

Conservation Economics
Dr. Ankur Awadhiya, IFS
Indian Forest Service
Indian Institute of Technology, Kanpur

Module 1
What is Economics?
Lecture 1
Making decisions

Namaste and welcome to this course on Conservation Economics. I am Doctor Ankur Awadhiya. I am an officer in the Indian Forest Service and your instructor for this course.

In this course, we shall try to understand how conservation and Economics are interlinked; how certain economic decisions - certain bad economic decisions - lead to issues of conservation; how they lead to environmental disasters and how we can make use of the principles of Economics to ensure that we also are able to meet our goals of conservation.

We shall also try to explore why conservation is important for the economic well being of a society. After all we require Economics - we require development - to provide certain amenities to our people. And when we do good conservation we can provide those amenities at a cheaper cost.

So, on the one hand Economics helps in good conservation. That is, good economic sense and good conservation at the same time. Good conservation helps in the development of the society which is also one of the objectives of Economics. We shall also try to explore how we can use the principles of Economics to provide funding for conservation.

These and several other issues will be discussed in this course. This course will be divided into several modules and each module will have three or four lectures. Each module will comprise those lectures that cover a thematic area in either Economics or conservation - or their interlinking.

The 1st module is: "What is Economics". In this module we will have three lectures. The first one is introduction to the course and making of decisions; the second lecture is making decisions part II and interactions, followed by interactions and working of the economy. We begin with the first lecture: "Introduction to the course and making decisions".

When we talk about Conservation Economics, the first question that comes into the mind is

"What is Conservation Economics?" That is, what is conservation? What is Economics? And how are both of these linked together?

The word conservation is derived from these word roots: con meaning together and servare which means to keep. So, essentially conservation means "to keep together." And what do you keep together? You keep together the natural environment because it is under threat. In one of the later lectures we shall explore what is causing this threat, why is our environment - and why are our wildlife - in great danger, and why we need to protect them.

We are not protecting these organisms because of our love for these organisms. We are not protecting tigers because we want to protect the tigers or because we are very much affectionate to tigers - because after all in most of the human history we have been killing tigers - because tiger is a ferocious animal. But, over time we came to this realisation that tiger also provides several benefits. Tiger protects the forest and forests provide us with several benefits such as clean air and clean water.

Forests ensure that our rivers and our streams have water throughout the year - they are perennial in nature. Forests ensure that whenever there is rainfall all the water does not just reach into the rivers causing floods and for the rest of the season the rivers get dried up. Forests have a role.

Where there are forests there will also be herbivores - animals such as deer, animals such as sambar. Now, if these animals are there in the forest - these herbivores are there in the forest - and there is no carnivore that is predating over them, that is eating them as prey - in such a scenario the number of herbivores would go up like crazy, they would eat up all the young plants.

Now, for a forest to continue it requires that the seeds of the trees get germinated and the young plants that come up are able to survive. But if herbivores eat up all the young plants then we will have a stage at which the forest will only have old trees.

And, in such a scenario, if there is any catastrophe - if there is a forest fire, if there is a disease, then this whole forest will be gone. Or even if we do not have a disease - in certain point of time those trees that are old will die off and in the absence of young regeneration the forest will not be able to come back. So, we need to keep a check on the population of herbivores.

How do we keep the population of herbivores in check? Well, we can do two things - one, we can go into the forest and we can start killing up these herbivores, but when we do that in a short time we will come to the realisation that these herbivores are also playing a role in the maintenance of the forest - because the seeds of a large number of plants require these herbivores. When these herbivores eat up the fruits, the seeds - when they pass through the alimentary canal or the gut - become more suited for germination.

So, if you just take the seed and put it into the ground it will probably not germinate, but once it has passed through the alimentary canal of these herbivores - the seed will germinate. A number of plants also use these herbivores as transporters of their seeds.

Because what happens is: if you have a tree in a location - and if all the seeds or all the fruits of this tree fall down here itself, the young plants that will come up - they will be coming up in the shade of the mother tree. And, when we say the shade of the mother tree it means that these young plants will not have sufficient sunlight and so, these plants will not be able to grow.

So, the seeds require a mechanism to transport these fruits and these seeds to other locations and one such mode of transportation is the herbivores. When the herbivores eat up a fruit - and the herbivores are moving - the plants are stationary, but the herbivores are able to move. When they move then this fruit or the seed that is within their stomach also moves with them.

And, when these herbivores go to another area and they defecate, then the seeds are able to germinate in those areas. What happens is that by using herbivores the trees ensure that the plants are coming up away from the shady areas, in those areas where they can actually grow into new plants, into new trees. So, the herbivores also have a role in the ecosystem.

Now, the question is: We need to maintain these herbivores in a quantity that is neither too high - because if it is too high then all the plants get eaten - nor it is too low - because if it is too low then also the forests are gone and when the forests are gone all the benefits that we get from the forest they are also gone. How do we maintain that? Well, we could do another thing.

We could keep a track of all the herbivores, their populations, which herbivores are where - keep a track of things and start to kill certain herbivores to maintain the numbers.

But, once we start to do that we will come into another problem because when a tiger eats up a deer, then it is eating that deer that is either diseased or it is too old because of which this deer is not able to run fast. But, when humans get into the field, once humans are permitted to get into the forest with guns to kill deers to keep the population in check, how will they know whether a deer is in the prime of the health or it is a diseased deer? In a number of cases what has been found is that whenever people were doing hunting, they were killing off the best animals - because the humans also have a desire to use things such as the hides of the animals.

So, if you permit humans to kill these herbivores to keep their population in check what will happen is that they will kill off those animals that are the best animals and in a short while you will observe that the herbivore population is now only having diseased animals. And, so, in the long run the herbivore population again will be gone which will again have negative consequences.

Now, at the same time when we use humans to keep these populations in check just think about how much amount of computations will need to be made. You will have to keep a record of each and every animal, find out which animal is healthy, which animal is not healthy and then track that animal and kill that animal, so that the population is kept in check. But, you are also killing off only those animals that are either diseased or weak, so that the herbivore population remains a healthy population.

Now, just think of how much amount of effort would be required! The other option is: just have a predator in the jungle - just have the tigers! Tigers will do everything for you. What can be better than that? When we talk about conservation, when we say that we are keeping things together, we are doing preservation - protection and restoration of natural environment and wildlife. This is not because we are very fond of tigers but this is because we need the tigers.

We need these forests, we need these wildlife because they serve purpose for ourselves. Whenever you find a new disease people will start to look for cures. Now, a large number of cures are found from different plants. You must have heard of the name of quinine. Quinine is a medicine that is used to treat malaria and quinine comes from the bark of the cinchona tree.

Now, of course, the cinchona tree is not infested with mosquitoes - the cinchona tree is not protecting itself. But, what is happening is that the cinchona tree produces the secondary metabolites to protect itself from the predators and the predators of the cinchona tree are things like insects or herbivores. When you have this quinine in the bark, then the quinine is very bitter in taste and so, the herbivores avoid it. The insects also avoid getting into this plant.

But when humans discovered that there is this chemical quinine, we extracted those chemicals and that was used as an antimalarial and once you have found this chemical you can always synthesise it in an industrial reactor. But, first of all you should know that there is such a chemical that can help you. Now, to have such chemicals it is important to have the cinchona trees. Now, whenever we get a new disease we will again start to look for the chemicals that can be used to treat this disease and where we will they get these chemicals from? From the plants! And where do we have these plants? We find them in the forest! Because when we talk about an agricultural field, then we are talking about a monoculture. People only grow paddy, people only grow wheat or there are maximum two or three crops that are grown, but when when you are looking for new chemicals you have to look for biodiversity. So, when we say that we are protecting a forest we are not protecting the forest because we love the forest. We are protecting the forest because we need the forest - because forests provide us with certain benefits.

And, when we talk about Economics, Economics is also concerned about providing benefits to people. When we say that we want an economic development, it means that you want to have more of more things. That is, we should have more electricity, we should have more vehicles, we

should have better houses - that is economic development.

But what is the premise of economic development? It is to provide comfort to people. And biodiversity is also doing the same thing! Because if you have good houses, you have good vehicles, you have sufficient electricity, but everybody is diseased - will you say that the society is a very happy society? Or when you have a medicine that treats these diseases and people are healthy? What do you prefer?

Obviously, people will prefer to have a healthy population and to have that healthy population we need clean air, we need clean water, we need biodiversity which will give us medicines, we need food, we need fibres, we need water, we need a lot number of things. And for that, we need to do conservation, that is the preservation, protection and restoration of the natural environment and wildlife.

Then what is Economics? The word Economics comes from these word roots - oikos means house and nemein is to manage. So, Economics is the study of how to manage a household and some of the best economists are the ones who are managing our households because in a household you need to make several decisions: What sort of food needs to be prepared, so that everybody is happy? You cannot have a just one thing throughout your life. So, every day you would need something different. Now, to we make that something different, you will require ,say, food grains, you will require salt, you will require oil.

Now, whenever we are having these things and we are making a food item - let us say that we are preparing dosa. Now, when we are preparing dosa we will require oil. So, the oil needs to be had in a quantity that we should always have oil available to make dosas, but we cannot also store a very large amount of oil otherwise it will get rancid. Things get spoiled if they are stored for a very long period of time. So, we need to make a number of decisions - what to buy, when to buy, in how much quantity to buy, what to produce in on different days and how to decide for whom to produce. Do you want to produce the food taking into account the children in the house or taking into account the adults in the house or taking into account the old people in the house - because they will have different requirements.

They will be happy with different things. The children might like to eat sweet items more, but the adults might want to go for more healthy food items. They want to have salads more. Now, the thing is you need to make these decisions: what to produce, for whom to produce, when to produce, how much to produce and these are the same decisions that we need to make even at the level of the society.

Economics is derived from the word roots house and manage. It is the science of managing the household or the science of managing the society, the study of how society manages its scarce resources. So, as a society as well we have these questions: what to produce, for whom to

produce, how much to produce, when to produce, and we take the same insights from the management of household to the management of the society because the principles remain the same. So, this is Economics.

Economics is a science of making decisions and these decisions are necessary because there is a scarcity of resources. Now, how are conservation and Economics related to each other? In conservation we are saying that we need to keep things together - we need to protect the natural environment. And in the case of Economics we are saying how does the society manage its scarce resources. How are they connected to each other?

Well, there is a very great intricate relationship between both of these because certain economic decisions have ruined the environment - things like pollution due to industrial revolution. Now, when we talk about what to produce in a household - what food items to produce, we are making this decision to ensure that everybody gets a sufficient nutritious food and everybody gets the food of their liking which means that we want to make everybody happy. In Economics terms, we say that we need to maximise the happiness - or the surplus.

When we are trying to do that it is possible that in the short run we make certain decisions that are not the most optimum decisions. So, for instance, a factory is being set up in your neighbourhood and you think that ok this factory is going to provide us with jobs. But once this factory has been set up you find out that it gives out so much amount of noise and so much amount of fumes and smoke and noxious gases that it is now difficult for you to even breathe in the area. Now, when this factory was being built you were in support of this factory, but once it has started its operations you think that oh we were much better before this factory was built in this area, at least we had clean air to breathe, at least we were not having this noise.

Now, the thing is that factory in itself is not a bad thing, but when we talk about implementation of things we need to know why the factory owners chose not to install noise controlling devices or not to install the smoke controlling devices. These are because of things that are known as externalities. We will have a lecture devoted to externalities which helps us understand why people make these decisions that harm everybody.

In short what is happening is that the factory owner thinks that ok, if I install this device there is a cost that is involved, but if I do not install this device then I am saving money. The consequences are being faced or are being suffered by people in the society but, I am not suffering the consequences because I live far away and there the air is good. We will observe that a large number of countries these days are taking this choice to move their polluting industries to certain other countries.

So, in that case they are saying ok let us have the profits, but we should not have this pollution in our country because we want clean air. Now, Economics also gives us options to ensure that

people install these devices and we will look at things like the Coase theorem that can help us ensure that these pollution controlling devices get installed.

But what happens is that certain economic decisions - especially bad economic decisions - ruin the environment and so, the environment needs to be protected. In the case of conservation we were talking about the protection of the natural environment. If the natural environment is getting degraded because of certain economic decisions then conservation is required. So, both of these fields are related in this way.

Another thing is some economic decisions have led to a total collapse of the ecosystems - extinction of species such as over harvesting of whales or extinction of dodo. Now, dodo was a bird that was extensively hunted for meat. It was a flightless bird. It could not fly away to protect itself with the consequence that people hunted it to such an extent that now not a single dodo remains on this planet.

This is not just the story of dodo. We are doing this every day to a large number of species in the name of economic development. In one of the lectures we shall explore what is the level of this loss that is happening. Now, remember that these species are required for the well functioning of the natural ecosystems. The dodo also had a certain role, it was required for the germination of certain species of trees and with the dodo gone those trees are also gone. There are a large number of inter linkages.

Now, probably, when we talk about a new disease there was certain chemical in that tree that could have been useful in treating the disease, but once that tree is gone you do not have any access to that chemical. So, certain economic decisions have led to a total collapse of ecosystems and for that we again need to go back to conservation. How do we bring the things back?

So, some economic decisions have led to a situation that is calling for conservation. At the same time conservation requires funding and resources. When we talk about Economics we are asking the question: how does the economy or how does the society manage its scarce resources? We have money, but we have also different things that require money. We can use the money to construct a school, we can use the money to construct a hospital or we can use the money to conserve the forest. How do we ensure that there is some amount of money that is made available for the conservation of forests? For the conservation of biodiversity?

Remember here again that we are not trying to conserve biodiversity because we love the forest - because man is a selfish being and we want to conserve the forest only because it provides us with certain benefits that we cannot have otherwise. But, these resources can come only when they are allotted for in the present and the future economic decisions.

And, so, if the conservationists and if the economists are not on talking terms then we will have a

situation where both will be at logger heads - whereas actually, both are working for the same goal - both are working to maximise the surplus of the society. The only difference is that a person who does not know about conservation will have only a limited set of choices.

A person who does not know the benefits of forest would say that ok we can construct a dam but, he would not know that we could have done the same thing for a much cheaper cost. Another example is that when we talk about tidal surges or when we talk about tsunamis then these days it is a fashion that we should construct a wall along our shores and these walls will protect against the against the sea water that is rushing in during the tsunami. Well, good enough, but then if you have mangrove forest in place of the wall you will also have the same benefit and mangrove forest will also protect your biodiversity. They will also clean up the water; they will also clean up the air. Your wall is not going to do that. So, you are getting more benefits for a lesser cost, but then to make this decision the economist needs to know what are the benefits of conservation and so, here is a relationship between Economics and conservation.

Economic decisions have the power to promote conservation - when we talk about renewable energy, when we talk about green technology, etc. Why are we shifting towards renewable energy? Well, we are shifting towards renewable energy because there is a shortage of petroleum. The price of petroleum increases and when that happens the cost of energy also increases. At the same time whenever we are talking about the use of petroleum or coal to generate electricity, it generates huge amounts of pollution. When we talk about renewable energy we can have the same energy there is no difference between the electricity that is generated by renewable sources such as solar energy or wind energy and the electricity that is generated out of a thermal power plant - the electricity is the same!

But we can have that electricity for a cheaper cost and with less amount of pollution and a number of economic decisions have been promoting conservation. So, when the government says that we should shift from incandescent bulbs to LED bulbs, the government is making this choice - or is promoting this choice - so that the amount of energy consumption reduces because we only have a limited capacity to produce electricity, but then once we do that we are also aiding conservation.

So, the thing is can we correlate both of these together so that we can have the best of both worlds? Conservation aids Economics, so that you are able to get the maximum utility at a cheaper cost and at the same time Economics aids conservation so that you are able to protect and preserve the environment. This is the relationship between conservation and Economics and this is what we are going to explore in this course.

This course will have several modules. The first one is: What is Economics. With these three lectures: Introduction, making decisions, interactions and the working of the economy. The second module will explore about conservation. Conservation in the anthropocene; anthropos is human beings and cene is a time period.

We call the current era as anthropocene because in today's era the impact of human beings on everything - on climate, on geology, on biodiversity - is much greater than any other factor. We say that that today is the man's age, but the thing is in this anthropocene - that is the age of human beings - what is the need for conservation? Do we need it or not? We will also explore human population growth and food requirements because our populations have been increasing with time and more people means that we require more resources. And, remember that Economics is the science of making decisions - about how to use the scarce resources for maximum benefit.

Now, if the number of people goes up the per capita availability of resources goes down. What can we do to ensure that the people still have access to resources? How does population grow? How do we provide it with food and other requirements? And, when we are meeting these requirements are we meeting that sustainably or unsustainably? This comes to sustainable and unsustainable development. The difference is that if you have a resource you can use it to get benefits for a very long period of time or you can use it to get benefit for a short period of time. You would have heard of the story of the hen or the goose that was laying golden eggs. Now, the farmer that was having this goose that was laying golden eggs was getting one egg every day and it was a golden egg. The farmer could have had these eggs for a very long period of time, say, for many months or say, many years. When we talk about having those eggs for a very long period of time we are talking about sustainable use. But, what the farmer did was that the farmer got very greedy and said that ok, there are eggs inside this hen or this goose so let us kill this goose and take out all the eggs. Once that was done the goose is dead and so, now, there are no more golden eggs. That is unsustainable development.

When we talk about sustainability we are asking the question that ok there is this lake; this lake has fishes. How many fishes do I take out every day, so that the fish population is also able to maintain itself and I am able to get this many number of fishes for a very long period of time?

Sustainable development is development that lasts not just for a short period of time, but for a very long period of time typically for many generations. So, we are using resources in such a manner that we are able to meet our present needs while also ensuring that our future generations are also in a position to meet their needs. We do not over exploit the resources so that nothing is left for our children and our grandchildren - that is sustainable development.

In the third module, we will talk about the modern impacts that necessitate conservation. We will talk about things like climate change, plastics, oil spills and mining. These are certain impacts because of which conservation has become an urgency. We are generating so much amount of plastics that a large quantity is being dumped into the environment and it is leading to negative consequences. We are dumping so much amount of carbon dioxide that there is a huge amount of global warming. We are observing changes in the climate today, we are observing the sea levels rise right before our eyes and if we do not do anything to solve this problem, then probably it

will be too late. So, these are the certain impacts of human beings that are now necessitating conservation as an urgency.

In module 4, we will look at threats to wildlife. We will look at push and pull factors. If you talk about any organism it has certain requirements - requirements of food, requirements of an amiable climate, the maximum-minimum temperatures, requirements of water, requirements of space. Those areas that provide these requirements give a pull factor to these organisms - that is, the organisms can live in those areas. The areas that do not provide these necessities of life give a push factor to the organisms - that is, the organisms will no longer live in this area.

Now, if you have a situation in which the organism is finding that everywhere it is getting pushed and there is nowhere to live, then the species will move towards extinction. So, push and pull factors are those factors that help us understand the threats to species and understanding these threats is important when we want to conserve these species.

And here we will also talk about ecotoxicology and developmental hazards: what are the hazards of development, what are the kinds of toxins that we are releasing in the name of development, what are the negative impacts of those toxins, and what kinds of influences do they have on the working of the ecosystems. That is ecotoxicology.

In the fifth module we will ask the question: "Can Economics help and how (can Economics help)." Because a large number of these decisions are occurring because of bad economic decisions we need to understand how economic decisions are made in the first place because once you understand Economics only then will you be able to use Economics to conserve the wildlife, to conserve the natural resources. In this module we will look at the need to understand controls. We need to understand how both of these are related and we will learn about thinking as an economist - what is the thought process that goes on in an economist's mind?

We will further look at interdependence and gains from trade. In a large number of cases these economic decisions are being made to maximise profits and these profits are coming from trade. So, trade is an essential thing that we need to understand the working of the economy. This trade happens in the markets - markets are places where Economics works.

We will explore markets in the 6th module. We will look at what is demand, what is supply, what is elasticity and how can government policies influence the market outcomes.

Suppose the market says that no, we need these materials in such a large quantity that even unsustainable development is what we will go for. Then government has the responsibility and government has the power to ensure that these market outcomes are modulated, they are tempered down so that we also ensure that everybody is able to get their due share.

What we are asking is if there is a certain group of people who says that no we are going to go for gas guzzling vehicles; we want the largest size SUVs even if we have to travel alone - in that case the pollution that gets released will cause an impact on all the people not just the person who is driving the SUV. Can the government do something to desist people from using these SUVs or desist people from using those vehicles that are not fuel efficient? This brings us to the role of government policy.

In the 7th module we will look at markets, welfare and conservation. Markets are important because they enhance the welfare of the society; they enhance the surplus of the society. We will understand what is surplus, how the surplus is measured and why do we want to go for economic development at all. And, we will look at market efficiency, cost of taxation and international trade in this context.

In module 8, we will look at public sector and conservation. In this case we will talk about things like externalities. Externalities are the impacts of one person's actions on the welfare of the bystanders. Remember that we are going for economic development to increase welfare, to increase surplus, but if there are certain actions that reduce the welfare, then those actions are known as externalities.

E.g., if one person is playing a very loud music and he is enjoying the party, but the people in the surrounding are not able to sleep, then that is an externality. How can we solve this problem of externalities? How can we come up with a solution that the person is able to hear music, but others are also not disturbed? We will look at public goods and common resources that mostly the government supplies for and the design of the tax system which pays for the public sector and conservation.

In the 9th module, we shall look at industrial organisation and conservation. A large number of bad economic decisions are to maximise the profit; they are because of cost cutting measures. Now, why do industries go for cost cutting? To understand that we need to understand how these industries make this decision of how much to produce and at what price to produce. So, in the 9th module we will look at the cost of production.

Competition and monopoly: You can have a competitive market or you can have a monopolistic market where there is only one seller. We need to understand how a seller in a competitive market makes decisions and how a seller in a monopolist market makes decisions because these are the decisions that have a ramification for conservation.

In the 10th module we will look at Labour Market Economics and conservation. In this case we will ask what are the markets for the factors of production that is what is the market for labour. The people who do work are also working in a certain market. They are providing their labour; they sell a sellable product and they are getting wages in return. That is the price that they are

getting.

What determines how much will be the wages? What determines how many people get employed? This is important because in a number of cases we have observed that when people are very poor, when their productivity is very less; then to feed the people they will want to extend their fields into the forest. They will want to cut down forests to expand their agricultural fields. This is because their productivity is less.

So, if we want to do conservation we would want to ensure that people are not poor: Everybody gets sufficient resources, so that they do not have to put a very great amount of pressure on the environment. This is what we will explore in module 10 - markets for factors of production, earnings and discrimination, and income inequality and poverty.

From modules 1 to 10 we will be working on several theoretical aspects that is we will make certain assumptions: that people are rational beings, that people want to maximise their surplus or their benefit. But in a number of cases these assumptions do not hold true because if you go to the market it is not that at all times you are trying to think that what will give me the maximum benefit.

It is also possible that your parents said that you should go and buy this particular brand of soap and you go and buy that particular brand of soap without giving a thought whether there are other soap brands that are probably better or cheaper. Now, when we have this sort of a situation, we are talking about the things like Behavioural Economics, the role of Psychology in Economics.

In the 11th module we will look at such practical issues as consumer choice. If there is an option to have two vehicles and one vehicle is say very fuel efficient - it does not give out lot of pollution, but it is a bit expensive and there is another vehicle that is a gas guzzler, but it is cheaper. How does a consumer decide which vehicle to buy? What are the psychological insights in that? When there are two parties and they do not have sufficient information how do they process? How do they make decisions when there is a shortage of information; there is a shortage of processing power? Because, remember that we had started by saying that Economics is the science of making decisions about how the society manages its scarce resources. When we are making decision and we do not have the processing power to make those decisions, how do we make decisions? We will also look at evaluation of natural resources.

The 12th module is case studies. We will look at the Economics of predicted areas and the Economics of environmental disasters followed by a summing up and discussion.

We will now touch upon how the society makes decision.

We have explored that there are certain basic questions of Economics: what to produce, how to produce, how much to produce, for whom to produce, when to produce and so on. Now, Economics helps us answer these questions and in this course we shall explore how these questions are answered, but the question is why do we have these questions in the first place.

We have these questions because the wants are unlimited, but the resources are limited. So, we want to have the best food, we want to have the best clothes, we want to have the best houses, the best vehicles, but our resource - in fact money - is limited. So, you have to make a choice. Do I want to have the best house and go with a not that good car or do I want to have the best car and live in probably a not so good house?

So, wants are unlimited, but resources are limited - which leads to a conflict. You need to make a choice because there is scarcity; there is a limitation on the society's resources both at an individual scale and at the scale of the society, which is why we need Economics to help us understand or study how the society manages its scarce resources - how you make this choice.

When we talk about scarcity, we have a trade off at all points of time. Whether you are thinking about it or not you are doing a trade off at all points of your living life. For example, now you are watching this video - you could have spent this time not watching this video and you could have spent it, say, watching a movie. Or you could have gone out with your friends, or probably you could have read a book, or probably you could have been working somewhere.

Now when you are watching this video you have given up all of those. So, there is this trade off - you are giving up something to get something and such a trade off is always there at the individual level. And it is also there at the society level. We have this classic thing that is known as guns versus butter debate. Should a society spend its resources on national security that is guns - or on consumer goods that is butter.

Why? Because if we talk about two things - you have factories that can produce aircraft and you can use this factory to produce fighter aircraft or you can use it to produce commercial aircraft. Fighter aircraft is your guns and the commercial aircraft is your butter or a commercial good. If the factory is being used to produce only the fighter aircraft that is this point, at this point the number of commercial aircraft that we have is 0. On the other hand, if the factory is producing only commercial aircrafts then the number of fighter aircrafts is 0 or the society could decide some other point so the society might say that we will have these many commercial aircrafts at this line and we will have these many fighter aircrafts.

Or the society could choose a point like this or else or the society could choose a point like this which is probably outside of the capacity of our industry. So, things such as these questions - whether to go for the fighter aircraft or the commercial aircraft - lead us to things known as production possibility frontiers. This line is the production possibility frontier.

It is giving us the option that if we were to use our factory to the fullest extent, we could choose any point on this line. If we choose a point like this, at this point we are making less number of commercial aircrafts and less number of fighter aircrafts than is possible. If we choose this point then we will have more commercial aircrafts and more fighter aircrafts as compared to this point, but if you choose a point outside then this is outside of our ability, we cannot have this point. So, this is the production possibility frontier.

When we talk about the trade-offs we have the trade-off between guns and butter, we have the trade-off between efficiency and equality. Efficiency is the property of society getting the most it can from its scarce resources. Equality is the property of distributing economic prosperity uniformly among the members of the society. When we talk about this debate, we are asking the question that there is an industry and in this industry we are making, say, biscuits. Now, these biscuits can be made using either machines or they can be made using labour. If you use machines, then probably the efficiency will be very large - the factory will be churning out a huge quantity of biscuits. This is efficiency. But in that case only the factory owner will be earning all the profits because there is no other person to share the profit with. This will create an unequal society. On the other hand, we could say that only labour intensive factories can be permitted. In that case we will have only labour because of which we will be having less number of biscuits that are produced. The efficiency goes down, but now the profit is shared by so many people and the equality is high. Economics helps us choose whether we want to go with more efficiency or more equality. And we have things like taxation and subsidies that promote equality at the cost of efficiency; there is always this trade off.

When you have trade-offs you also have cost. Cost is something that you give up to get something. When you are watching this lecture you are not able to watch a movie. So, the movie is the opportunity cost of watching this lecture. Because we have a trade-off we have a cost. And when we have costs then these costs can be explicit or implicit. Explicit cost is something that requires an outlay of money that is if you say that you want to buy a box of pencils or a bar of butter what is the money that you will have to spend. Implicit cost is a cost that does not require an outlay of money. That is, what you could have earned in a part time job, if you were not listening to this lecture. So, we have different costs.

When we talk about Economics we assume that people are rational and rational people are those people who systematically and purposefully do the best they can to achieve their objectives. That is, when we say that a person is rational then this person is trying to get all the information that he or she can, trying to process it in such a manner that they maximise their welfare and reduce their cost.

When we say that a firm is doing profit maximisation, we will say that the firm is a rational firm. In this context when you talk about rational thinking - a large quantum of it occurs at the margin.

Margin means what is the incremental change - a small incremental adjustment to a plan of action - that is margin. Marginal change is a small incremental change and a good example is, if you think about yourself, how do you think? Should I study 8 hours for the exam or not study at all? Do you think like this? Because everybody knows that if you do not study for the exam at all, you will probably fail. So, nobody thinks like this. But we normally think like this that should I watch my favourite TV show for 30 minutes and study 7 and a half hours for the exam. In place of 8 hours now we are thinking not about 0 hours, but we are thinking about 7.5 hours because whether I study for 7.5 hours or 8 hours will not make that much of a difference.

When we are thinking like this we are doing a rational thinking at the margin and a lot of rational thinking actually occurs at the margin. For example, if you talk about an airline and suppose the cost of flying a 200 passenger jet is 10 lakhs of rupees. The average cost of flying per passenger is 10 lakhs divided by 200, is 5000 rupees. Now, suppose the plane is about to take off and there are 5 seats that are remaining and there is a passenger who is willing to pay only 3000 rupees for that seat. Should the airline sell the seat for 3000 rupees or not?

If we think about an average thinking then we will say that no we are selling the tickets for an average of 5000 rupees and this person is paying 3000 so, we should not sell it. But, what happens actually is that airlines - if they are rational thinkers - they start to think at the margin. What is this marginal thinking? The airlines would think that ok what is the marginal cost of putting this extra passenger, because in any case the aircraft is about to take off.

Now there are two choices. We have choice 1 that is take off without this passenger and in this case the earning is rupees 0 because in any case the flight is going to take off. The choice 2 is to get rupees 3000 from this passenger and allot a seat.

Now, once you have this extra passenger on the aircraft, then it will also incur certain costs because there will be an increase in the weight. Now, one person on an average is like 60 - 70 kgs. So, what is the additional amount of fuel that will be required for this particular passenger? Let us say the additional amount of fuel that is required is 500 rupees because in any case you have this aircraft that is weighing several tons and this aircraft is going to take off. If you add 60 - 70 kgs extra then the change in the extra fuel will be very less say 500 rupees. When this passenger is there in the aircraft you will probably serve him with a bag of peanuts or certain snacks. What is the cost of that snack? Suppose the cost of this snack is 100. In this case the aircraft will be earning 3000 rupees. So, this is the revenue and the cost is rupees 500 plus rupees 100 is rupees 600.

In this case what is happening is that the marginal profit - should the aircraft permit this extra passenger - is 3000 minus 600 rupees is 2400 rupees. If the passenger is not permitted the aircraft the airline will not earn this profit, but with the extra passenger the airline will earn this extra profit. And, even though this is less than the average cost of selling the ticket, the airline will

probably permit this passenger because permitting this passenger is giving the airline an extra 2400 rupees.

What is wrong with that?

Now, this is marginal thinking that while on average the person is paying less than what the airlines charge, but marginally the airline is at a profit. And, so, taking a rational decision the aircraft should fly with this passenger.

To sum up when we talk about making decisions there are three important principles: one - people and society face trade-offs because there is a shortage of resources. Our wants are unlimited and so, there is a trade off. These trade-offs lead to cost and cost is what you give up to get something and what you are giving up could be in the form of money. Like you are giving up 50 rupees to buy a pen. That is the cost of this pen. Or probably you are giving out something else. Probably if you are not buying this pen you would have spent that 50 rupees on an ice cream. So, we can also say that the cost of this pen is the ice cream that you have to forgo.

So, cost is what you give up to get something and here you can also talk about the opportunity cost which is the next best alternative that you are giving up. When you say that you are giving up the ice cream that you wanted so much, then that is the opportunity cost of buying this pen.

We also saw that rational people think at the margin. Rational people are those people who take all the information, who process all the information to get to a point where they maximise their welfare. And, when they try to maximise their welfare they often think at the margin - that is small incremental changes. When the factory is thinking at the margin, the factory is asking the question should I produce one extra good? I have already produced 10000 cars. Should I make the 10,001th car?

When the buyer is making a rational choice thinking at the margin, he is asking ok I have had four chapati's should I eat the fifth chapati or not, and a lot of rational thinking happens at the margins. So, that is all for today.

Thank you for your attention. Jai Hind!