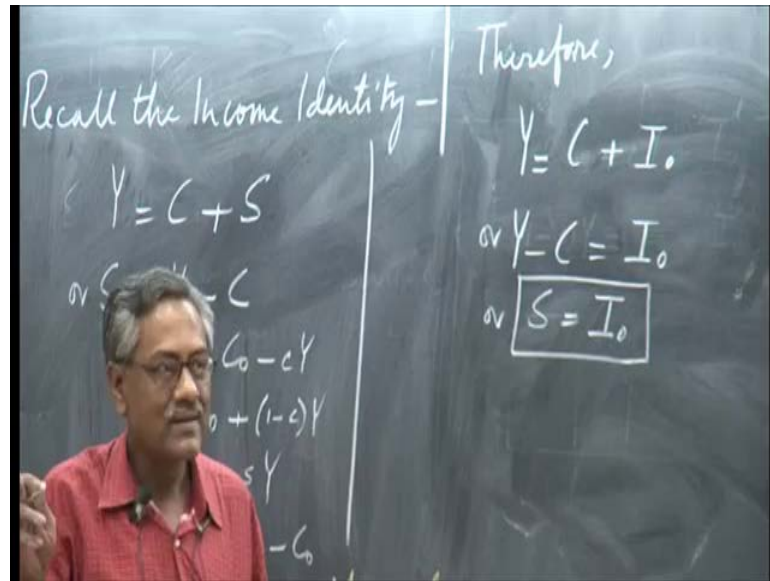
Therefore, y is equal to c plus I naught or y minus c is equal to I naught or s is equal to I naught, now, this for part s is equal to I naught is the very familiar thing in the goods market in the classical models. The same equilibrium condition was used saving is equal to investment, except the savings on the investment, where function of rate obedient here we have in the simple model investment has autonomous or constant and saving is the function of income.

So, the economic which is equilibrium when given a investment demand, some I naught value when the economy produce enough income, which renders matching amount of savings with investment then the economic reaches equilibrium, that what we saying nothing else. Can I use one diagram, before we take a break very simple diagram why call cross model you can see align crosses, something that is why this is called cross model. So, this equilibrium condition is familiar, but we arrive that with using different functions, different kinds of things which in the classical model we did not have.

(Refer Slide Time: 35:51)
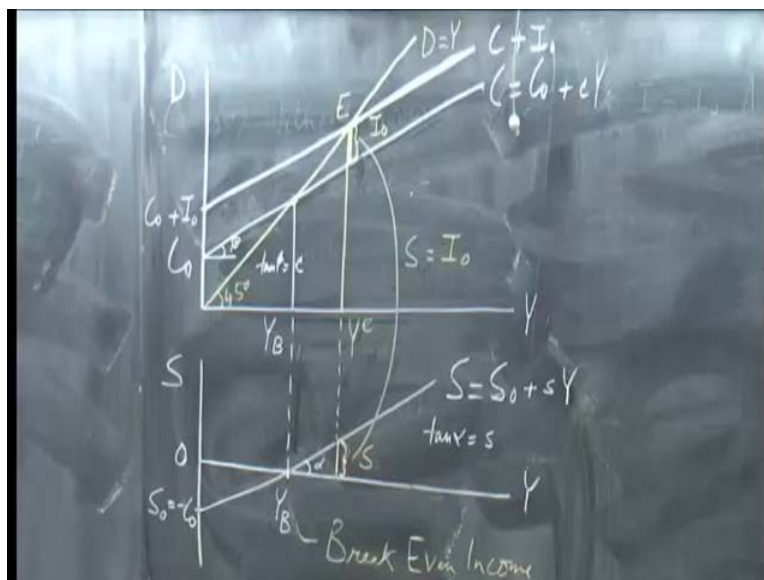
Lets draw diagram where this axis has y here I measure demand, what are the demands I have recall d is equal to c plus I. So, the c line is like this, which is autonomous consumption is c naught and this is c is equal to c naught plus small c y at autonomous consumption are amounts. So, you have c naught plus I naught and you have the aggregate demand line, you have the aggregate demand line as c plus I line like this, d is aggregate demand for equilibrium you require d to be equal to y for equilibrium you require y the d variable value to require y.

So, what you need diagonal you need a 45 degree line, because all the 45 degree line through origin 45 degree lines through the origin, d will equal to y at a point. So, all we need now is 45 degree line, which I am going to without the ruler, I am trying to draw that something like this, which is that d equal to y line equilibrium line, where the angle is 45degree.

So, now, you tell me given the demand curve draw in a very different way, upwards sloping demand curve like c plus I naught is the total demand, equals to output equilibrium where is equilibrium reached at this point, where the height d is equal to x axis intercept which is y. So, this is where equilibrium had been reached, so this the equilibrium value a y you can call y if you wish, this is the equilibrium value of y the module that I have drawn.

But, so y is equal to c plus I we also have a virtual of the equilibrium condition s is equal to I naught I do not see the you can ask me sir, I do not see that on the diagonal there how do you draw that well to draw that the another line here and draw a line like this again y. But, draw the saving function here, now this is the 0 value, so at y we would 0 this is the amount of this saving c naught is equal to s naught I said. So, this amount of this saving is taking me to s naught value here, which is equal to minus c naught value.

And when c naught processes y, c naught process y you can see that the c naught is equal to y then what you have here not c naught is equal to y, while c is equal to y the entire consumption is equal to y s is equal to 0. So, at this point when the consumption line intersects, the 45 degree line that is consumption this is the high consumption. Because, this is consumption point, the first line is a consumption function. So, at that point at that point a y what you have the here is the savings is 0.

So, the savings lines is like this, where that angle here is some alpha where 10 alpha is equal to small s and the angle here, this angle say some beta where 10 beta is equal to small c. The marginable consumes the slopes of the savings line is margin propensity to save and this intersection 0 value, so this is a negative value here on the y axis measures saving then the negative value.

And here you have the positive value at some eve income, you can call the that y v income I will explain that y it is called y the level of income at y d level of income what you find is consumption equal income therefore, savings this 0, after that if you have a any income you are going to have savings is equal to consumption. Now, the question is and the equilibrium point, this is the equilibrium point called that e equilibrium point do you have saving is equal to autonomous investment.

So, essentially what I am trying to say is that this height the defines between consumption and aggregate demand is investment, should be equal to the savings on the savings line. So, this part they should be equal this is essentially s is equal to I naught, this is I naught and this part is some s, at the equilibrium point that the equilibrium level at e you will have I naught is equal to s at any other level of income, you take this income you see savings more than investment.

And lower income you will see less than investment, investment is the gap between the two parallels lines here that is either more or less than, the height here at the equilibrium

point e you will have investment equal to saving the algebra that you have seen on the board, earlier and y is equal Keynesian cross modeling, you can see in a very funny way we draw the demand lines of course, sloping crosses the 45 degree line to give you the equilibrium.

And this part portion of this Keynesians module also rough there you can see book developed later with some assumption of Keynesian model. We has come to know as the Keynesians model that has come to be known as Keynesians cross model people later give it a name, it incorporates some assumptions of Keynesians not all and came of this into version of Keynesians models, in a very funny way demand lines are drawn upwards sloping, there is no pricing in the models competitive no price.

Because, you remember the short term is say prices fixed, so I can ignore price all I have is a real demand and real output, and equilibrium is real demand is real output price can be ignored. Because, the price line is supply line, which is fixed, so this no possibility of price change, if you have any possibility of price change then this diagram will be never effective, because there is no room here for a p variable.

So, we will require at different diagram with piece of variable, but the simple Keynesians models, which incorporates the few assume of Keynes as come to the known as assumption cross model. In case of different assumption do you arrive the same market clearing condition, which is saving is equal to investment although saving is a very different function, now that is very interesting you arrive the same condition which you have in a classical model, if you open notes you will see that the first equation s r is equal I r we do not have r here.

But, we definitely have a similar kind of a condition s equal to I, I is autonomous s is function of income, is this diagram clear. Now, this is nearly coming to the end of the first part of the Keynesians cross model, I have 2 3 stages to go, this model is algebraically not complex. But concept use to knew, because you have seen any macroeconomics at macroeconomics refer this problems, so you are seeing macroeconomics the first time my job is explain things to you.

Now, income at which level at which savings is 0, that is the savings line intersects line the x access, which I been indicated from this diagram with y v level of income, where consumption is exactly equal to income in the country and savings are 0 has name is text

books or discussions, which called break even income break even means to exactly balance something. So, breaking even means basically you all are enough for your consumption you still do not save, at the individual level it can happen also a family runs enough to consume like a poor family.

And has zero savings note this saving they are not borrowing from in anybody is no more disaving, but they are earning enough to have all, then basic needs met and they are not saving either anything for future. So, why d is called break even income this is term you may cross in books, when you read them why the d is called break even income, this is one thing that you have to know, the second point to note this friend of mine who are discuss to something pointed out, I was about to do that, but I talked myself.

You note this line, that diagram if today the line which is called diagonal time, which is c plus I aggregate line or the c line diagonal line or c line as came in the sense only autonomous use there. So, the line slope not the position, the slopes depends upon the c function. Because, the slope of the line is small c if you differential that find out the slop you will get small c, you note one thing if the line becomes steam then the line aggregate lines c plus I intersects the 45 degree line to the right.

 So, there is increasing term in the economy or output economy, if the line becomes flatter then it will intersect 45 degree line to the left where it is now. So, the income level would drop, so depending upon the slope of the aggregate line, it assume whether income would be higher or income would be lower you can see that clearly is very clear this is very important to tuition, which book store right they go straight due to interact derivation, if this line is stepper it would intersect the 45 degree line to the right.

And there will be higher income higher savings this line to go forms flatter then it would intersect to the left. So, the amount of income and etcetera would be smaller is very clear, that the slope of the line is a very important variable which is small c, small c increase in economy this line will become stepper. And equilibrium output income everything will increase if small c marginal of institution drops in the economy, then the line will become flatter and the income as the income of put everything, will drop in the economy is that clear to you geometrically speaking relating to small c.

So, marginal propensity to consume, which concern the consumption function seem to a very important parameter for the macroeconomics. Because, depending upon what the

marginal propensity consume is input and output economy would be consequently determine. You see that this is the second thing from the consumption function, that is coming out is that actual income output or in the economy does depend upon marginal prophesy consume.

So, in a country where margin prophesy consume is high, they will spend a lot will have a high income or output my children demand more. So, I will have tendency to supply mode to them, my children demand less you have a tendency to supply less to them, if the country demands more goods, they came spent more economy also produces more this is the one of reason why multinational companies are more interested in coming to India, is that the margin consume is this confess very high, this country also very big size population. So, the conceal more they can produce more make more profit, very simple and this kind of is also their Keynes is macro model margin prophesy consume.

(Refer Slide Time 51:53)


Now, let me formulize is this argument by talking one more steps further from this algebraic equation, I would use a different color chalk you see there is a thing there is coming up, which is very interesting relationship from this I can also get y is equal to c naught plus small c y plus I naught also. If I take c y to the left hand side, you have one minus small c into y is equal to c naught plus I naught or you can solve for y as c naught plus I naught over one minus small c clear, this is even fact class seven algebra.

So, plus seven algebra should not bother you good the math part is not complicated for the intuition economics is very important, what is the saying what I just told you if the c value increases towards one, what happens to the denominator here false, the ratio goes up the equilibrium value goes up, why value just, now what I have told you this needs to another very interesting. Now, relationship lets solve this a naught y over one minus c a naught is c naught y naught, where a naught is equal to the autonomous component c naught plus I naught.

Now, here we go suppose there is the shift in the autonomous variable c naught, I naught or whatever both of them are one of them companies decided to invest more by more machines, expand their factory is a whatever they want to do that, suppose I am coming out of the short run period I am going into another short run period now they decided more.

(Refer Slide Time 54:26)
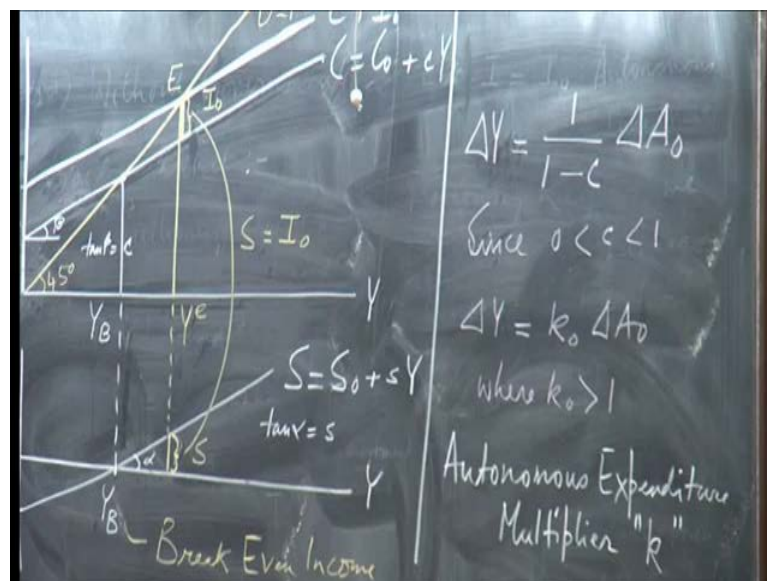
So, there is the delta a naught amount of increase, what will be delta y, delta y may be equal to 1 over 1 minus c into delta a naught, the autonomous part. Since c lies between 0 and 1 delta y will be some k naught times delta a naught, where k naught will be greater than 1, simple algebra c is the fraction 1 over a fraction is a number greater than 1 very simple, c is the proper fraction say 1 point 7. So, 1 minus point 7 is point 3 1 over point 3 is 3 point something ((Refer Time: 55:28)).

This is the second contribution, that follows from the consumption function one thing is change is the look the result you are getting, if there is any autonomous change in the economy in terms of induce consumption in terms of autonomous assumption, private investment, which is often discuss and we will discuss other variables, later the impact or output or income real income is multiple fold many fold.

So, autonomous investment increases by hundred corers point 7 is the marginal propensity to consume, that k value is 3 point how much point 3. So, 3 over 10, 10 over 3, 3 point 3, so the delta y increase in a output will be how much 3 hundred and 30 corers 3 hundred and 33 corers for hundred corers increase in investment, the output increase is the real income increase in the economy, will be 3 hundred and 33 corers.

If, I assume the marginal propensity to consume to be point 7, if marginal propensity consumes goes up, now 2 point 8 than 1 minus point is point 2 then the multiply value k which I called multiply k is therefore 5. So, hundred corer of increase investment extra investment delta I or delta a excuse me, will leave to delta y equal to 5 hundred corers. So, the marginal propensity consume therefore, is a very important parameters, which gives you another inside that, if there is the shock to the system in term.

Because, of increase investment demand or the reverse can work or also if the investment demands, solves the negative impact or output is huge reverse direction also it can work [FL]. So, what you see here is the famous, this is known as autonomous expenditure multiply and that is also, because of Keynesians consumption function it was an there in the classical model multiply means essentially something which multiplies.

So, autonomous expenditure multiply is the small k, that is very important which is greater than 1 value you get the second very important result here, first looks like I am trying to be clever and stating the same goods markets theory conditions, which we had in the classical model which is savings is good investment no big deal. But, when we look into it was as done you realize there are many more things, that are following one of them is the role of marginal propensity to consume from a very simple linear function are demonstrated that consumption function may not be liner, it may be non-linear.
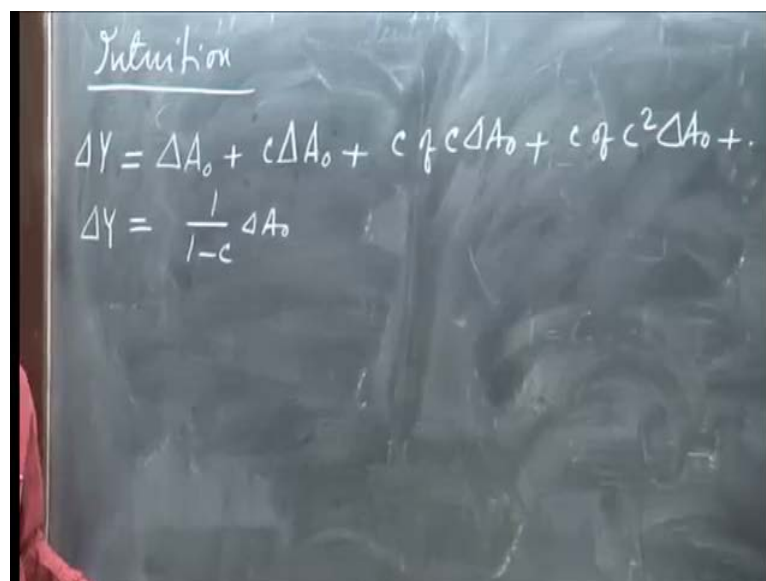
But, I do not want to complicate my life or your life right, now even to the linear function you get amazing results from coming out there something called the multiply at work, in the economy where expenditure increase. It will have a multiplied effect may be

over all multiple time indicate, multiple effect of output question is you did not ask me I will try to explain that next 1 is this there a multiply defend, how what work reach the multiply, that way if forms invest hundred more 10 years 10 months later or 2 years later.

Suppose, I have three hundred four hundred corer both of etcetera income or output why it, so what creates that is my next job is to give you the insight, the intrusion behind the multiply. And you can imagine my intrusion would be definitely dependent upon the marginal propensity, consume what role marginal propensity consume creates has will become even clearer, when I give you the intuition as to why the multiplier exist, which I will call later expenditure multiply simply.

Now, we have only autonomous variables, we are calling a autonomous expenditure y is the multiply, let us let my next job is explain why this multiply exist, then I will go into other issues. So, geometrically you can draw and increase delta I with aggregate demand shifting of to this point, but that intersect of x axis will give you an increase in y much larger than the vertical increase, on the y axis. Vertical increase in the y axis measure with the actual increase income when this line shifts you will see this proportion, it this is much larger here for a small shift in this line, which I went there in terms of that multiplier, geometrically speaking what will happen, now let me try to explain why the multiply works there is an algebraic prove, which a explains the intuition quite well, which I prefer to use why the multiplier works.

(Refer Slide Time: 01:01:54)

$$\Delta Y = \Delta A_0 + c\Delta A_0 + c \text{ of } c\Delta A_0 + c \text{ of } c^2 \Delta A_0 + \cdot$$

$$\Delta Y = \frac{1}{1-c} \Delta A_0$$

The algebraic proof are intuition behind, the multiplier is as follows the companies have demanded, an extra amount autonomous investment right hundred corers. The stage starts placing demand from machines, tools, resources for extra hundred corers, what of goods investments goods companies place with companies co produce them, form a, form b, form c, form d. Whatever one this start within the demand in this economy where there is unutilized capacity they start producing them extra cost do not go up much additional cost.

Of course, you are bring a cost to produce extra goods, extra cost are not rising no additional cost in the simple world prices, non increases what it does when any everybody company a, company b, company c, starts producing extra machine extra computer extra fan extra nuts and bolts extra other tools, they are hiding the sources people producing them and generating income. In the simple worlds let us assume that after the first period this amount or demand has been placed, on various companies by companies by form.

So, investing extra creates an extra create an extra amount of income, because this amount to go to this supply they creates the additional amount of income, call delta A which is the additional amount of income, it creates and when this income people were households go home, they spends c amounts of it, much of the propones is c economic. So, they would be therefore, placing c times the extra income as demand, new demand in the economy for all of consumer goods [FL] Film, TV, new cars whatever they are while.

So, Sunday after the initial demands for machines etcetera, because autonomous investment increase, which creates an additional amount of income generated in the economy to delta A, consumers when they come home with that income after working in the company the place of extra c times of that in terms of extra goods, that they would like to buy. Because, they are extra income, now consumer goods this consumer goods creates c times delta A naught amount of income.

Because, the consumer goods factory is not producing more consumer goods, but a more jam more fans more auto mobiles more ac is a more income by ac is very hot an extra fan and extra cooler [FL] So, that is generate and c times delta a naught amount of income again, where consumer goes home with that extra income house holders, I will produce

that they go home that will income and they have a children and children wife and etcetera they say now lets out of it.

So, then the next period they will spend c of c times delta A naught of income, again when the place an extra amount of consumer goods demand is less which c of c a naught which will be produce and generate income. And when we go home there will spend again c of c square delta A naught, so this process is to be going on and on every period and income is generated c times is suspend from that extra income extra demand for punch, which requires productions and against their amount of it become which income recipients when the go home they stars spending of it.

So, the total process if you add them up, if you add them up goes to infinity and that is the total income that is generated delta y over a successive period of time. The now this geometric serious in final serious some geometric final serious, what you have common factor is c it will be one over one minus c into delta a naught delta y is equal to 1 over 1 minus c into delta a naught, which is preciously the multiply we have there.

So, why the multiply works, because of the existence of c on the discover of c by kids and now you have a second very important result the there is working of multiplier economic. When extra demand is created is just one time and extra amount goods jobs produce, it has a multiple repel effect like when the wave come towards the show you will see the large way follow by us little smaller and the smaller 1 smaller and then finally, lies down c is the waves lacing on the soap.

So, when the expenditure extra boost happens in one periods, it happens it has a subsequent multi period effect on the economy and the total amount using mathematics, I can count that by addition method geometry series are geometry series method to be a multiplier that work. And essentially that smalls c is very important is the intuition clear y a multiply works in the economic, this inside was there working out multiply even if they had acknowledge at list not in their academic papers among classical math economist, they never talk about multiple even they were at most sometimes for political regions you dome you know that works.

But, it disturbs your famous where is stand politically if you do not mention that, but you very well know that works Keynesians brought it out. So, this is the first concluding the first face first stage of the Keynesians cross model in this multiply and intuition is clear

alright clear second stage, I want to talk a little bit about some stability issues, which we do a lot in macroeconomics not.

So, much in macroeconomics, but I want to talk about the little bit of satiability issues this equilibrium, that economic is stage is a theoretical question in macroeconomics stability issues are discuss in terms of something called second out of conditions like, if you have maximum how do you rich maximum the curve must be decline after reaching a mask.

So, the second derivative of a function should be negative you should reach the maximum otherwise you can minimum it is the first derivative is saying is the tangent condition which is 0, when you rich a maps or a main the first derivative which is tangent is always slap is 0. But, you do not know whether you reached the map or min to ensure that you on bring in the second order condition at list this you know the third and the fourth.

And the conditions, the second conditions which we use in microeconomic is for a max in mathematics is coming from, the second derivative should be negative for a min the line must going up it rich the main. So, the second derivative should be positive in the microeconomics that we reach which equilibrium points, how stable are they that the issue we ask if you reach you reach that or go and come out of it are this multiple stable.

We ask the issue similar to my create or second order conditions is the stability issues, so I want to talk about equilibrium stability theistically issue bent, it does not require anymore mathematics. But, involves the few economics concept that is why I want to do it all kind of you teach you is the economic between I am not trying to teach you mathematics, I am using mathematics expense some other you see the end of the course, you have learn only economics nothing else nothing else. So, let us talk about stability issue little bit not difficult that all can I use this part of the board again.
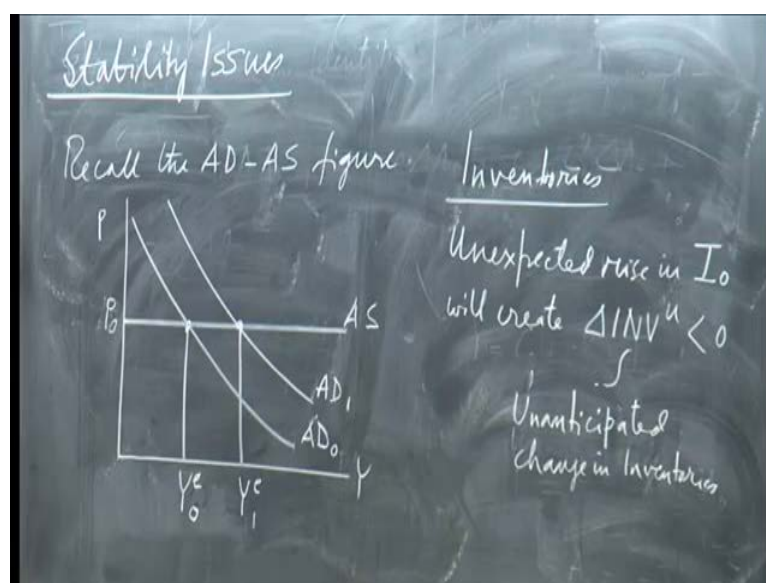
I require that diagram again stability issues, now we call the diagram demand aggregate supply diagram, we call that diagram what you have you have is the following thing. But, y here tries here and suppose this is aggregate demand and this is aggregate supply this is price p dot, this is the aggregate supply and you call this the equilibrium point call that y e naught in equilibrium developing income.

Now, suppose aggregate demand shifts, because of autonomous investment increases consumption increase, something had a demand shifts from a d naught to a d 1 this kind of parallel kind of a shift equilibrium output showed. According to the diagram increase to y 1, but what is the mechanism through, which where the increase well in a static diagram.

We know the 3 point is equilibrium or mechanism through will that features that stability issue as soon as extra demand is faced on companies consumer demands, in consumer goods demands as both c and I, may be consumers demands it investment goods. As soon as extra demand is place from to produce that, what happens is company c that what to do. Now, they go to the go down which is called inventories they go to their inventories.

When they go for inventories and find out what stalk, they have they open the law they take the good out which lying the inventories and supply to the market immediately over I, they cannot produce the good. Therefore, what I assuming or this modes assuming in

some sense is that company holds inventories preciously, because of this that they can be unexpected increase in demand, when you will open the lock of the inventory is go down bring it out, I meets the demand.

Because, why would we, so we miss opportunity to make an extra profit, so we should keep in introduced, now when the extra demands suddenly comes it was unexpected inventory changes are unexpected all right. So, there will be some unexpected change or unexpected rise in save of another investment will create delta INVUI, will tell you what negative where delta I and u is half and unanticipated change in inventories people they did not expect inventories to change and unanticipated change, which is unexpected change is negative why negative, because this is a extra demand.

So, the inventory have at cost hundred items unit units of items some even this demand even this going to be fifty. So, the inventory change is very it is following not increasing decreasing. So, delta INVUU is unanticipated change in inventory will be negative and as soon as there is the demand I go to inventory, then I come to the production measure and till the production major look super investment.

And extra demands for resisting what to do while then we have to shift out here produce more from, the next day next month right, now meet the extra demand from inventory change. But, the inventories stock is going down should be produce extra to foreign bring the inventory up to the level view out, the design tire level and if the demand process you have to increase our production.

And we see the demand this purchasing, so finally, what happens the economy starts producing high level of output, because the increasing investment for instant and the increase demand per instant within go down, 1 period increase the they did. So, that you cancel each other and a minor inventory change that took place in the companies inventories stops over 1 of the periods no I did not back by inventory again it goes down.

Because, they want that extra income increasing output to process in some ways, so the economy will start, now producing high level of output. Because, this high level of demand that process it went up is went up never came down, so what I am trying to tell you is that I soon as, why aggregate demand increases in order to go there what happen is there is a in the process here delta.

I and v u becomes negative, which means it is signally company is to produce more inventories going down, because there is the extra demand in the market, when it process you have to produce more in order to produce more therefore, y starts increasing slowly towards y e 1 equilibrium value. It does not mature over night it times to be reach then and then, reaches that all right.

Similarly, if the demand fall companies can solve of the text to the market. So, what they do are we come back [FL] you come back without selling all that, where will they go they will go to the inventory are a unexpected change inventory is positive. Because, inventories what I have in the morning by the time, evening came is bigger, because I cannot sell it. So, companies when the notice that are expected change invest talk is positive for a few subsequent periods that means, the market is experiencing the demand.

So, they go to the production flow and adjust the, we adjust the production level, so that output starts following to new up levels. So, when you reach the new equilibrium level at y e 1 at y e 1 again delta I n v u will become 0, there is no change, because it has reach equilibrium until it reaches that delta I n u v u will be negative, the inventories stock will be decreased, it make you a demand once output reaches, the new level where it should be when no more inventories are touched they remain.

Whatever the desired levels are all right, so there is no extra demand that requires to be made from inventories all demand is made, now keeping inventories gap from the current output, that we have reach the equilibrium point. So, whenever we reach the equilibrium point inventory changes unexpected inventory changes become 0 and as soon as our deceived or unexpected, inventory changes are either positive or negative.

And that process products of couple of periods, from immediately know there is some permanent change, that is occurred in the market, either more demands for good or less demand. So, this slowly they are for start at just in the production starts, so definite period, they either produce more or produce less to meet the new demand to confirm to the new demand to match the new demand once they match it inventory [FL].

Inventory is go back to the desires level, so this is how inventory adjustments signals how to the just and the economy adjust, to a new output level either higher or lower, which when the reach the reach and equilibrium point, when inventories changes become

un inventory changes u unanticipated or un inventory, it will changes become 0 am I clear yes.

Of course, I am assuming that inventories will go back to the new desire level may be, but the inventory unexpected changes will be 0, if output has permanent change the inventory is may not also go back to hundred any more yeah you have to replace invented and the desire inventory level itself may be change for which the company. Few periods would produce more which will not come to the market.

But, we will produce more to replace inventory and put up the inventory company may decide previously we have to hundred units in the inventory. But, if un excepted change are, so large that hundred goes friction we would like to make it this a planning goes in a company, when we company see that inventory planning goes on and they may say let make it hundred and 50 for non word.

So, they will have to take back in to reached 2 hundred and 50, when it reaches the equilibrium 1 it reaches 1 hundred 50 and the current output matches, the demand alright the no more changes to the inventories will reach equilibrium. According to this macro model you could be right inventories, when the sufficient the with all the demand then you do not meet the demand for if you pay, that is why I am saying y naught e to y 1 e the equilibrium value, this on a diagram looks like a smooth line, it will not be at all it takes a few time periods, it takes a few gaps few adjustment.

And finally, reaches some times in macroeconomic there is an also issue they called over suiting that they are producing. So, much extra they over short the equilibrium value and then they will come back, so inventories I mean may not reach equilibrium, so it is at all, but once it does that means, is the new production land the inventories stock everything. But, there is the another company inventory change, I did not discuss this is inventory there is a component equal inventory change, which came up in this discussions.

Because, the company were decide to intensively consist the increase, the desirable 2 hundred and 50, so that is the interment change inventory I will take data up in the listen to investment, latter of timing notice. The variables there are the shock like that autonomous investment as known as up the adjustment also takes times and the signaling comes to first terms the something [FL].

Is when the look the inventory adjustments, there is unexpected up and down inventories for a subsequent quarter the periods say weeks or days companies realizes, now they have to adjust certain things change. And that shift to a new equilibrium point is not necessarily over night it takes time, so are you what I have thought is it in interesting in the little bit more macro theory moderns are very interesting very different mathematical not very complicated, they do talk about. When you thinks economy, I hope some of you would enjoy and what I want to 1 more equation function of what I just said.

(Refer Slide Time: 01:25:41)
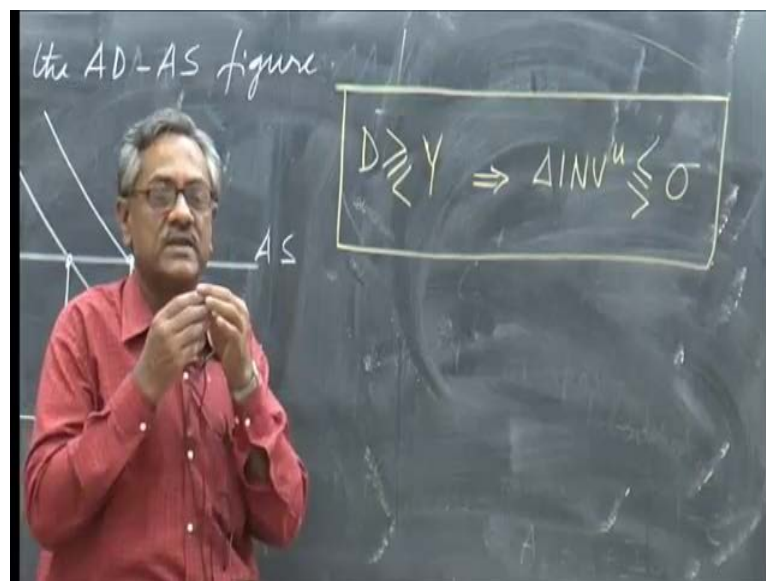
So, will I be correct to say that this one more thing, I need to write demand greater equal to less than y your demand is more than output would imply delta I n v u all right less than equal to greater than 0, A demand is more than output a demand is more than output I n v is negative, I told you the demand is equal to output. Now, whatever the company produces then delta n v u reaches 0, if demand is less than output delta I n v u is greater than 0, this relationship ensures the market reaches equilibrium company adjustment, when show the market reaches equilibrium, this is called the salary condition the secretly is invest to the inventory adjustments.

So, whenever company see unvented inventory changes is something it signals companies are they should do, and therefore the adjustment call back to the equilibrium point climb up to that or go down or whatever, this is the basic relationship that was I am trying to tell you in mathematical term, this is properties are you happy with this, what I

said now next day on Monday. I will complicate this diagram on little bit I will bring it government taxes expenditure. Let see, how you feel about it, because those where the contribution of obtains you will see the a very funny thing this Wilson basic one unchanged, but algebra becomes a little n bit more complicated.