Microfoundations of Macroeconomics
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Lecture - 15
Credit Market Imperfection II

Hi everyone, welcome back to a new session. We are talking about the credit market imperfections. And we have so far covered the issues like how and when we have the information differences that the borrower is sharing with the lender. If you have that kind of scenario then what are the issues that we normally face? We also introduced the credit market asymmetry where we said that if the borrowers are going to default, then the banks are going to face the risk.

In order to avoid that risk, they charge higher rate of interest for borrowing. The difference that we normally see between the borrowing and lending rates, it is mainly because borrower may have shared the limited information with the bank. In case of default, the risk will be completely bound by the bank not by the borrower. In most of the cases in real life scenario, the borrowing rates are higher than lending.

We analyse that and we also mentioned that when we see rise in uncertainty or when we see the rise in the number of bad borrowers then we have the high chances of default. When we assume that a is the good borrower $1 - a$ is the bad borrower. If number of a which is the good borrower if it is increasing then you have almost same borrowing and lending rate.

The moment you have the $1 - a$ rising and a falling then we see a wide difference between the borrowing and lending rate. In that scenario the borrowing rate increases. If you have a situation like this then we normally call it as the credit market imperfections. Imperfection arises because of the uncertainty.

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Reference Book

Author Name: **Stephan D. Williamson**

Williamson, D.S. (2014), Macroeconomics (5th Edition). Pearson International Edition, Boston, USA

Williamson, D.S. (2018), Macroeconomics (6th Edition). Pearson International Edition, Boston, USA

Author Name: **Sanjay K. Chug**

Chug, S.K. (2015), Modern Macroeconomics. MIT Press

Or the lack of information shared by the borrower or because of the default risk that the financial institution face in case there is a default.

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Key Learning Objectives

- Understand the basics of credit market imperfections
- Introduce asymmetric information to explain the credit market imperfections
- How limited commitment makes collateral important in the credit markets model
- Introduce different social security schemes to counter the relevance of Ricardian Equivalence

This part we have already covered and it looked quite smooth to understand.

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Credit Market Imperfections and the Financial Crisis

- Two key credit market frictions: asymmetric information and limited commitment.
- Asymmetric information: Would-be borrowers know more about their characteristics than do lenders.
- Limited Commitment: Borrowers may choose to default – lender can overcome limited commitment with collateral.

Credit Market Imperfections and the Financial Crisis

- Suppose that a fraction a of the borrowers in the economy are good borrowers, while a fraction $(1-a)$.
- Suppose the loan quantity sanctioned to each good or bad borrower is L.
- Banks charge the interest rate r_2 on loans and pay r_1 on deposits.
- It means that banks have to pay $L(1+r_1)$ amount to depositors and receive $L(1+r_2)$ from good and bad borrowers.
- Here one thing to not that the banks will not receive any payment from $(1-a)$ who are bad borrowers.

Now, here we are introducing two more concepts.

Asymmetric Information–Deposit Rate and Loan Rate

- The average profit of the bank will be

$$\pi = aL(1 + r_2) - L(1 + r_1) = L[a(1 + r_2) - (1 + r_1)]$$

- In equilibrium, each bank must earn zero profits
- Zero profits for the bank implies:

$$r_2 = \frac{(1 + r_1)}{a} - 1$$

- Therefore, there is a default premium $r_2 > r_1$ when $a < 1$. The default premium increases as a decreases.

One is about how the borrower is going to react if he or she is facing what we call the limited commitment.

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Limited Commitment and Credit Markets

- Borrowers need incentives not to default on their debts – these incentives typically provided by collateral requirements.
- Examples: House is collateral for a mortgage loan, car is collateral for a car loan.

If you have the limited commitment problem then how it works in real life scenarios. Limited commitment in the sense that if the borrower is going to borrow from the institution if it is not paying then how in that scenario the banks or the financial institutions are going to react. And limited commitment also deals with the paying capacity of the borrower. In case the financial institutions have sanctioned the loan to the borrower then if the borrower is not going to pay then what will be the issues?

How can we safeguard that risk? Safeguarding the risk arises with the introduction of collateral which means that financial institutions will be asking from the borrower that if he or she is

having any valuable wealth. Then, how this wealth can act as a collateral? That in case of default of loan, bank will be able to compensate the loss by selling the collateral value. But collateral plays very nodal role here.

Because on collateral value, bank is going to finance the loan or sanction the loan to the borrower. If the collateral value is going to be lower than the amount of borrowing capacity of the borrower will also be lower which in turn means that the borrower's capacity of borrowing depends upon the value of the collateral. If the collateral value is rising it means that the borrower's capacity of borrowing is also rising.

And financial intuition will not have any difficulty in giving or sanctioning the money. In that scenario, the collateral value plays very important role. And that is why, when you go to the bank and you are seeking a loan for the short term, for example, one or two years, but you are already having a long-term saving account with the bank. Then bank does not hesitate to sanction the loan.

Because bank knows that since your long-term saving account is with the bank then whatever amount of money that is flowing to that account it will have the higher value in future because rate of interest will accumulate. Once you have the rate of interest accumulating then this will have a positive impact even if you are going to borrow the smaller amount. For example, in your long-term account you have 10 lakhs but you need immediately 5 lakh rupees.

And then you are going to borrow from the bank. Bank knows that you have these 10 lakhs but over the period of time, this may be having the value of 15 lakh which means that bank even does not care about how much information you are going to reveal to the bank. Bank will immediately sanction you the money because they know that they can recover from your long-term account easily.

Here the collateral understanding is important and that is what we are mentioning. If suppose the collateral can be any valuable asset, land, you have the house, the house can also act as collateral. Suppose we take the example of house. House is a collateral for a mortgage loan and car is a collateral for a car loan.

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Example

H = quantity of housing owned by consumer

p = price of housing

Assume: Housing is illiquid – can't be sold in the current period. However, it is possible to borrow against housing wealth, with a collateral constraint.

Here we are mentioning that suppose H is the quantity of housing owned by the consumer. This is the housing the consumer is having or maybe you can say one house. One house is owned by the consumer. This house, he is keeping as collateral. The price of housing is p, which means that since housing is a fixed asset, here we are saying that this collateral value will be playing important role in the future period not in the current period.

Because current period whatever is the value that can be sanctioned as loan. But if the value increases or decreases this evaluation of increase or decrease in the value of the collateral asset will play very important role about deciding current and future consumption of the representative consumer. Based on the borrowing and lending capacity, the collateral is going to play important role not in the current period but in the future period.

Because in current period it is deciding that how much money the representative consumer is eligible and how much, till what extent he or she can borrow. It is possible to borrow against housing wealth with the collateral constraint.

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Consumer's Constraints

Lifetime budget constraint:

$$c + \frac{c'}{1+r} = y - t + \frac{y' - t' + pH}{1+r}$$

Collateral constraint:

$$-s \leq pH$$

or

$$c \leq y - t + \frac{pH}{1+r}$$

Assume: Housing is illiquid – can't be sold in the current period. However, it is possible to borrow against housing wealth, with a collateral constraint.

How does it look like? This is the budget constraint of the representative consumer. Here,

$$c + \frac{c'}{1+r} = y - t + \frac{y' - t' + pH}{1+r}$$

The disposable income in the current period, disposable income in the future period. But here you have the pH, pH in the sense that this representative consumer owns a house. This is the value of the house $\frac{pH}{1+r}$.

The collateral constraint is

$$-s \leq pH$$

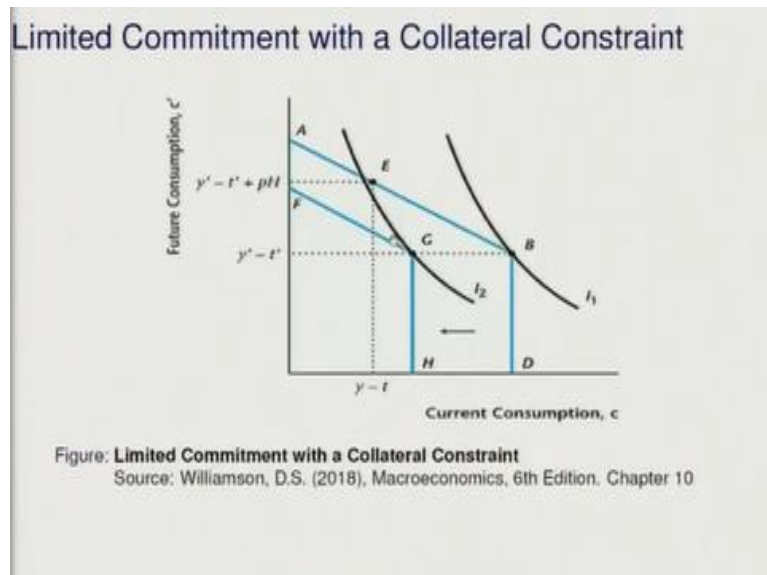which means that this can act as a saving or you can also write it as

$$c \leq y - t + \frac{pH}{1+r}$$

This is the consumption function in the current period. This representative consumer will have the $y - t$, the current income which means that in the current period this is the disposal income that this representative consumer receives.

Plus, the present value of the collateral asset. In our case, it is house H. $\frac{pH}{1+r}$ is the present value. In the current period, this representative household is having the income, disposable income, plus the present value of the collateral asset. This is the current period scenario.

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Figure: **Limited Commitment with a Collateral Constraint**
Source: Williamson, D.S. (2018), Macroeconomics, 6th Edition. Chapter 10

Here you have to note that the representative consumer is at equilibrium at point B. It means that if he is here then he is utilizing the full of collateral wealth. But what happens if the value of the collateral comes down? So if the value of the collateral is coming down then there is inside movement of the budget line. Instead of ABD now the consumer income comes down because the collateral wealth whatever we have assumed the housing.

The value of the house has come down. As a result, we see decrease in income. But here, we have to think from the current consumption and future consumption perspective. Here, we are seeing that with the reduced income that this representative consumer is going to have which means that this will also reduce the collateralized wealth from which this representative consumer can seek loan.

Now this representative consumer is having a current consumption decline. Future consumption remains same. This is what we want to emphasize that with the decrease in the value of the collateral the consumption the representative consumer compromises is in the current period whereas the future period consumption remains same. He is moving from B to G.

We can see that this arrow line indicates that because of this decrease in the value of the collateral the representative consumer is compromising in the current period whereas in the future period, the consumption remains same. Consumption comes down in the current period. You can also think about inverse. This is same like what we have discussed in case of two period model what happens if the representative consumer sees a future income decrease.

It is the same way. The slope of these two budget lines are the same. There is no change in the budget line slope because budget line slope is the rate of interest. But we are not bothering about that. We are directly thinking about reducing the size or the wealth of the representative consumer, given this collateral wealth. When you have the decline in the wealth of the collateral you compromise on the current consumption. Your future consumption remains same.

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Limited Commitment with a Collateral Constraint: Example

- Suppose consumer A faces limited commitment problem on pH wealth that can be sold only in the future period and not in the current period and can act as pledge as collateral against a loan. The individual faces lump-sum tax t and $t + 1$ in the current and future periods. We superimpose the limited commitment problem with taxation that if a consumer does not pay the tax then the government will seize the collaterized wealth but cannot stop his/her income.
- What will be the consumer A's collateral constraint in the limited commitment environment with respect to taxes?
- Does limited commitment problem put a check on government expenditure? Please explain in the contexts of current and future periods.

Now let us face an example here. Suppose we have consumer A which has the limited commitment problem, pH wealth that can be sold only in the future period and not in the current period and it can also act as a collateral constraint alone. The individual faces lump-sum tax t and $t + 1$ in the current and future periods. We superimpose the limited commitment problem with taxation. Now here, we are dealing with the scenario.

What we are saying is that if you have the representative consumer who is having the collateral constraint pH. This pH will be used in the future period not in the current period. If you have the future period and this representative consumer is also facing a tax that he is paying tax t and $t + 1$ in the current and future period. Tax is certain. Now, if we are going to impose the limited commitment problem here, what will be the limited commitment problem?

Limited commitment problem will be that if this representative consumer is not going to pay the tax, then the government will be taking out the collateral asset as a compensation for not paying the tax. This is what we are saying. If we are imposing this condition then how we can

calculate the consumer A's collateral constraint in the limited commitment environment with respect to taxes.

And can this limited commitment constraint because it is going to play a role in the future period, can this collateral impact the government expenditure because government can only react to the taxes if he or she is not paying but cannot control on the income of the individual.
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This is how it looks like. What will be the consumer A's collateral constraint in the limited commitment environment with respect to taxes?

$$-s(1 + r) \leq pH - T_{t+1}$$

This is the future tax. Until unless, this representative consumer is going to give less than this or have the value less than this then only this amount will play a role and if you derive the consumption. What it looks like

$$c \leq y - T + \frac{pH}{1 + r} - \frac{T_{t+1}}{1 + r}$$

Overall, what it looks like that the representative consumer is, as long as pH value is higher the representative consumer is not going to face any trouble. But if the pH value is lower then the representative consumer may feel the impact.

In this scenario, if you think from the Ricardian equivalence perspective it does not look like that Ricardian equivalence will have any trouble here because it will hold. But in this
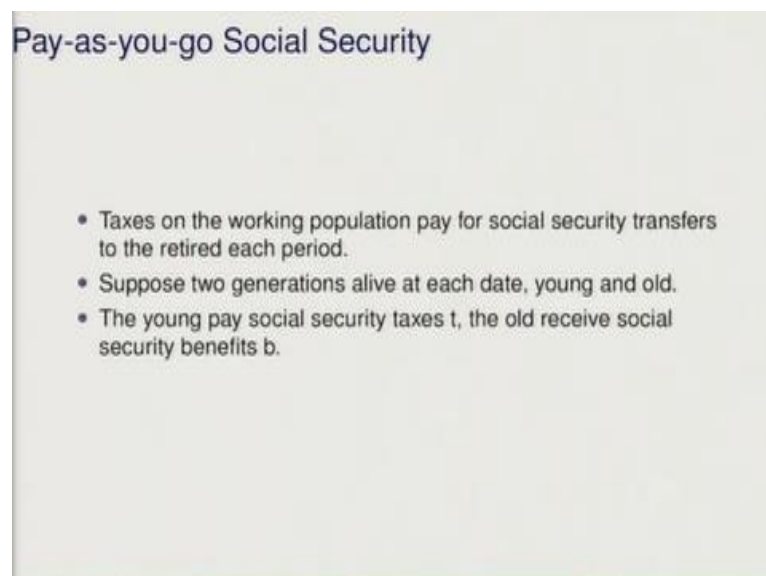
environment that we are assuming with respect to the current taxes even if the individual is having a tax burden but if it is compensated with the rise in the collateral asset then this will play very important role.

Does limited commitment problem put a check on the government? Yes, it will put a check to the government because as long as the value of pH is higher than the T_{t+1} then the there is no issue. The moment you have the pH value lower than T_{t+1} then the government will always have the limited money. As long as this is higher government does not care about. If the individual will not pay the taxes government will simply seize that pH and sell it in the market and get the higher value.

As long as, the pH value is greater than T_{t+1} the size of the government will not matter. But if pH is less than T_{t+1} then the government size will matter. Because this government will not be able to extract the same amount of tax that the individual is supposed to pay. Now here, we have a further one more topic to be discussed so what we learned from here that in case of limited commitment what typically happens is that the individual is going to face a situation where the representative consumption will be dependent upon the value of the collateral.

If the value of the collateral increases the consumption will increase otherwise, it will impact the behaviour. And here we can see easily that it is impacting.

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Pay-as-you-go Social Security

- Taxes on the working population pay for social security transfers to the retired each period.
- Suppose two generations alive at each date, young and old.
- The young pay social security taxes t, the old receive social security benefits b.

Now we are going to understand new tools and concepts in the field of social security. Now in macroeconomics, those of you who are getting used to or getting introduced to this topic for

the first time we often talk about what we call it as pay-as-you-go scheme. There are two types of schemes in social security. One is called the pay-as-you-go which means that when you are young you pay the tax, when you are old you get the benefit.

Then second scheme is called mandatory requirement. What happens in the mandatory requirement? In mandatory requirement, the individuals are supposed to save mandatorily as per the instructions of the government a certain amount of money for the contribution towards the social security. And once they retire, then this amount of money will be used for their welfare.

Here you have two things to understand that when I talk about social security it speaks about the commitment of the government. Government can say that we are no more bothered about the social security. Individuals will start saving from their disposable income and this disposable income will be creating a some kind of cushion for the households in the post retirement period.

But in real life, we always see that the government is also having some kind of commitment. Individuals are also aware that government will provide some kind of social safety net. After the working age and once they retire then the government will be taking care because for the high-income class or the middle-income class it may not matter much. But for the poor class, social security does matter.

And we found that in case of the US economy when we had the first wave of pandemic and the stringency announced, we found that a lot of people were asking for the social safety net and seeking fresh social safety net at that time. Taxes on working population, pay for the social security transfer for the retired each period. Suppose we talk about two generations.

That we discuss about the finite lives we had overlapping kind of scenario, so we say that here we have young and old. The young pay social security taxes t, the old receive social security benefits b. When I say that young is paying the social security tax when you are young you are paying, the old receive the social security benefits b.

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Pay-as-you-go Social Security

- The population grows according to the following equation. Each period, there are N' young and N old alive.

$$N' = (1 + n)N$$

Which means that if I am saying that N represents the old, N' represents the young. N' the young is equivalent to $1 + n$ which means the growth of the old you can say. Whatever we say the young population is equal to $1 + n$ which shows, you can say, the additions to the old. Which also means that if I go for solving for N we get,

$$N' = (1 + n)N$$

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The Government Balances Its Budget

- Total social security benefits must equal total taxes on the young.

$$Nb = N'$$

Now, if I am going for social security benefit, so if I substitute here N' instead of here. it becomes $(1 + n)N$. If I write here suppose we want to get the social benefit so here the old is N. The benefit that old is getting is b which is equivalent to the number of young. The old benefit which is multiplied by the number of old people it is equivalent to the young which means that the rate of growth of young population will matter a lot.

If I am saying why, it is mattering a lot? Because as long as it is higher it does not matter. If the population growth rate is higher, if the n is getting higher then of course this will compensate and the share will be distributed. distribution will play important role here.

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Relationship Between Taxes for the Old and Benefits for the Young
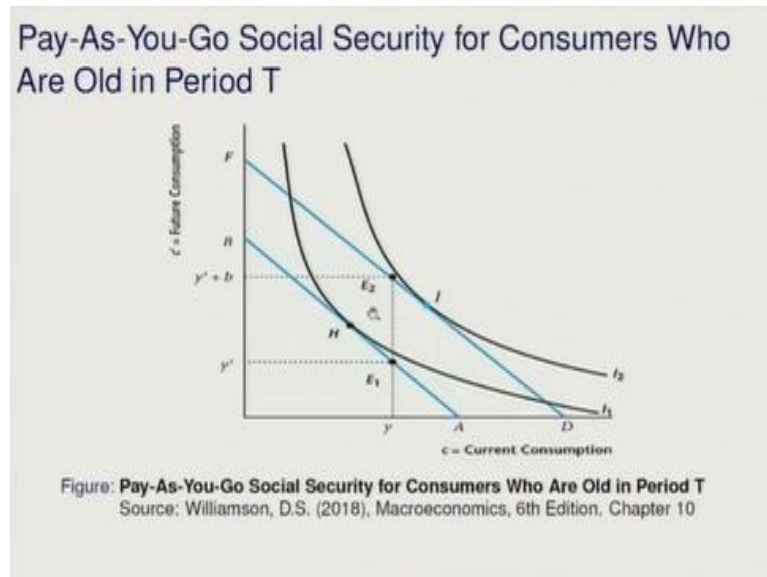
$$t = \frac{b}{1+n}$$

If I substitute N' of this here then what we get is nothing but your total, I would say, tax will be equivalent to the benefit that old is getting and it is divided by $1 + n$, which means that the ratio of benefit. Benefit that the old is getting, it is distributed across the population growth, $1 + n$. If this is higher the burden of benefit is going to be lower which means that overall tax is going to be lower.

If this is going to be lower, then the burden is going to be higher which means the tax is going to be higher. And this t is born on the younger population. The older one is going to get b. As long as $1 + n$ is higher then it is always better to have the scenarios for the younger people. But it can be also argued that instead of focusing on the population growth why the government is not simply, whatever amount of money it is collecting why cannot it invest?

When you are investing in the market you will get the higher rate of interest that return will be further addition to the net capital whatever amount of capital has been invested. And the rate of return generated from the interest can also be used for the benefit of the younger population, which in turn will reduce the burden of the younger population. Tax will be lower. Here it matters a lot that as long as the population growth is higher.

The burden of the benefit going to older population will also be lower on the younger generation. And this will simply reflect the lower taxes on the young population.
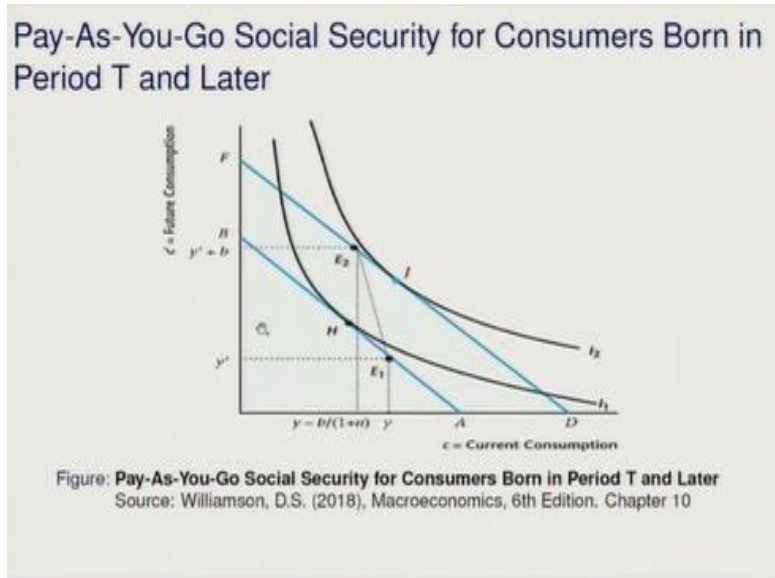
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Figure: **Pay-As-You-Go Social Security for Consumers Who Are Old in Period T**
Source: Williamson, D.S. (2018), Macroeconomics, 6th Edition, Chapter 10

Here, we have pay-as-you-go social security for consumers who are old in period T. In period T, if this individual is not going to be bothered so much about then we can say he is at H. The moment he gets the social security benefit from the pay-as-you-go then this is going to be on a higher indifference curve.

He can enjoy the consumption here. Earlier, he was having the consumption of this much. But now the endowment has gone up with the benefit in the future because in current period, this particular individual is not bothering so much. His future consumption rises and this future consumption rise will also accompanied by the upward movement or the parallel shift of the budget line. And here, it is clear case that how we are seeing the parallel movement.

And the individual is moving from lower to higher indifference curve. And the old is having good time. But what happens when you are talking about the younger generation. What happens to the younger generation? Younger generation so here it makes sense to understand so what we are saying that this $y' + b$ which is the amount that has been taken out from or that will be shared on the younger population.

It is going to play very important role here $y' + b$. This b we are analysing the value of this here in the next section.

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Figure: **Pay-As-You-Go Social Security for Consumers Born in Period T and Later**
Source: Williamson, D.S. (2018), Macroeconomics, 6th Edition. Chapter 10

The pay-as-you-go social security for consumers born in period T and later: here, we are saying that this is the amount that this particular guy will have. This is for the younger generation. So here we have not put the scenario that what happens when n is greater than r.

If n is greater than r which means the rate of population growth is higher, then it does not matter to the individual. Once I am talking about the individual that how this representative consumer is going to decide about the consumption when he is young. It depends upon when n is greater than r which means that if the rate of operation is going to be higher it will also experience the similar change that earlier he was at H then he is moving to J.

H and J that here you have, you have the higher movement of the indifference curve and this also shows that this individual is going to get benefit as long as n is greater than r. The moment n is not greater than r then there you have the more burden shared by the individual. And there will be extra pressure on the private credit market. These things are important to note.

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Pay-as-you-go Social Security

- Pay-as-you-go is beneficial only if the population growth rate exceeds the real interest rate.
- The interpretation is that the population growth rate is the implied rate of return for an individual from the social security system, so social security is only worthwhile if the return exceeds what could be obtained in private credit markets.

As I mentioned pay-as-you-go is beneficial only if the population growth rate exceeds the real interest rate. The interpretation is that the population growth rate is the employed rate of return for an individual. This is how we try to mention.
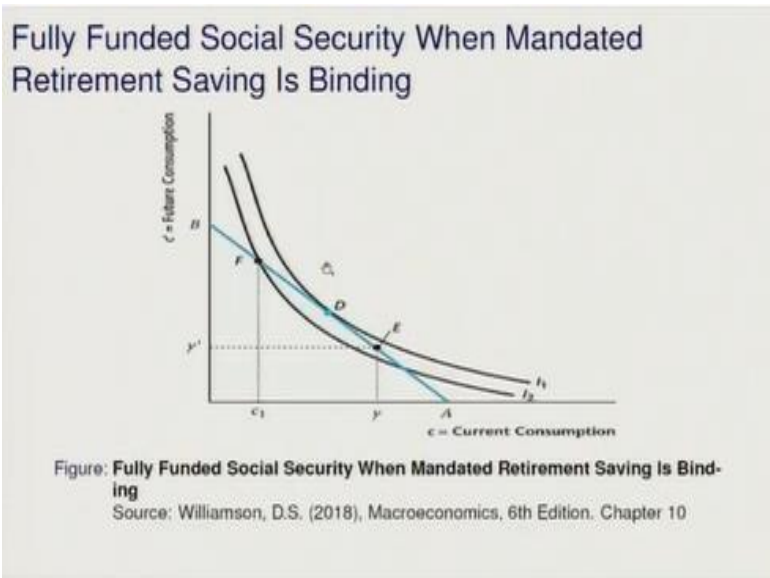
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Fully-Funded Social Security

- Essentially a mandated savings program where assets are acquired by the young, with these assets sold in retirement.

Fully funded scheme is important to understand. In fully funded scheme, it is government mandated. So here, it is like a force saving. Individuals are forced to save more.

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Figure: **Fully Funded Social Security When Mandated Retirement Saving Is Binding**
Source: Williamson, D.S. (2018), Macroeconomics, 6th Edition. Chapter 10

Once individual is forced to save more so suppose individual is at F now his endowment is here, he is happy at point D. But he is forced to save at F. And at this F, he is compromising on current consumption. Maybe the future consumption may be comfortable but he would like to enjoy at this point D. Because this amount that he is having E, he can save this amount of transfer in future.

What is the idea behind as the Economist have argued that as compared to point D in case of social security schemes it creates inefficiency. And this inefficiency is playing important role because of the force saving that the government is imposing on the individuals. And this has lot of limitations as highlighted by the Williamson that if you are thinking about the mandatory schemes mandatory scheme forces the individual.

And it also attracts risky investment that may also lead to moral hazard. It also attracts inefficiencies.

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Pay-as-you-go Social Security

- Fully funded programs encounter the problem of investment inefficiency because of political interference.
- Moral hazard problem
- Pay-as-you-go depends upon the rate of population growth

Those inefficiencies are discussed here. That fully funded programs encounter the problem of investment inefficiency because of the political interference. Because a huge amount you can invest and some risky investment may create trouble. Moral hazard problem, Lack of monitoring it may also happen that individuals who are going for forced saving they might not be taking care well. Because they are contributing so they know that the government is going to take care.

They will not be bothered so much about. But pay-as-you-go depends on the population growth. But fully funded schemes are those in which everyone is participating. This is what we have understood so far. In both the cases, as long as the rate of population in growth is higher, we do not care about the taxes. Taxes will be lower and individuals will be able to smooth out. Ricardian equivalence may not be applicable there.

But the moment, you have the rate of population growth going to be lower. Private credit market will be playing important roles. There will be some extra burden on the individuals which may not be helping in them in smoothing out the consumption. Then pay-as-you-go social security may have some troubles. During business cycle, when you have low income, the population growth is also low, income is also low.

At that time, Ricardian equivalence may not hold. Otherwise in most of the cases, the smoothing is playing important role. And smoothing can help in designing the certain social security benefits. Let me summarize what we have covered so far. We have covered the credit

market imperfections with the housing as in collateral. And we saw that how the impact is being seen.

We also understood from the example that if government is going to impose certain regulations that if individuals are not paying their taxes, then their wealth will be confiscated. If government is going to go for that kind of rule, then the value of the collateral will also play important role. Because the amount of the money recovery will depend upon how much is the wealth of the collateral. Then we introduce the social security.

Another point that we studied that how young generation plays very important role in most of the cases. Fully funded programs are important but at the same time they also have certain limitations as we find in case of pay-as-you-go. I am stopping it here in the next session we will be talking about a new topic. Thank you so much.