General Equilibrium Analysis

Week 14

M. Pelliccia

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In general, the prices of other goods will affect people's demand and supplies for a particular good

General Equilibrium Analysis

But, more generally, the prices of goods that people sell will affect the amount of income they have and thereby will affect their demands for other goods

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So far we have conducted a partial equilibrium analysis, now we want to conduct a general equilibrium analysis

Example

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Suppose the starting equilibrium prices are for corn \$2.15 per bushel and for soybean \$4.12 per bushel, while the relative equilibrium quantities are 8.44 billion bushels and 2.07 billion bushels respectively.

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Suppose a scare about the safety of American corn causes the corn export to fall by 10%.

Example

Table 10.1 Adjustment in the Corn and Soybean Markets

	Corn		Soybeans	
Step	*Price*	*Quantity*	*Price*	*Quantity*
Initial (0)	2.15	8.44	4.12	2.07
1	1.9171	8.227		
2			3.8325	2.0514
3	1.9057	8.2613		
4			3.818	2.0505
5	1.90508	8.26308		
6			3.81728	2.05043
.	.	.	.	.
.	.	.	.	.
.	.	.	.	.
Final	1.90505	8.26318	3.81724	2.05043

Example

	Drop in price	*Drop in quantity*
partial equilibrium	10.8%	2.5%
general equilibrium	11.4%	2.1%

General Equilibrium Analysis

General equilibrium analysis: how demand and supply conditions interact in all markets to determine the price of all goods.

Very complex problem! Some simplifications:

- only two goods
- only two consumers
- only exchange (no production)
- competitive markets

Exchange

- Two individuals: A and B.
- Two goods: 1 and 2.
- Each individual has an initial endowment in each of the two goods:
  - endowment of A is (e_1^A, e_2^A)
  - endowment of B is (e_1^B, e_2^B)
- Total quantity available of each of the two goods is $X_1 = e_1^A + e_1^B$ and $X_2 = e_2^A + e_2^B$.

Exchange

- Individuals have preferences over the two goods. It may well be that their endowment bundle does not maximise their utility $\Rightarrow$ they will trade units of the two goods so to reach the most preferred consumption bundle
  - consumption of A is (x_1^A, x_2^A)
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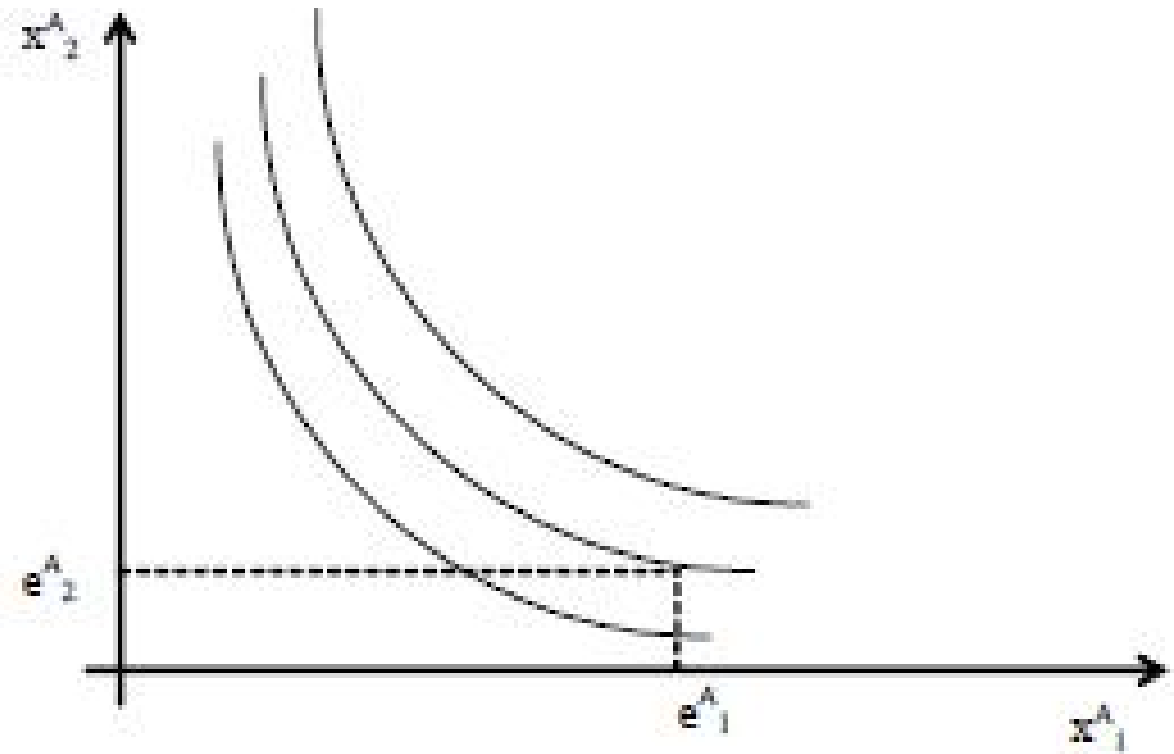
  - consumption of A is (x_1^A, x_2^A)
  - consumption of B is (x_1^B, x_2^B)
- A consumption allocation is feasible if
  - $x_1^A + x_1^B = X_1 = e_1^A + e_1^B$
  - $x_2^A + x_2^B = X_2 = e_2^A + e_2^B$

Exchange

- Exchange from initial endowment to final allocation

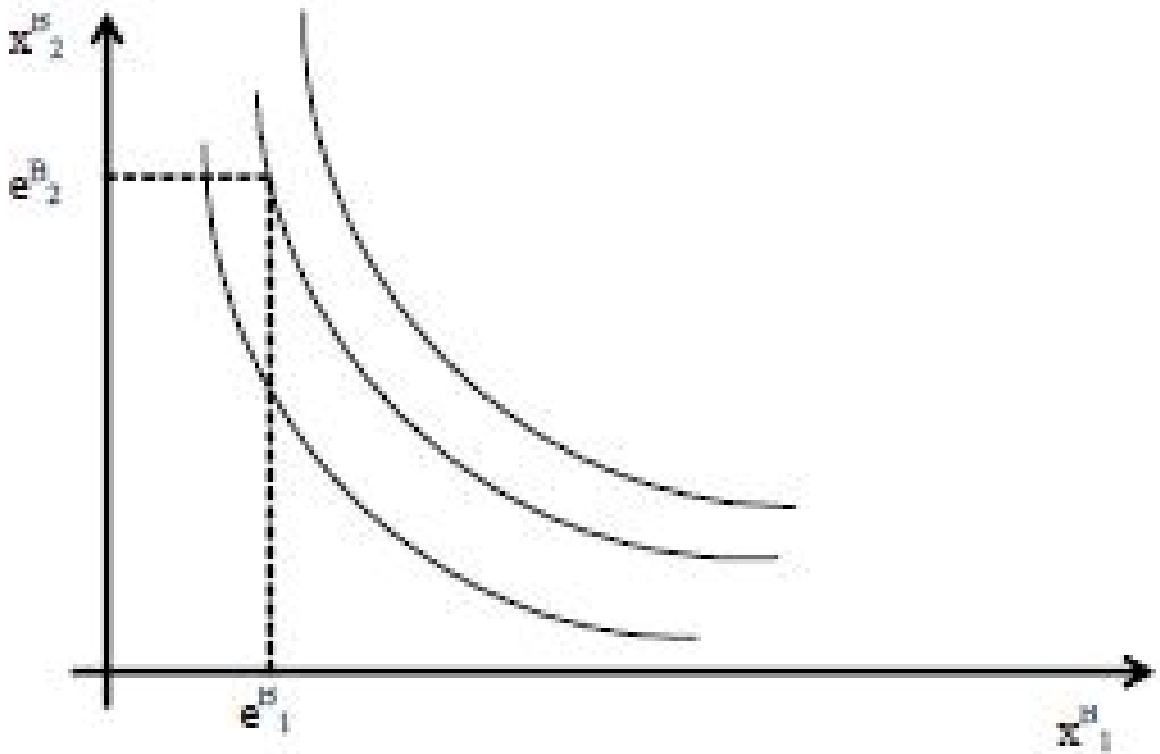
Edgeworth Box

Imagine that A is relatively well endowed with good 1, but has only a small quantity of good 2.



Edgeworth Box

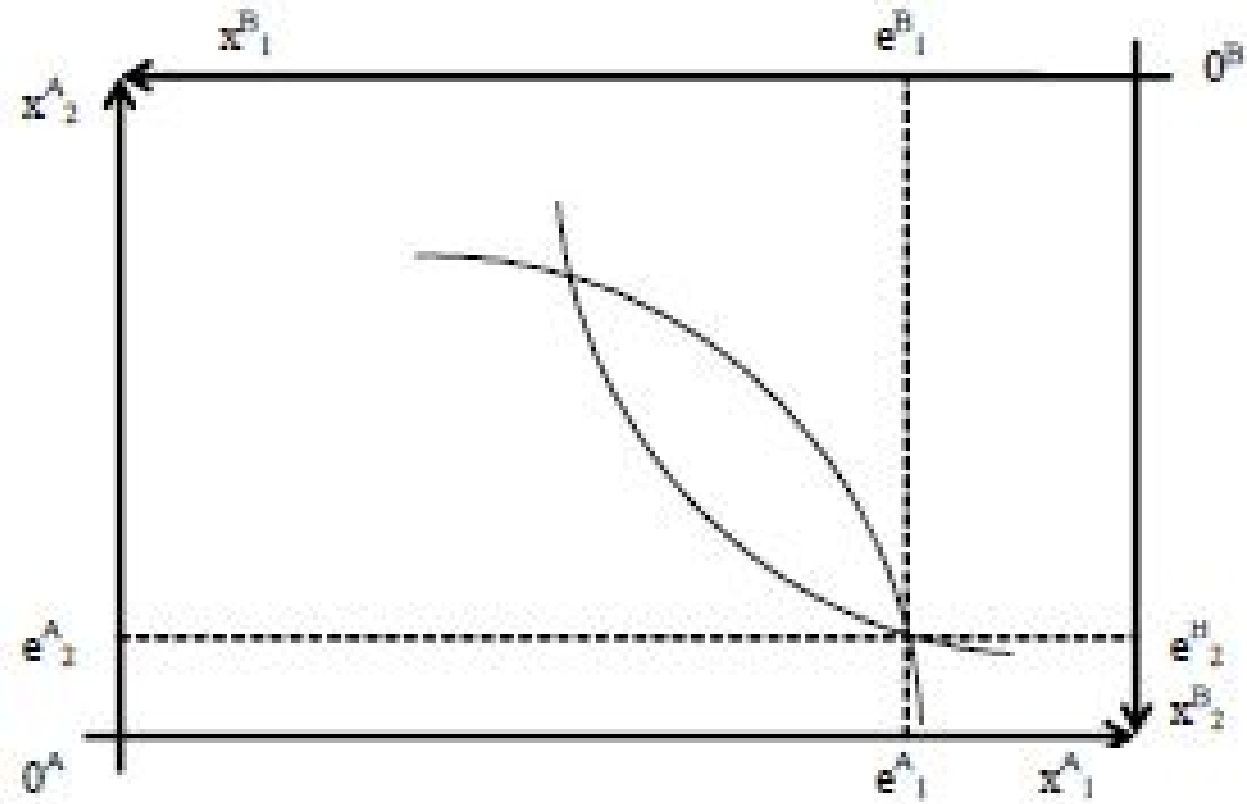
Vice versa B is well endowed with good 2, but only has a small quantity of good 1.



Edgeworth Box

To see how the two individuals will trade, we need to put the two diagrams together ....

Edgeworth Box



Edgeworth Box

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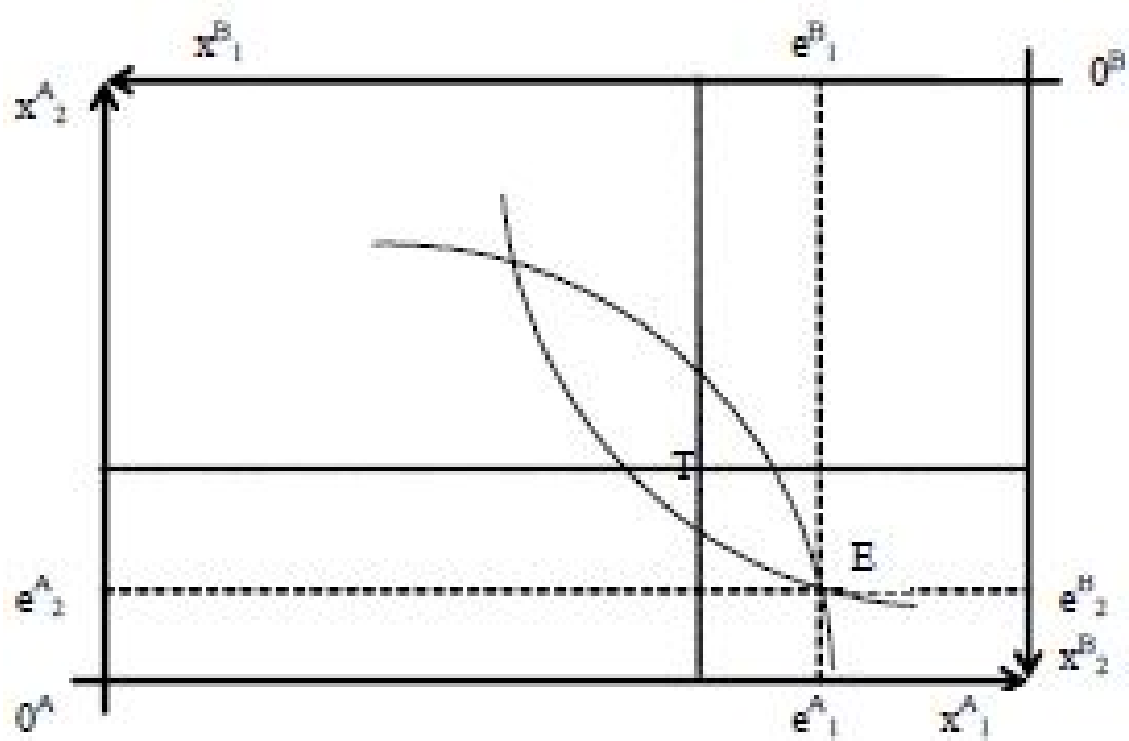
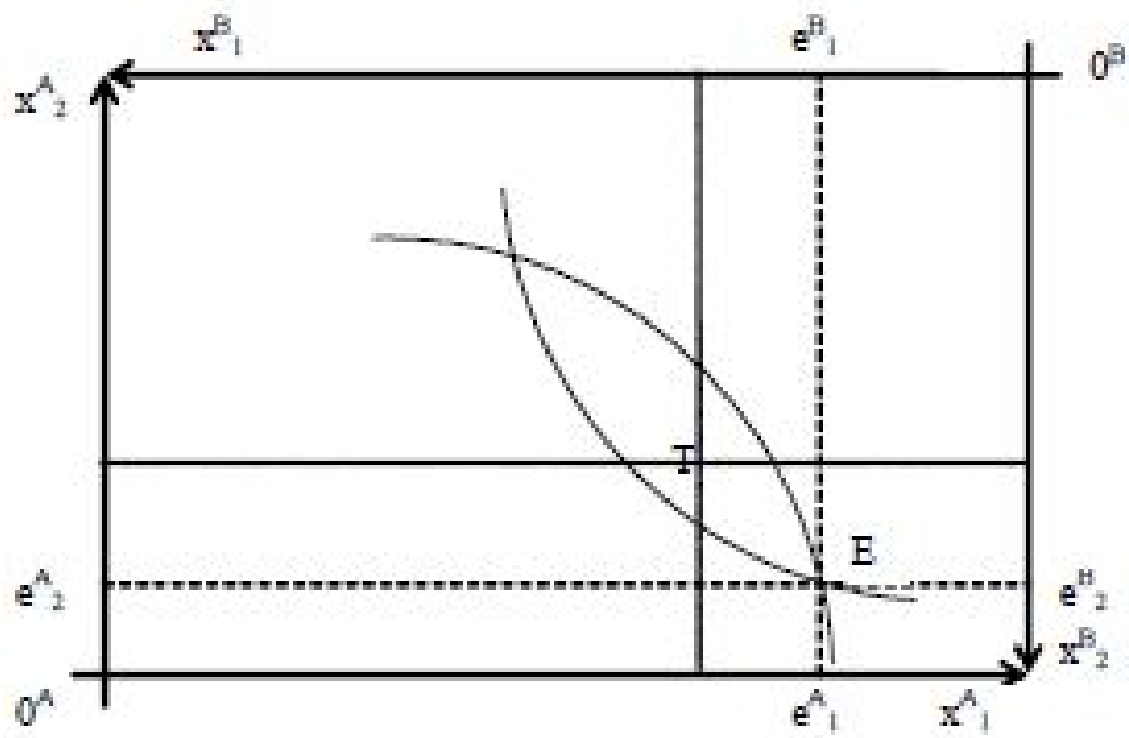
Why? Because the consumption allocations inside that area are such that both consumers prefer them to their initial allocation.

Edgeworth Box



Edgeworth Box



Moving from E to T is a Pareto improvement: at least one of the two agents is better off, and no agent is worse off.

Edgeworth Box

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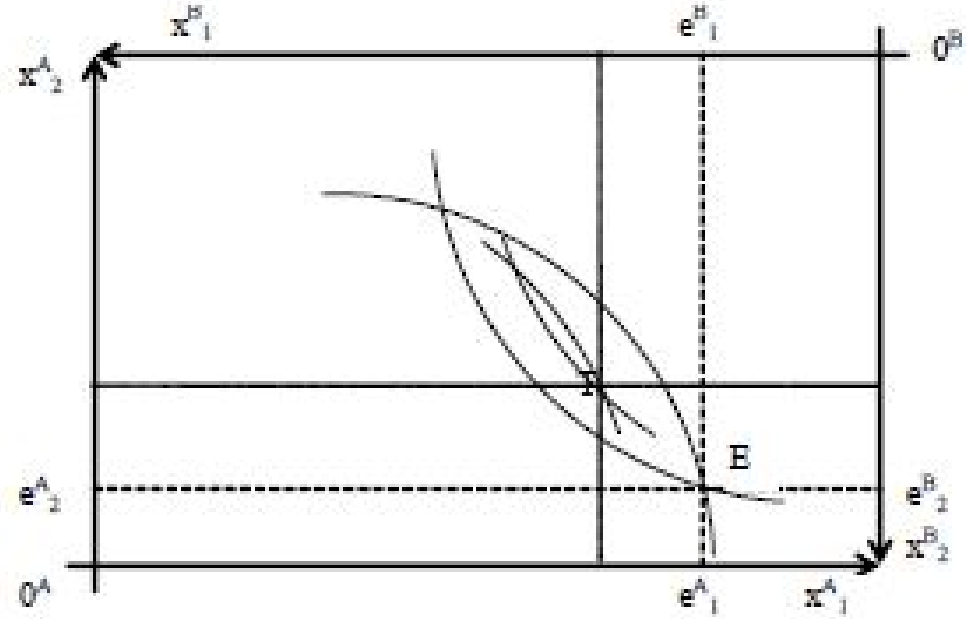
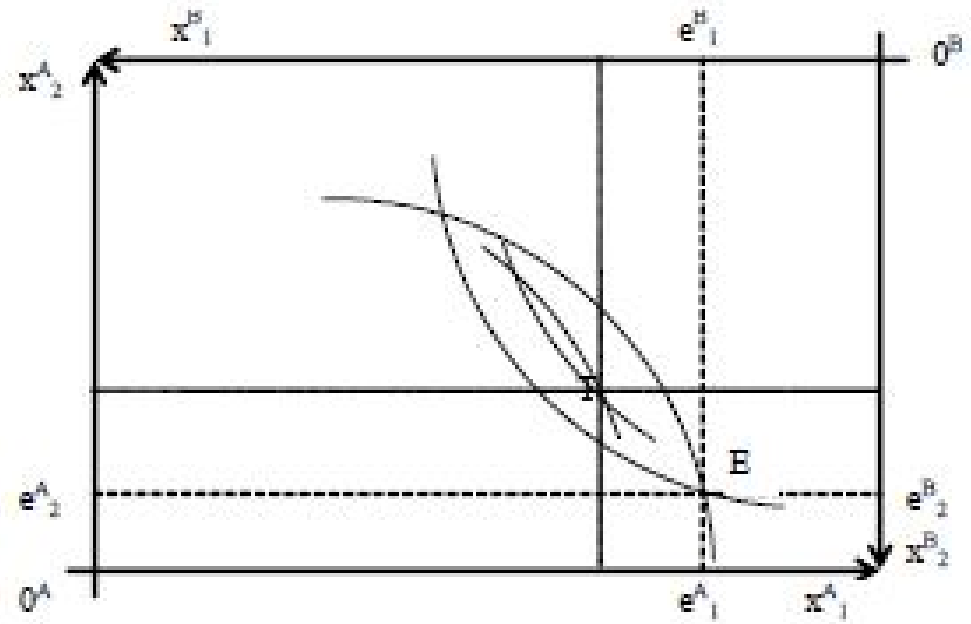
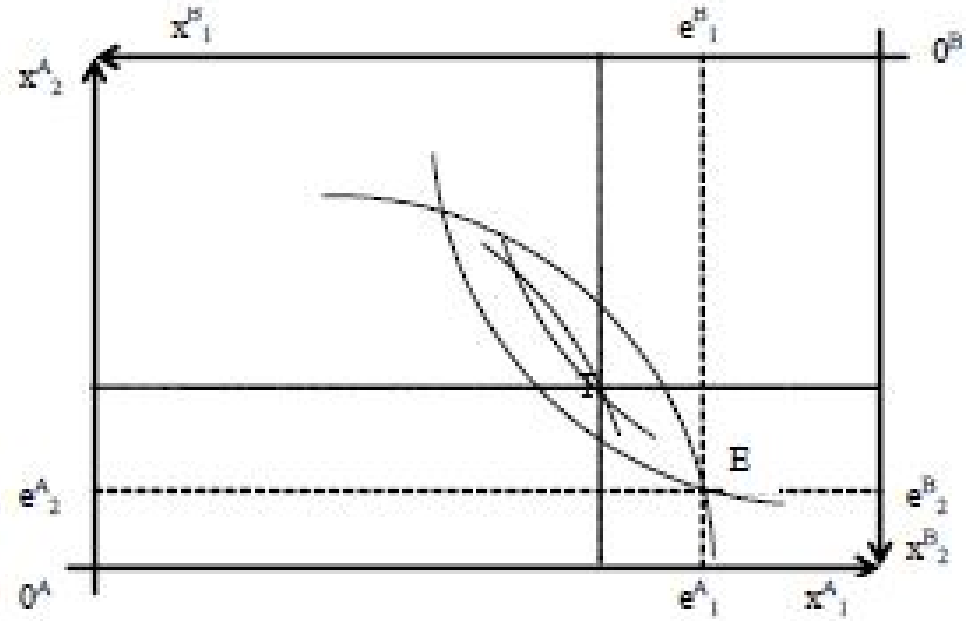
Does the allocation T correspond to a Pareto optimum?

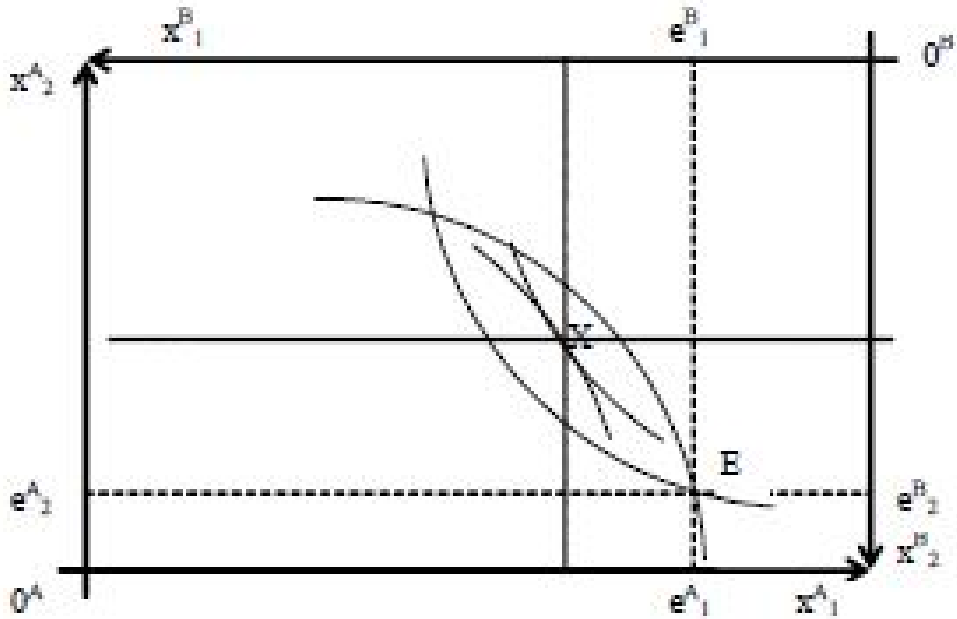

x^B_1
e^B_1
0^B
x^A_2
E
e^A_2
e^B_2
x^B_2
0^A
e^A_1
x^A_1



The allocation corresponding to T can be improved upon: there are still allocations that both individuals would happily trade with what they have in T. Trade will continue within the new smaller lens-shaped area above T.



The allocation corresponding to T can be improved upon: there are still allocations that both individuals would happily trade with what they have in T. Trade will continue within the new smaller lens-shaped area above T.The process will continue until the indifference curves for the two consumers are tangent.


x^B_1
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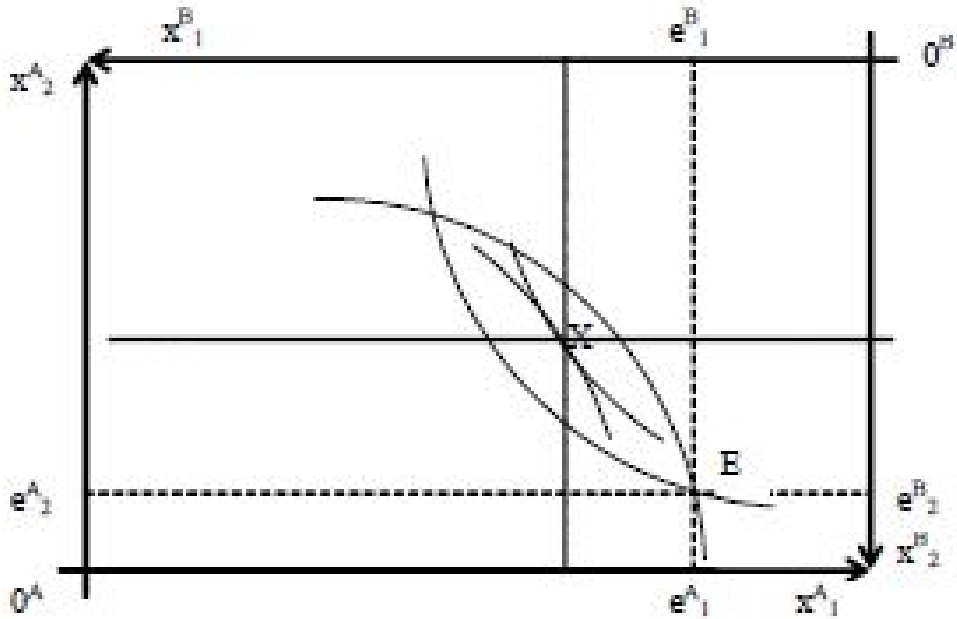
x^B_2
0^A
e^A_1
x^A_1



When the two individuals trade their initial endowment for the allocation represented by X, there are no further pareto improvements possible. There is no further exchange that can take place!

Hence Pareto optimality requires indifference curves to be tangent.

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Recall that slope of indifference curves is equal to marginal rate of substitution: in a pareto optimal allocation marginal rate of substitution are equal across individuals.

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Is X the only Pareto optimal allocation that the two individuals can reach starting from initial conditions given by E?

Locus of points where the indifference curves for the two agents are tangent (without specifying the initial endowment) is called the **contract curve**.

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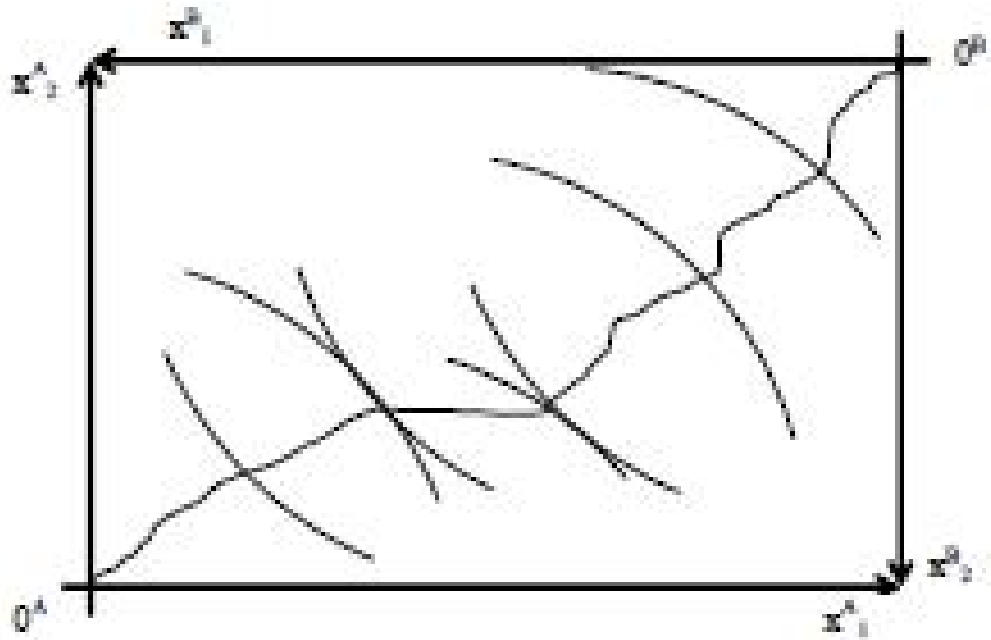

Notice that the origins of the Edgeworth box belong to the contract curve: the allocation that gives everything to one individual and nothing to the other is Pareto optimal!

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Pareto optimality has nothing to say about fairness of the distribution. It is a notion of efficiency (if a Pareto improvement can be made, then the allocation is inefficient), but does not provide us with a tool to assess the desirability of an outcome.

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Very weak concept.

First Welfare Theorem

Given the previous assumptions,

Theorem

The competitive equilibrium is efficient.

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In other words, if markets are competitive, the market allocation is Pareto optimal.

Why?

First Welfare Theorem

If markets are competitive, individuals take prices as given and choose a bundle such that:

marginal rate of substitution = price ratio

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marginal rate of substitution = price ratio

Given that all individuals face the same prices, then **MRS for A = MRS for B**.

First Welfare Theorem

Hence at a competitive market equilibrium, the indifference curves for the two individuals are tangent.

Decentralised trading (markets) gives us the same solution as bilateral bargaining.

The importance of the First Welfare Theorem is that it gives us a general mechanism - the competitive market - that we can use to ensure Pareto efficient outcomes.

First Welfare Theorem

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Very simple informational requirement: we only need to look at the market price for a good.

Second Welfare Theorem

What if we also care about distribution?

Theorem

Any efficient allocation can be achieved by competition.

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Theorem

Any efficient allocation can be achieved by competition.

We do not need to alter the mechanism. All we need to do is redistribute initial resources and then let prices (the competitive market mechanism) do the job.

Second Welfare Theorem

Idea is the following: suppose that the policy maker would like to implement a particular pareto optimal allocation (i.e. a specific point on the contract curve).

Then, all the policy maker needs to do is to redistribute initial resources and then let the market mechanism operate to ensure that the desired allocation is reached (and to ensure that the allocation that is reached is pareto optimal).

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Main message from the second welfare theorem is that the problems of distribution and efficiency can be separated.

Second Welfare Theorem

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- an allocative role: they indicate relative scarcity
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- a distributive role: they determine how much people can afford

Second welfare theorem says that these two roles can be separated: we can redistribute endowments of goods to determine how much wealth agents have, and then use prices to indicate relative scarcity.

Taxation

Distortionary versus non-distortionary taxation.

Non-distortionary taxation is a form of taxation that does not affect individual decisions at the margin, i.e. taxation that does not interfere with the price mechanism. The only type of non-distortionary taxation is lump-sum taxation on endowments.

Taxation

What about taxing income?

Taxation

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Income is generated by the sale of the labour endowment that we have. Taking income is distortionary because it affects our incentives to sell labour. If we were taxed on our endowment of labour (how much labour we can potentially sell), this would be non-distortionary.

Taxation

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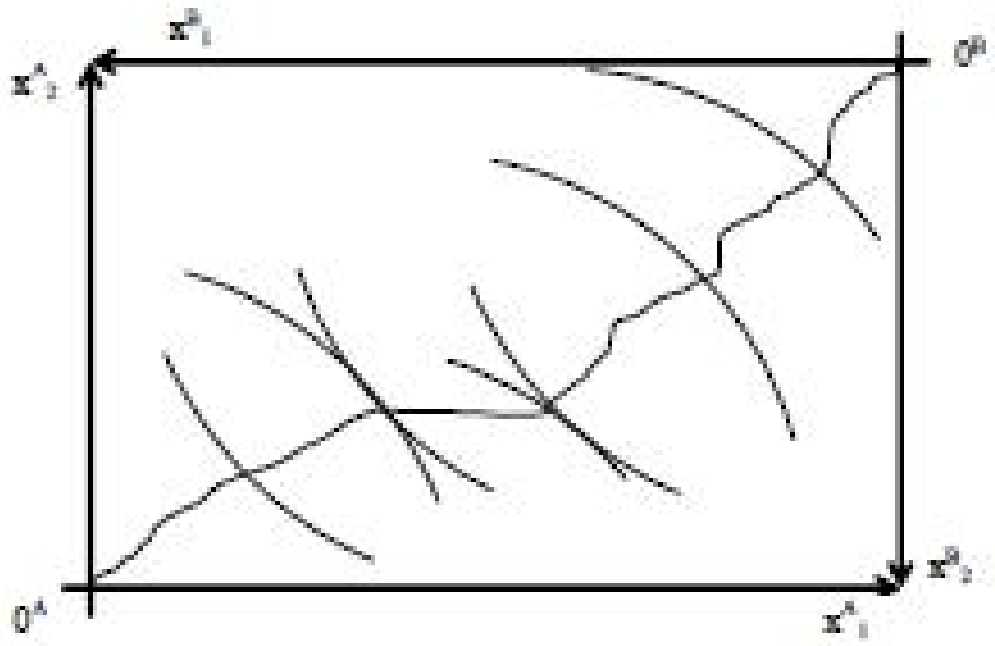
Main problem is: How to implement this?

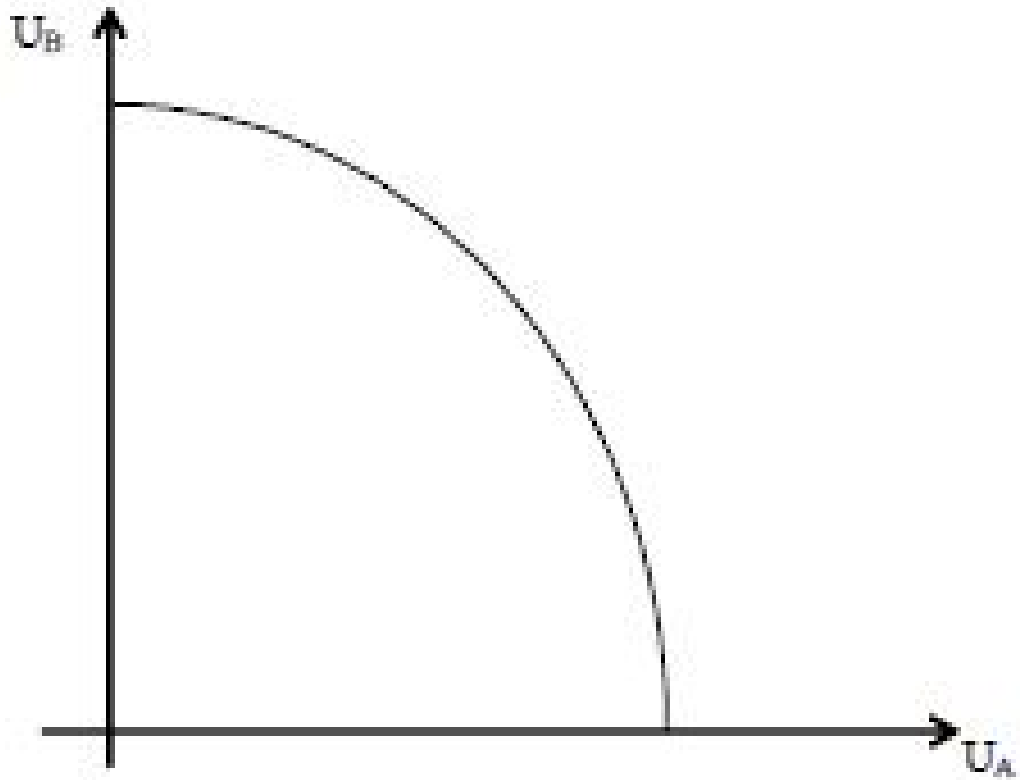
Welfare

Start from the contract curve.

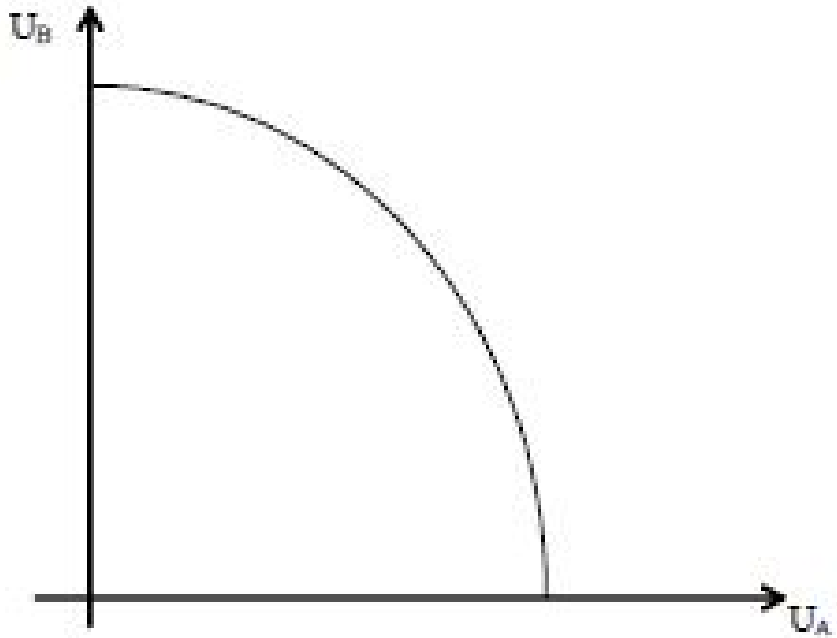


Welfare

Use a different diagram to represent the level of utilities that each of the two individuals achieve at Pareto optimal allocations.



Welfare



This is the **utility possibility frontier**.

The two intercepts represents the level of utilities that correspond to the two origins of the Edgeworth box.

Welfare

We need to describe social preferences on the way in which utility is distributed.

Several possibilities for a social welfare function.

Welfare

- **Utilitarian approach**: I could give all individuals the same weights

$$W = U_A + U_B$$

and more in general, for n individuals $W = \sum_{i=1}^{n} U_i$

- **Weighted-sum-of-utilities**:

$$W = \sum_{i=1}^{n} \alpha_i U_i$$

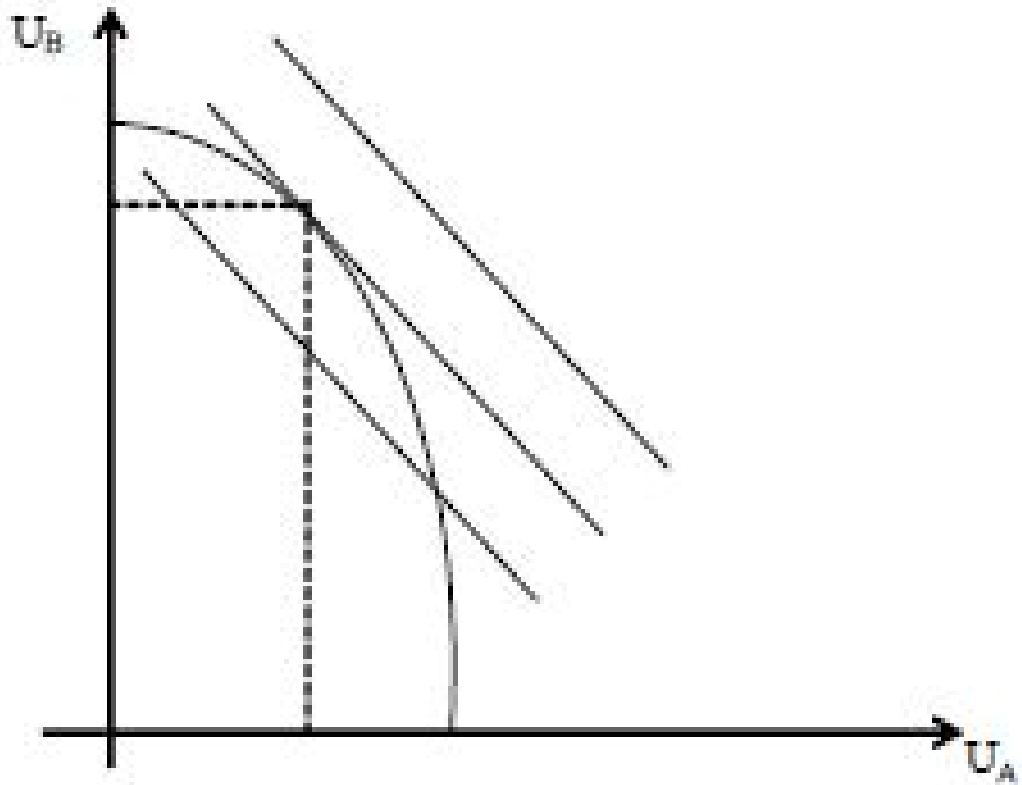
Welfare

- **Minimax of Rawlsian social welfare function**: it is only the individuals with the lowest utility that matter

$$W = \min \{U_A, U_B\}$$

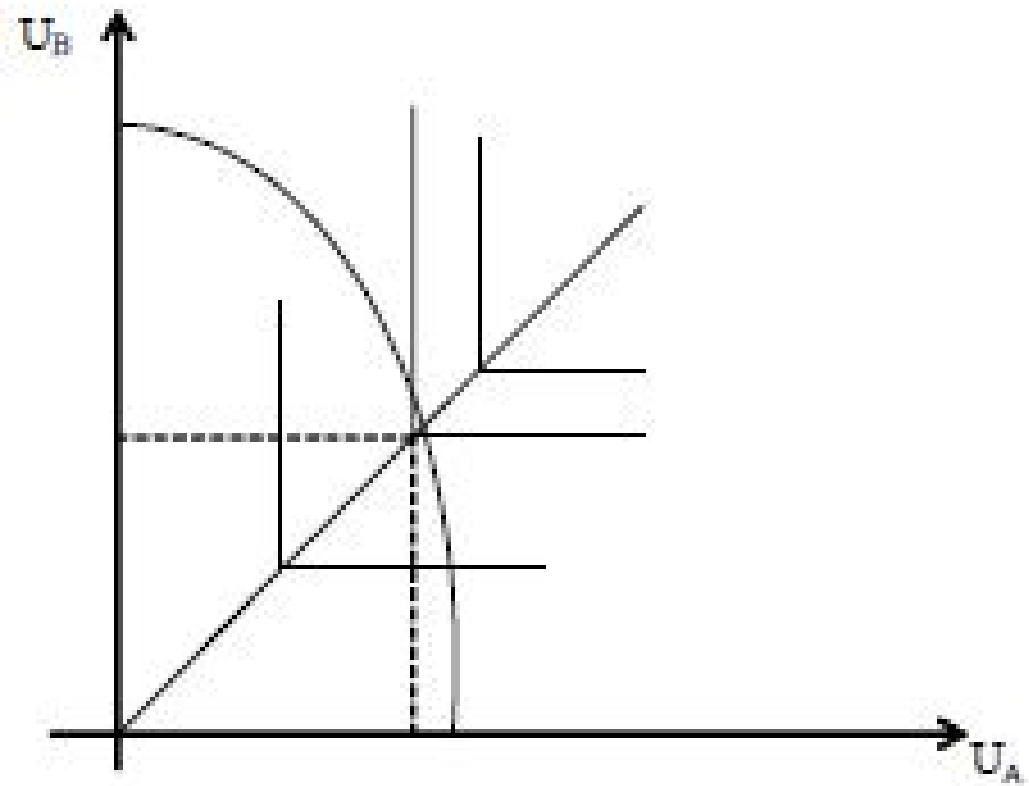
Welfare

If the policy maker is utilitarian, this is the distributional choice:



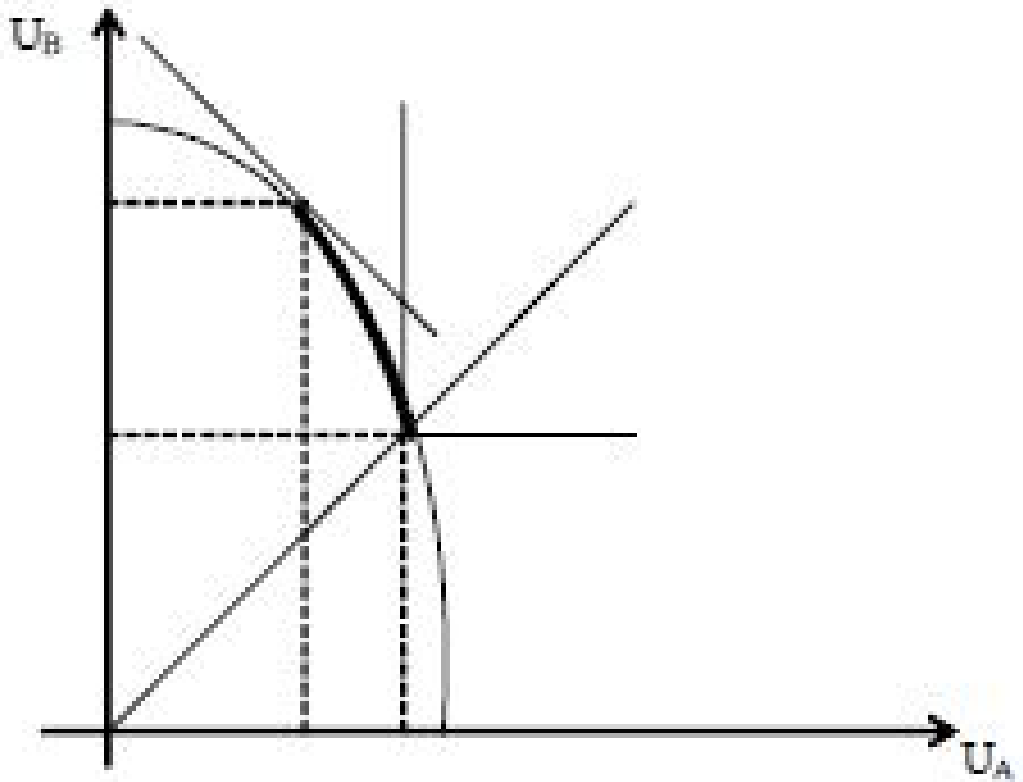
Welfare

If the policy maker is rawlsian, this is the distributional choice:



Welfare

Range between the two extremes:



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We say an allocation a is **socially preferred** to an allocation b if through a specific voting system (majority for example) a is chosen over b.

Voting

Suppose the following case and a majority voting system:

Individual:	*1*	*2*	*3*
first choice	a	b	c
second choice	b	c	a
third choice	c	a	b

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Voting leads to nontransitive social preferences.

Voting

Kenneth Arrow (1951) found a result known as the **"Arrow's Impossibility Theorem"**.

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- Society's ranking of a and b should depend only on individuals' ordering of these two allocations and not on how they rank other alternatives.
- Dictatorship is not allowed. Social preferences must not reflect the preferences of only one single individual.

Voting

Arrow proved that it is **impossible** to find a social decision rule that satisfies ALL of these criteria.

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This suggests that also a *democratic decision making* may fail!