Energy Resources, Economics and Environment
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Lecture 11
Utility and Social Choice- Part 3

We have been looking at the issues related to utility, comparing utility and preferences across individuals and in general, the idea of going from utility for individuals to group choices or social choices. And we looked at different possibilities of having social welfare functions and we carry on with this to try and look at the question that is starting with the knowledge of individual preferences over a whole set of different outcomes.

Is there a general way of aggregating this into a social preference or an ideal way in which we can get a social preferences that is reasonable. And this is the problem that has exercised several economists and thinkers and one of the persons who did some pioneering work in this was Professor Kennett Arrow.

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And Professor Kenneth Arrow got the Nobel Prize in economics in 1972 and the noble citation basically says for his pioneering contribution to generally Economic Equilibrium Theory and Welfare Theory and the paper, one of the papers that enabled him to get this prize was the paper that he had written in 1950 called A Difficulty in the Concept of Social Welfare and so the theorem that he proposed is called Arrows impossibility theorem.

And it is a very powerful result that he showed and basically what he started off is he started off with a set of axioms if you want to make a choice, and if you want to look at individuals, their choices and can these be used to have us way in which we can have an ideal social choice and the interesting thing that he has showed and he proved was that it is impossible to have a social choice which meets all the requirements of an ideal choice mechanism.

Unless you want to individually compare utilities, utilities between different individuals if they are to be compared and quantified. If you just want to do it in terms of ordering, then it is not possible to have a social choice mechanism, which is ideal and this is extremely powerful result and for those who are interested you can go into the original paper and read it, we will just talk about a few points which come from it.

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So, his conclusion was that interpersonal comparison of utilities has no meaning and that there is no meaning relevant to welfare comparisons in the measurability of individual utility.

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So, basically he said that if you have a social choice mechanism, that mechanism and ideal social choice mechanism should have the following characteristics and the six characteristics. Completeness, unanimity, non-dictatorship, transitivity independence of irrelevant alternatives and universality and so if you look at what these mean.

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In the case of completeness, it means that all social alternatives can be compared and that essentially means that all the alternatives, when we are looking at, all possibilities can be compared. So, all the entire set of choices is possible unanimity means that if everyone prefers a particular option, if all the individuals prefer A to B, society will prefer A to B and this is sort of an obvious statement.

Non-dictatorship means that it should not happen that one individual controls all social decisions. So, that means no one should always get their way. And transitivity we talked about this when we talked about preference, if A is preferred to B and B is preferred to C implies that A it would be preferred to C.

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The fourth option that is there, fourth axiom is that the, there should be independence of irrelevant alternatives. That means society's choice between A and B does not depend on the introduction of a third option and so it did does not depend on other alternatives. Now, we can see very clearly that this need not always be true, you see this in the form of elections, if there is an election between two candidates, and a third candidate comes in, then there is choice between those two candidates often gets spoiled and it affects it so, in reality, this does not happen.

To give you another example of this, let us say that three professionals, early working professionals, they are sharing an accommodation.

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So if you had this, you had in the Inder, Ram and Ashish all three of them say in a flat and its been decided that we want to paint the flat. So, we have these preferences Inder has a preference where he prefers painting black to white and yellow these are the three choices we are looking at black, white, yellow.

In the case of Ram white is preferred to black prefer to yellow, Ashish prefers black to white to yellow. So, in this particular case if you see it will be appropriate to paint both two of them have black as the best preference and Ram has preference of black over yellow, so from all these points it would be appropriate to paint the room black. Now suppose we have a different choice where Rams choice is now replaced and Rams choice now is white preferred to yellow preferred to black.

Now, if you look at it, what happens is two have a preference now, there are 2 blacks and there are you know there are 2 whites, 2 blacks the decision gets quantified, change, but it could be, we can look at black or white but if here now you have the option, you have a statement which says that Ram essentially hates black. So, there is an intensity of a preference where Ram does not want it to be black, in which case the choice which we get is we will go for white.

But the fact that Ram has such an intensity of dislike for black is affecting the decision between black and white for all of black, white and yellow for the choice. So, this is often

what happens is that you would have these kind of issues which are there in reality and universality means that any possible individual ranking of alternatives is possible, that means that whatever choice mechanism you should have. Supposed to have n set of people, each one can have a whole set of different preferences.

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And so, Arrows impossibility theorem states that there is no rule satisfying the 6 axioms for converting individual preferences into a social preference ordering and this has been shown with some examples and proof by Arrow in his pioneering work. So, this implies that there is no need theory of social decision making.

And this has of course, very severe implications in terms of that means that there will always be tradeoffs, there will be winners and losers and it is not possible to have in general, it has been shown that it is not possible to have a social choice mechanism where individuals have different preferences and it comes out into a neat preference where everyone gets an improvement.

And this has been in future work, this has been relaxed with the idea that if you can measure and compare utilities and then quantify under certain conditions, you can show that you can have this kind of a social decision making, but the implication of this is that in general, whenever we talk about society making decisions, there will be winners and losers, and there will be tradeoffs involved.

And so, we will now move forward with this and try to see when we talk about the Pareto optimality and we look at the markets, how do we try and get the optimal kinds of solutions.

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So, in general when we talk about we, this is from Kolstad, if you had two different goods, we could have, we had talked about this earlier where we have a, we can see that you have these indifference curves, which represents constant utility function and this is increasing and then depending on the budget constraint between the two goods, we have

the marginal rate of substitution between these two goods, this is for a particular individual.

Similarly, for other individuals there would be marginal rates of substitution. So, there is this theory and within this course, we will not go into this theory, but you can go into this if you are interested, you can look at the whole concept of the Edgeworth Box and the idea is that if you look at two individuals who have different utility functions, and based on the utility functions, they will have different marginal rates of substitution between the two goods.

We could then the two individuals with their utility functions, we can see if individual A will exchange with individual B so that overall the utilities get improved. And this is where we can remove the inefficiencies in exchange.

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And with the result that we can then go to something which is called between A and B, we can get a set of preferred options and in based on the kind of resources which are there, this is the preference region, this curve represents the limit in terms of, these are all Pareto dominance points.

Any of these points is Pareto preferred over any other point which is on the interior and movement between these points would the utilities would get modified but basically we cannot have any improvement, if you are on any of these points, it is not possible to have any Pareto preferred move where the utility of A or B one of the utilities gets reduced. So, it is not possible to have any Pareto improvement when you are on this curve and this is these are all Pareto dominant, this frontier is called the Pareto frontier.

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And the Pareto frontier is defined as all allocations for which there are no allocations that are Pareto preferred. And so an allocation is supposed to be efficient if it lies on the Pareto frontier. And so that is the definition of efficiency. That means, that no movement is possible with any Pareto preference and which means that either we showed this for two individuals, but this can be generally extended for n individuals.

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And with this result that we can look at, these are under two sources of economic inefficiency, inefficiency in exchange and inefficiency in production, we can analyze it using the Pareto frontier example, we can look at creating the Pareto frontier and looking at the fact that the marginal rate of substitution would be equal and would be equal to the prices.

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So, if there are two individuals, the marginal utility, the marginal rate of substitution of A with respect to marginal rate of substitution of B this would be equal, if there is efficiency in trade, so, that there is no incentive for trade and this would also be equal to the ratio of the prices. So, this is in terms of efficiency of trade.

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In a similar fashion we can look at the efficiency in production, if there are different sources of production for instance, if we look at a tray, the production of garbage disposal and wine if you look at this and you have different kinds of production possibilities, we can find the marginal rate of transformation, in terms of machinery or equipment.

So, that you reduce, you have more garbage disposal or you have manufacture more wine and you can see that these marginal rates of substitution would be equal so that you can reduce the efficiency, inefficiency in production can be minimized.

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And so, that the marginal rate of transformation between in this case bad or good or if can talk about garbage disposal, which becomes a good and, and so on.

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So, in general what we are looking at is, we are looking at a marginal rate of transformation between pollution and the good should be the same for all producers. If this is not true, then we can actually get an improvement by producing more of good A as compared to good B.

So, similarly, in the case of pollution where we are looking at pollution as a bad or pollution control as a good marginal rate of pollution control should be the same for all firms. That means, the per unit cost of pollution control would be equalized across different firms. There are different ways in which we can represent goods and bads and for instance, if you talk about garbage, garbage is created in the household level, garbage is created in the in terms of pollutants at the industry level or at the commercial level and that is something that has no value for us, it is a bad.

Garbage on the other hand can be shown as so, you can look at a bad and the good and we can represent it in terms of supply and demand or we can convert the bad into a good by talking about the removal of pollution. So pollution control or garbage disposal.

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So there are two ways in which we can draw supply demand curves. And this is shown in Kolstad you can see quantity of garbage consumed and the price of garbage if you look at, the price would be negative because the negative price of garbage consumed, but if you convert this in terms of in our normal way in which we analyze supply and demand for a good, we would like to have a positive price, then we can talk about garbage disposal.

And this will be having the same kind of mechanism that we talk of in terms of demand and supply and so this is another way of representing. So, we can either represent it as a bad or we can represent it as a good by converting it into garbage disposal, pollution control and depending on the way in which you find it convenient you can do either of these two representations, the sign of the price will change, but in all other aspects analysis will remain the same.

So, now let us look at when we talk about the market and market trying to get the reduce the inefficiency, minimize and not have any inefficiency in trade or inefficiency in production, we can look at the market and the equilibrium that is formed from the market.

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So, there are certain assumptions that we have when we talk in terms of a market, the first assumption is that you have complete property rights. What do we mean by complete property rights? If we are looking at, we want to look at a pen, right. If this is my pen, I have purchased it and I own this pen and then I can which means that I have a property right over the pen.

Similarly, when we are looking at, let us say, a house or a product or you are buying something to eat, you have you have complete property rights over that. And when we look at something like a negative thing like garbage, if there are rules that prevent, if we are responsible for the garbage that we create and we cannot just litter it and dispose it anywhere.

If there are proper laws then there are complete property rights and that complete property rights is essential, implementation of that complete property rights is essential for us to have the ability to buy and sell the goods and to have the ability to try and find out what will be the demand under different kinds of conditions. So that is the first kind of assumption and that assumption is valid for most of the goods and services that we are considering.

The second assumption is atomistic participants, atomistic participants means that there are a large number of small participants. So, there are many different suppliers, there are many different consumers, why is this required? This is required, so, that no one individual has that much demand that he or she can affect the overall dynamics and the setting of the price and with the result that this is the, this can someones utility does not predominate and this is one of the assumptions which is there.

Similarly, there should be there cannot be multiple, there should be many suppliers, one supplier cannot have a monopoly and then you and affect the whole thing and this is one

of the things which is an approximation in many cases this is violated and that is why then there are problems with the market and then you need to have regulation.

Complete information, now, complete information means that every producer has information about the different kinds of conditions, about the conditions of the market, about the conditions of the demand. Similarly, every consumer knows what is the prices which are available in different markets, and this is often not there, there is asymmetry in information so that often the end user then this leads to middlemen.

People who get a benefit because they use this asymmetry in information to be able to get some kind of leverage and get some revenue and profit and the fourth thing is that we presume that there is no transaction costs, there is no cost for entry or exit, you want to start manufacturing something, you can just go ahead, you can if you want to make something and transfer it to the consumer again there are no transaction costs. In reality, ofcourse, there are transaction costs and this, ofcourse, creates some modification in this.

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So there are these two theorems of welfare economics and I will just state them we are not going to look at it in too much detail, but basically, we are looking at in a competitive economy, we are talking of a market equilibrium, and the market equilibrium results in a Pareto optimal solution.

There are no Pareto, it is on the Pareto frontier, there is no inefficiency in the trade or no inefficiency in production and so we get a Pareto optimal solution no further improvement is possible. Of course, this is the ideal case of market equilibrium when all these conditions are established in terms of the requirements for transparency in terms of complete information for non-atomistic participants.

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It is also the second theorem of welfare economics says in the competitive economic, any Pareto optimum can be achieved by market forces provided the resources of the economy are appropriately distributed before the market is allowed to operate. So, the market does not have anything to talk about the distribution and in case the distribution is unequal, then the solution which is there will result in being unjust and unfair.

However that solution may not result in any, it may be a Pareto optimal solution and it may be something which is from a market point of view it is efficient. And so, the economics, when you talk about efficiency is only looking at overall whether any improvements are possible through efficiency in trade or efficiency in the production transformations it depends on the pre-existing distribution.

So, the market often will tend to perpetuate and accentuate the status quo and just to give you an example of this, is an extreme example there is a memo, which was written by one of the economists in the World Bank, way back in the 1990s. It is very controversial memo, it was a memo written by Lawrence Summers and Lawrence Summers wrote, and he was the chief economics of the World Bank when he wrote this memo.

Subsequently Lawrence Summer also served with the US government and was also the President of the Harvard University. But just look at the memo and what it says and then we will come up with this is just to illustrate to you the fact that a market economy need not necessarily result in something that is ethical or that is correct or fair.

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So this is a memo, which was written in December of 1991, it is there on different websites and I am just going to read this out to you, talks about Dirty Industries and of course, when there was a big controversy about the memo, Lawrence Summers said that he was just, he mentioned, he did not mention it very seriously it was just to illustrate some of the facts which are there in the economic calculations.

He sort of backtracked but the fact is, this was a memo which he send to others in the World Bank. So, the memo says Dirty Industries just between you and me, should not the

World Bank be encouraging more migration of the dirty industries to the less developed countries. So, the idea is that instead of having the industries polluting the developed countries, they should actually be polluting the developing countries.

And then he goes ahead to talk about three reasons. The first reason is the measurements of the costs of health impairing pollution depends on so, if you look at health impairing pollution, we are saying how many days of labour loss, what are the kind of increased because of loss of work, increasing morbidity or loss of life increasing mortality. So it depends on the foregoing earnings from increased morbidity and mortality.

From this given point of view, a given amount of health impairing pollution should be done in the country with the lowest cost, which will be the country with the lowest wages, since it has lowest cost and lowest wages that would mean that the impact would in money terms would be much-much lower than it would be in a developed countries.

And I think the economic logic behind dumping a load of toxic waste in the lowest wage country is impeccable and we should face up to that. So you can, it is a shocking argument but it is an argument which is being made based on an economic terms. So this is the point one.

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The second point that he made is costs of pollution are likely to be nonlinear. So, that means in a country or a region which has very low pollution. The initial cost of or the initial cost of that pollution is likely to be very low. So the nonlinear, initial increments of pollution probably have very low cost and then he goes on to say, I have always thought that under populated countries in Africa, a vastly under polluted, their air quality is probably vastly inefficiently low compared to Los Angeles or Mexico City.

So the idea is that those who have less pollution are from an economic point of view under polluted so, you can just see what is the kind of argument which is being made only the lamentable fact so much pollution is generated by non-tradable industry. So what he is saying is that it is unfortunate that when you talk about industry, we cannot transport the pollution.

And so we look at transport, electrical generation, it is happening locally and the unit transport cost of solid waste are so high, prevent world welfare enhancing trade in air pollution and waste. So, what is being proposed from an economic viewpoint is that it would be, it is been proposed that we should trade and move the pollution from the urban, from the cities which are highly polluted and which have high wages and take them to regions where the cost of the damage is relatively low.

And you can see that very clearly from an ethical point of view, from a feminist point of view all these arguments are completely wrong. But from an economic point of view, this is and this is one of the biggest problems with economics and it continues to be, several people do realize this but you can actually see that someone actually makes arguments like this in an official document and a memo.

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The third point that he makes is, the demand for a clean environment for aesthetic and health reasons likely to have very high income elasticity concern over an agent, for instance, that causes one in a million change in odds of prostate cancer, obviously going to be much higher in a country where people survive to get prostate cancer than in a country where the under-five mortality is very high.

Much of the concern over so essentially what it says is, if in regions where there is higher income, higher quality of life and higher people survive for longer, their demand for clean environment would be much higher and they would be willing to pay much more so then, they are basically say, he is again arguing for trading goods that will be, the pollution will increase in developing countries, but it will increase their welfare.

So, the production is mobile consumption of the good quality air is non-tradable and so he anticipated that this would create a controversy and people would oppose it. And so the last sentence that he says that the problem with arguments against all of these proposals for more pollution in LDCs intrinsic rights to certain goods, moral reasons, social concerns, lack of adequate markets could be turned around and use more or less effectively against every bank proposal for liberalization.

And this is one of the problems which has been there with many of the multi-lateral agencies and their proponents. Often the economics when we talk in terms of equilibrium and market equilibrium, does not consider anything in terms of what is fair or what is moral. And it just looks at the efficiency from a Pareto frontier perspective. Please keep in mind this is not the final perspective, the perspective has to have an issue of values and ethics and morality.

And so this is just word of caution to say that whenever we do all of these calculations, we can calculate the costs and the economics but then we have to see overall what is fair and what is just and what is the right thing to do.