UNIVERSITY OF HOHENHEIM
Institute for Agricultural Policy and Agricultural Markets

Agricultural and Food Policy

(4201-410)

Economic Foundations of Policy Intervention
and
Essential Economic Tools for A-F Policy Analysis

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Daily, 14.15 – 17.30, HS 23

Lecture notes and further information:
http://www.uni-hohenheim.de/apo

LECTURE OUTLINE

- **Economic Foundations of Policy Intervention**
  - Principles of Economics
  - Rationale for Policy Intervention
- **Essential Economic Tools for A-F Policy Analysis**
  - Elasticity
  - Consumer and Producer Surplus
  - Welfare Theorems and Welfare Economics
  - Pareto Principle

Principles of Economics

- The word *economy* comes from a Greek word for “one who manages a household.”
- A household and an economy face many decisions, e.g.:
  - Who will work?
  - What goods and how many of them should be produced?
  - What resources should be used in production?
  - At what price should the goods be sold?
- Society and Scarce Resources:
  - The management of society’s resources is important because resources are scarce.
  - Scarcity. . . means that society has limited resources and therefore cannot produce all the goods and services people wish to have.

Principles of Economics

The Concept of Resource Scarcity

Scarcity = The gap between human wants and available resources.

- Goods have value because they are scarce.
  If goods were not scarce, they would be free – like air.
  But: Even with air, people are probably willing to pay more to live in cleaner environments.
- The more scarce resources are, relative to their demand, the greater their value.

➪ It can be argued that scarcity is the origin of all resource policy issues.
Scarcity of resources creates the conflict and pressure for changes in public policy regarding resource use.

Principles of Economics

The Concept of Resource Scarcity

General implications to maximize the set of goods and services in a world of scarcity:

- ***Choice:*** we need to make choices and set priorities.
- ***Opportunity Costs:*** highest valued alternative that must be sacrificed to attain something or satisfy a want.
- ***Efficiency:*** In the presence of scarcity, no individual or society can afford to be wasteful or inefficient.
- ***Social Institutions:*** In the presence of scarcity the allocation and distribution of resources always causes conflicts. To resolve these conflicts in a systematic fashion, some kind of institutional mechanism(s) need to be established.

Principles of Economics

ECONOMICS is the study of the allocation of scarce resources

- The theories of economics can be applied to any scarce resource, not just traditional commodities.
- Economics is not simply about profits or money. It applies anywhere constraints are faced, so that choices must be made.
- Economists study how incentives affect people's behaviour.

What questions does economics address?

- **How do nations, institutions, firms, individuals make decisions?**
  - People face trade-offs.
  - The cost of something is what you give up to get it.
  - Rational people think at the margin.
  - People respond to incentives.

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Principles of Economics

What questions does economics address? (contd.)

- **How do people interact with each other?**
  - Trade can make everyone better off.
  - Markets are usually a good way to organize economic activity.
  - Governments can sometimes improve economic outcomes.

- **What are the forces and trends that affect how the economy as a whole works?**
  - The standard of living depends on a country's production.
  - Prices rise when the government prints too much money.

Principles of Economics

Principle #1: People Face Trade-offs

⇨ A trade-off usually refers to losing one quality or aspect of something in return for gaining another quality or aspect.
  - It implies a decision to be made with full comprehension of both the upside and downside of a particular choice.

- "There is no such thing as a free lunch!"
- To get one thing, we usually have to give up another thing.
  - Guns vs. butter
  - Food vs. clothing
  - Leisure time vs. work
  - Efficiency vs. equity

⇨ Making decisions requires trading off one goal against another.
  - e.g.: Efficiency vs. Equity

Principles of Economics

Principle #1: People Face Trade-offs (contd.)

- **Efficiency versus Equity:**
  - *Efficiency* means society gets the most that it can from its scarce resources.
  - *Equity* means the benefits of that resources are distributed fairly among the members of society.

Even when an efficient solution occurs, it might not be desirable.

- Equity issues are also important.
- Policymakers need to consider how various groups will be impacted.
- This can be complicated, e.g. in environmental economics (e.g., how should the welfare of future generations be weighed when making global warming policy?)

Principles of Economics

Principle #2: The Cost of Something Is What You Give Up to Get It.

- Decisions require comparing costs and benefits of alternatives.
  - Whether to go to university or to work?
  - Whether to study or go out on a date?
  - Whether to go to class or sleep in?

⇨ The ***opportunity cost*** of an item is what you give up to obtain that item.

= highest valued alternative that must be sacrificed to attain something or satisfy a want.

Principles of Economics

Principle #3: Rational People Think at the Margin

- Marginal changes are small, incremental adjustments to an existing plan of action.

⇨ People make decisions by comparing costs and benefits at the margin.

- Marginal benefit: The extra benefit resulting from a small increase in some activity.
- Marginal cost: The additional cost resulting from a small increase in some activity.

Principle #4: People Respond to Incentives

- Marginal changes in costs or benefits motivate people to respond.
- The decision to choose one alternative over another occurs when that alternative's marginal benefits exceed its marginal costs!

Principles of Economics

Principle #5: Trade Can Make Everyone Better Off

- People gain from their ability to trade with one another.
- Competition results in gains from trading.
- Trade allows people to specialize in what they do best.

Principle #6: Markets Are Usually a Good Way to Organize Economic Activity.

- A market economy is an economy that allocates resources through the decentralized decisions of many firms and households as they interact in markets for goods and services.
  - Households decide what to buy and who to work for.
  - Firms decide who to hire and what to produce.

Principles of Economics

Principle #6 (contd.): **Markets Are Usually a Good Way to Organize Economic Activity.**

- Adam Smith made the observation that households and firms interacting in markets act as if guided by an "invisible hand".
- Markets have proved to be the best way of allocating a vast range of resources:
  - Markets are extremely good at
    - coordinating actions and at transmitting information,
    - responding to changes in relative scarcity.
- Markets give people the opportunity to trade = a good way of increasing social welfare as a whole.

⇨ However, left to itself, the free market system can generate the 'wrong' outcome. This problem is known in economics as *market failure*.

Principles of Economics

Principle #7: Governments Can Sometimes Improve Market Outcomes.

- Market failure occurs when the market fails to allocate resources efficiently.
- When the market fails (breaks down) government can intervene to promote efficiency and equity.

⇨ **But:** Government intervention does not always make things better, it can make things worse = ***government failure***.

How is Economics Done?

➪ What are key assumptions of economics?

- Individuals are rational and pursue self-interest.
- Individuals make their own choices and do what's best for them.

➪ What is an economic model ?

- Simplified representation of the world
- World (and humans) are too complex to make general assumption, models preserve the features essential to the question being analyzed.
- Unlike models in other social sciences, economic models make explicit assumptions (mathematical tools) and do a reality check (econometrics).

How is Economics Done?

➪ How is economics done?

- Economics distinguishes between *what is* and *what should be* – Normative vs. Positive
- Quantitative and qualitative results of economic analysis inform policy.

➪ Normative vs. Positive

- ***Positive analysis* explains observable behaviour – *what is***

  - Measures of observable phenomena
  - Examples

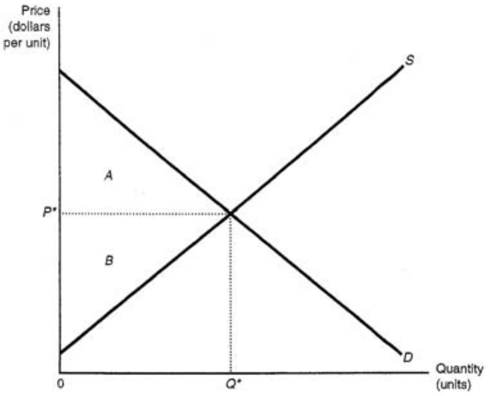
- ***Normative analysis* evaluates outcomes and recommends policies to improve the situation - *what should be***

  - Recommends what should be done
  - Requires judgement
  - Examples

EFFICIENT MARKET ALLOCATION

Principle: Markets Are Usually a Good Way to Organize Economic Activity.

Market Equilibrium



- Consumers maximize their surplus Demand = Marginal Benefit (MB)
- Producers maximize their surplus Supply = Marginal Cost (MC)
- In equilibrium, P = MB = MC
- No further beneficial transactions are possible.
- Normally, a free market brings us to this point.

EFFICIENT MARKET ALLOCATION

⇨ **BUT:**

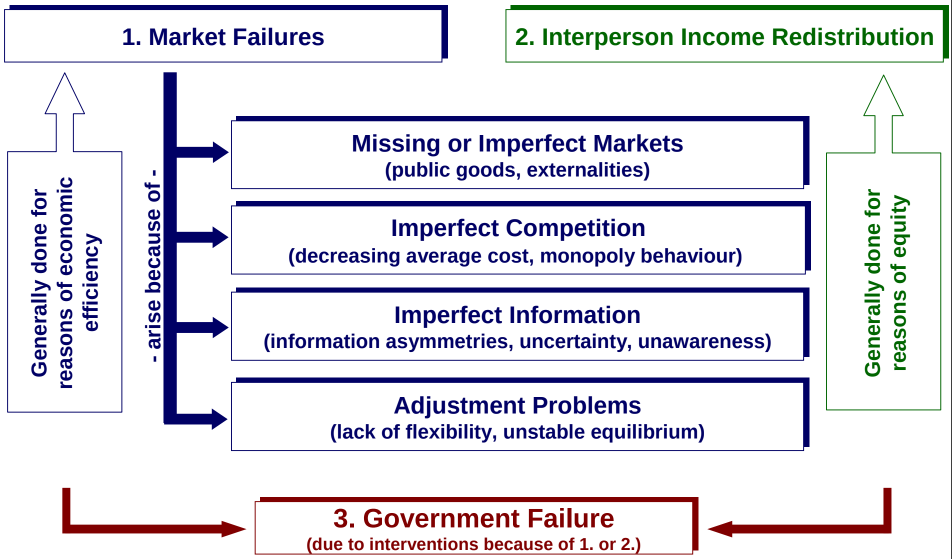
- There are times when private marginal benefits or costs are not equal to social marginal benefits or costs.
- When this occurs, the market is unable to allocate resources efficiently.

⇨ We call this ***market failure***.

⇨ There are various types of market failure:
imperfect competition, imperfect information, public goods, externalities, and also
inappropriate government intervention (= government failure).

⇨ Furthermore: What about *distribution*?

Rationale for Policy Intervention



Source: adapted from Fellmann, 2007, p.12

MARKET FAILURE

IMPERFECT INFORMATION:

= when different parties have different levels of information.

- The market depends on perfect information, so that everyone knows all of the options available to them. If this is not possible, people may not make optimal choices.
- If no one realizes an activity is bad, imperfect information is not the problem.
- There is a belief that on its own the market will supply too little information (labelling, disclosure of contents, etc.)
- ***Information asymmetry:***
  - **- *Adverse selection*** *(hidden information)* – where one party to the transaction knows information that is relevant to the transaction but unknown to the second party
  - **- *Moral hazard*** *(hidden action)* – where one party takes certain actions that affects the other parties valuation of the transaction, but the second part can not monitor these actions.
- **What can be done?**

MARKET FAILURE

PUBLIC GOODS

Have two key features:

1. *non-rivalry*

➪ The same unit of a public good can be consumed by many individuals: one person enjoying the good does not keep others from enjoying it.

2. *non-excludability*

➪ Once a good is provided to some individuals it is not possible (or at least very costly) to exclude others from benefiting from it.

➪ Leads to free-rider problem

Examples: street lightning, lighthouses, national defence, the natural (or urban) environment

MARKET FAILURE

PUBLIC GOODS (contd.)

- Because the goods are non-rival, efficiency requires that the sum of each individual's marginal benefit is equal to marginal cost.
- Underprovision: results when public goods are provided by a free market.
- How is this relevant to agricultural economics?
  - especially relevant concerning agri-environmental issues
- What can be done?

MARKET FAILURE

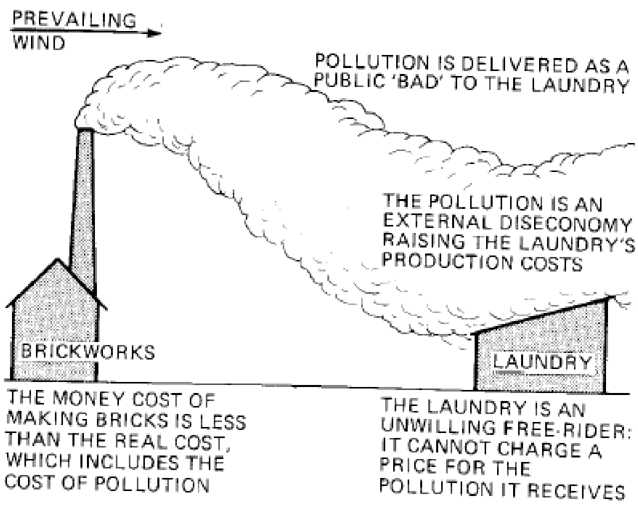
EXTERNALITIES:

= activity of one entity that affects the welfare of another and is not reflected in market prices.

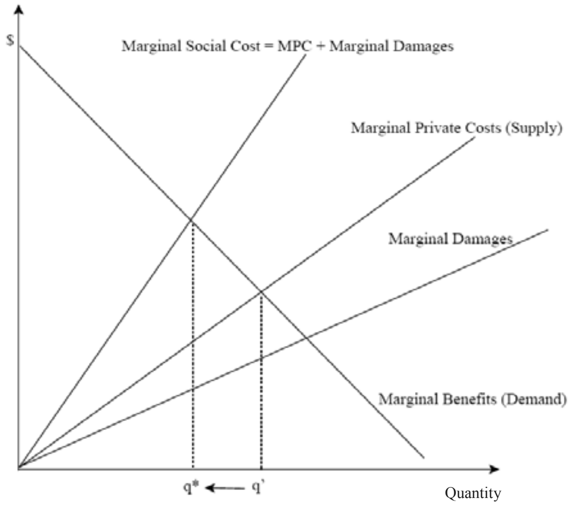
- Positive or negative external effects.
- To find the efficient level of activity, we need to know the marginal social cost (MSC).
- MSC = marginal private costs (MPC) + marginal external costs (which represent the damage done by the externality).
- Without policy, the free market will not lead to an efficient solution, as prices will reflect private costs, but not the additional external costs.

MARKET FAILURE

Example Negative Externality:



Effect of Negative Externality on Efficient Level of Production



- Individuals equate MPC and MB.
- Since MSC > MPC, over provision results.

MARKET FAILURE

Different Types of Cost and Benefits associated with Externalities:

- Generated in one production process and received in another production process.
- Generated in a production process and received in consumption.
- Generated in consumption and received in a production process.
- Generated in consumption and received in consumption.

MARKET FAILURE through GOVERNMENT FAILURE?

GOVERNMENT FAILURE:

= wrong or inappropriate government intervention moves the market away from an optimal outcome.

- Different from market failures.
- Removal of one cause of market failure does not necessarily result in a more efficient allocation of resources.
- How is this relevant to agricultural economics?
  - In some cases, chosen policy instruments may simply fail to achieve desired outcomes.
  - Government intervention in one area may lead to failures in another area.
- Reasons of political economy must also be considered.

- **Essential Economic Tools for A-F Policy Analysis**
  - Elasticity
  - Consumer and Producer Surplus
  - Welfare Theorems and Welfare Economics
  - Pareto Principle

What is Elasticity?

- ⇨ Economists use the concept of elasticity which compares rates of change in consumption to rates of change in an independent variable such as price or income.
- %Δ dependent variable ⇐?⇒ %Δ independent variable
- Does the dependent variable change by more than, less than, or the by the same amount at the dependent variable?
- So the elasticity is defined as:

$$\varepsilon = \frac{\text{rate of change in quantity of food demanded}}{\text{rate of change in independent variable}}$$

- Elasticities are useful measures because they are unitless measures so that comparisons can be made between the demand responsiveness of different goods. If the changes were in absolute terms the comparison can't be made

Own Price Elasticity of Demand

- ⇨ The own price elasticity of demand compares the responsiveness of the quantity demanded to changes in the price of the good in question:

$$\varepsilon_{ii}^{d} = \frac{\text{rate of change in quantity of food demanded}}{\text{rate of change in price of food}}$$

- Elasticities are estimated statistically and can give useful behavioural predictions;
  - ⇨ e.g., you estimate that the elasticity of demand is -1:
    - if the price of food declines by 50% what happens to the quantity of food demanded?
      - $\%\Delta\ Q^d = \varepsilon^d_{ii} \cdot \%\Delta\ P$
      - $\%\Delta\ Q^d = (-1)\cdot(-0.5)=50\%$
  - ⇨ For a 50% price reduction the quantity demanded will vary with the elasticity in the following manner:

ε^d_{ii}	$\%\Delta\ Q^d$
-0.5	0.25
-1	.5
-1.5	0.75

Own Price Elasticity of Demand

The own price elasticity of demand can be:

$$\text{price inelastic} \quad \varepsilon_{ii}^{d} < -1 \quad \text{then} \left|\%\Delta Q^{d}\right| < \left|\%\Delta P\right|$$

$$\text{unit elastic} \quad \varepsilon_{ii}^{d} = -1 \quad \text{then} \left|\%\Delta Q^{d}\right| = \left|\%\Delta P\right|$$

$$\text{price elastic} \quad \varepsilon_{ii}^{d} > -1 \quad \text{then} \left|\%\Delta Q^{d}\right| > \left|\%\Delta P\right|$$

- *Cross price elasticities* can also be defined:

$$\varepsilon_{ij}^{d} = \frac{\text{rate of change in quantity demanded of good i}}{\text{rate of change in price of good j}}$$

- Cross price elasticity:

  commodities may be substitutes (+), complements (-), or independent (0)

Income Elasticity of Demand

⇨ The income elasticity of demand compares the responsiveness of the quantity demanded to changes in income:

$$\varepsilon_{iy}^{d} = \frac{\text{rate of change in quantity of food demanded}}{\text{rate of change in income}} = \frac{\frac{\Delta Q^{d}}{Q^{d}}}{\frac{\Delta Y}{Y}} = \frac{\frac{Q_2 - Q_1}{Q_1}}{\frac{Y_2 - Y_1}{Y_1}}$$

- Elasticities are estimated statistically
  - ⇨ e.g., you estimate that the income elasticity of demand is 0.5:
    - if income doubles what happens to the quantity of food demanded?
      - $\%\Delta Q^{d} = \varepsilon^{d}_{iy} \cdot \%\Delta Y$
      - $\%\Delta Q^{d} = (.5)\cdot(1) = 50\%$
  - ⇨ For a doubling of income (100% increase) the quantity demanded will vary with the income elasticity in the following manner:

ε^{d}_{iy}	$\%\Delta Q^{d}$
0.5	0.5
1	1
1.5	1.5

Income Elasticity of Demand

Income elasticity for different responsiveness to income changes:

- *Luxury:* $\varepsilon_{iy}^{d} > 1$ then $\left|\%\Delta Q^{d}\right| > \left|\%\Delta Y\right|$
  Quantity demanded changes proportionately *more* than income
- *Necessity:* $\varepsilon_{iy}^{d} < 1$ then $\left|\%\Delta Q^{d}\right| < \left|\%\Delta Y\right|$
  Quantity demanded changes proportionately *less* than income
- *Unit elasticity:* $\varepsilon_{iy}^{d} = 1$ then $\left|\%\Delta Q^{d}\right| = \left|\%\Delta Y\right|$
  Quantity demanded changes proportionately *with* income
- *Inferior good:* $\varepsilon_{iy}^{d} < 0$ then $\left|\%\Delta Q^{d}\right| \downarrow \Leftrightarrow \left|\%\Delta Y\right| \uparrow$
  Quantity demanded moves in opposite direction to income

Factors Influencing the Size of the Price Elasticity

- The number and closeness of substitutes
- The importance of the Good in your budget
- Price of the good
- Level of income
- The amount of time given to react to the price change
- Type of market or level of a market

Market Supply Curves and Supply Elasticity

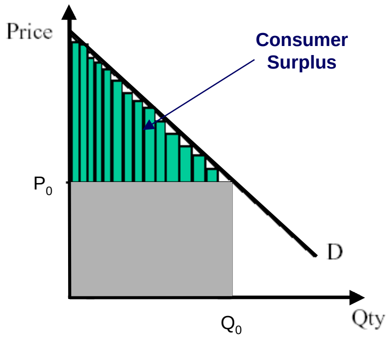
$$\varepsilon_{ii}^{s} = \frac{\text{rate of change in quantity supplied}}{\text{rate of change in own price}} = \frac{\frac{\Delta Q^{s}}{Q^{s}}}{\frac{\Delta P}{P}} = \frac{\Delta Q^{s}}{\Delta P}\frac{P}{Q^{s}}$$

➪ In general, the longer the time allowed for adjustments to occur the greater the response to a given price change

- very short run: the quantity supplied can be neither increased nor decreased
- short run: the amount of inputs can be varied
- longer run: area or animal units can be changed

➪ the tendency is for supply curves to become more responsive as more time is allowed for adjustments

Measuring Consumer Surplus



- A demand function is a schedule of the willingness to pay for each additional unit of the product consumed
- *Consumer surplus* is the area above the price line and below the demand curve

➪ “Excess of price which the consumer would be willing to pay rather than go without the good over that which he actually does pay”

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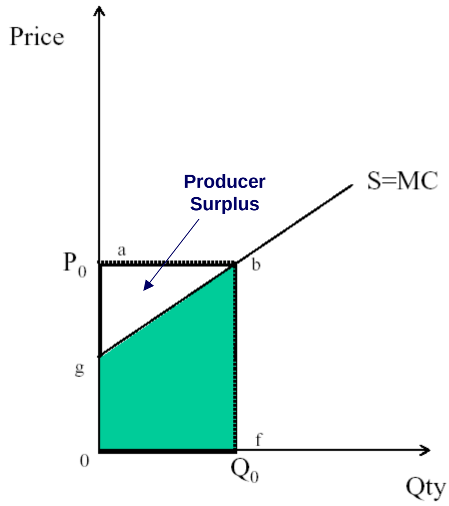
Measuring Producer Surplus



- Total Revenue is P_0*Q_0 = abf0
- Integrating under the marginal cost function will give total variable cost (gbf0)
- *Producer surplus* is the area abg or the difference between total costs and total revenues

Does the economy produce desirable results? - Welfare Theorems and Welfare Economics

SOCIAL WELFARE THEOREMS

- 1st Fundamental Theorem of Welfare Economics:
  - The Competitive equilibrium, where supply = demand, maximizes social efficiency.
- 2nd Fundamental Theorem of Welfare Economics:
  - Society can attain any efficient outcome by a suitable redistribution of resources and free trade.

WELFARE ECONOMICS

= is concerned with the social desirability of alternative economic states

- Distinguishes cases when private markets work well from cases where government intervention may be warranted.
- A central concept is Pareto Efficiency

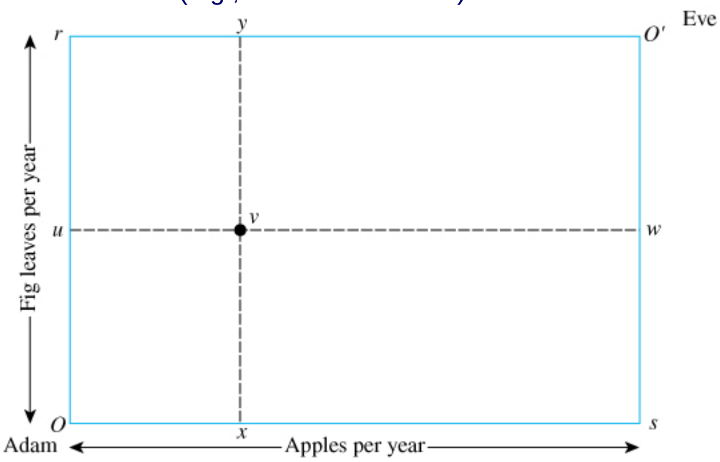
Does the economy produce desirable results? - Pareto Principle

PARETO PRINCIPLE

- Use the Pareto principle to determine the desirability of introducing a new policy versus an existing policy.
- An allocation is *Pareto efficient*, or say *Pareto optimal*:
  If there is no other feasible allocation that makes at least one person better off and no one else worse off.
- *Pareto improvement*:
  a new policy is desirable if some individual(s) are made better off, without making other individuals worse off.
  - There are a rare number of instances where this criterion will hold.
  - *Does not address* the question what the socially optimal income *distribution* is. Most of the output could go to one individual and still have a Pareto optimum.

- Pure Exchange Economy

- **Let's consider an economy with**
  - 2 people (Adam & Eve)
  - 2 commodities (Apples & Figs)
  - Fixed supply of commodities (e.g., on a desert island)
- An *Edgeworth Box* depicts the distribution of goods between the two people.

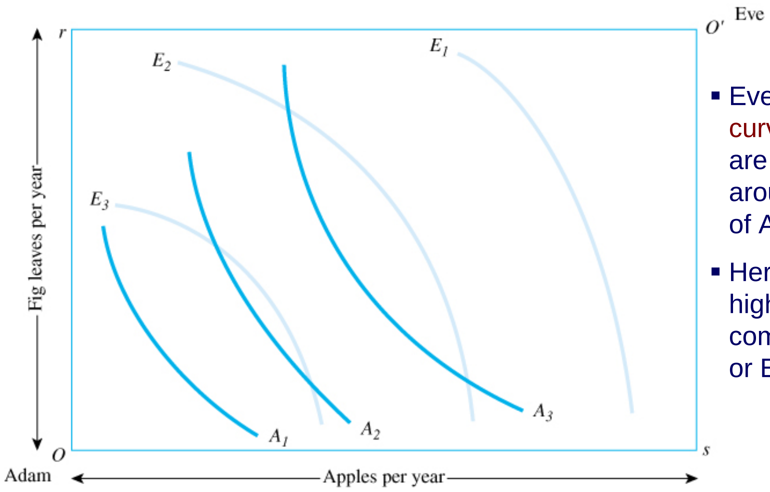


- Pure Exchange Economy

- Each point in the box represents an allocation between Adam and Eve
- Each point in the box fully exhausts the resources on the island. Adam consumes what Eve doesn't.
  - Adam's consumption of apples and figs increases as we move toward the northeast in the box.
  - Eve's consumption of apples and figs increases as we move toward the southwest in the box.
- At point **v** in the figure, Adam's allocation of apples is Ox, and of figs is Ou. Eve consumes O'y of apples, and O'w of figs.
- Now: Assume that Adam and Eve each have conventionally shaped indifference curves.
- Adam's happiness increases as he consumes more; therefore, his utility is higher for bundles toward the northeast in the Edgeworth Box.

- Pure Exchange Economy

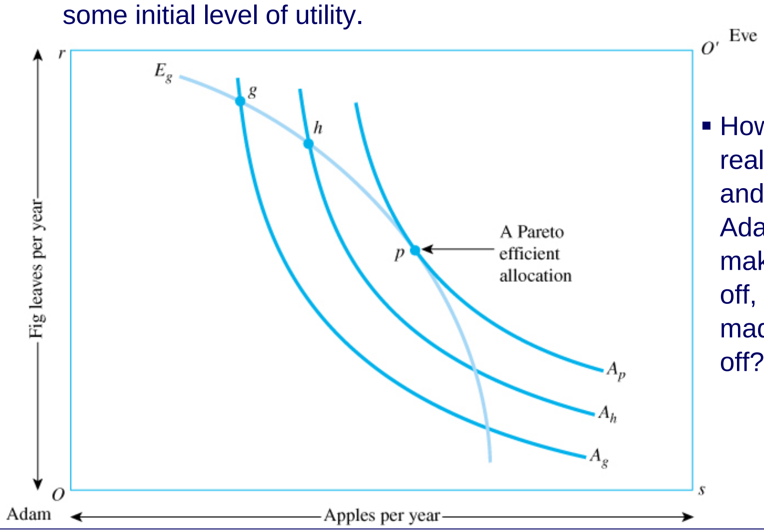
- Similarly, Eve's happiness increases as she consumes more; therefore, her utility is higher for bundles toward the southwest in the Edgeworth Box.



- Eve's indifference curves therefore are "flipped around" to those of Adam
- Her utility is higher on E3 compared to E2 or E1.

- Pure Exchange Economy

- Suppose some arbitrary point in the Edgeworth Box is selected, e.g. point *g*
  ⇨ this provides an initial allocation of goods to Adam and Eve and, thus, some initial level of utility.



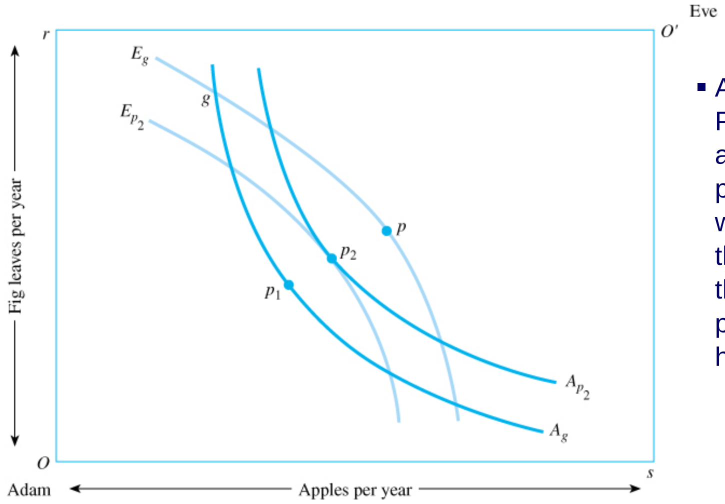
- How can we reallocate apples and figs between Adam and Eve to make Adam better off, while Eve is made no worse off?

- Pure Exchange Economy

- Is it possible to reallocate apples and figs between Adam and Eve to make Adam better off, while Eve is made no worse off?
- Allocation *h* in is one possibility.
  ⇨ We are "moving along" Eve's indifference curve, so her utility remains unchanged. Adam's utility clearly increases.
- Clearly, other allocations achieve this same goal, such as allocation *p*.
- Once we reach allocation *p*, we cannot raise Adam's utility any more, while keeping Eve's utility unchanged.

- Pure Exchange Economy

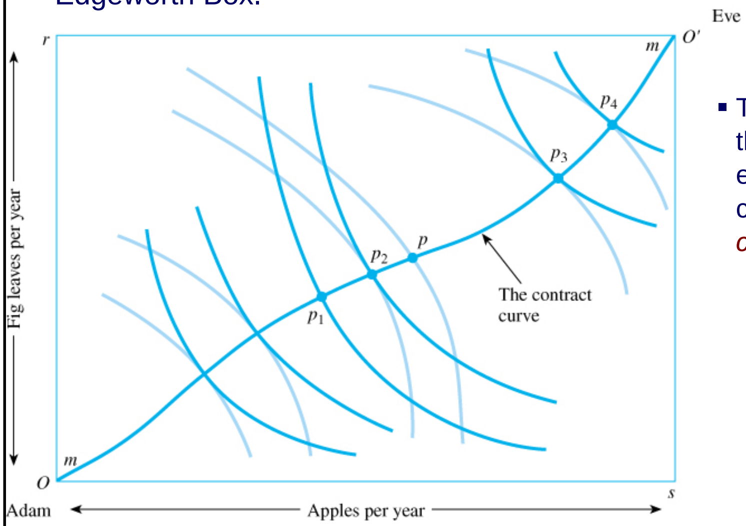
- Many allocations are Pareto efficient. The Figure illustrates three of them - allocations p, p1 and p2.



- Among these Pareto efficient allocations, some provide Adam with higher utility than others, and the opposite ones provide Eve with higher utility.

- Pure Exchange Economy

- In fact, there are a whole set of Pareto efficient points in the Edgeworth Box.



- The locus of all the set of Pareto efficient points is called the *contract curve*.

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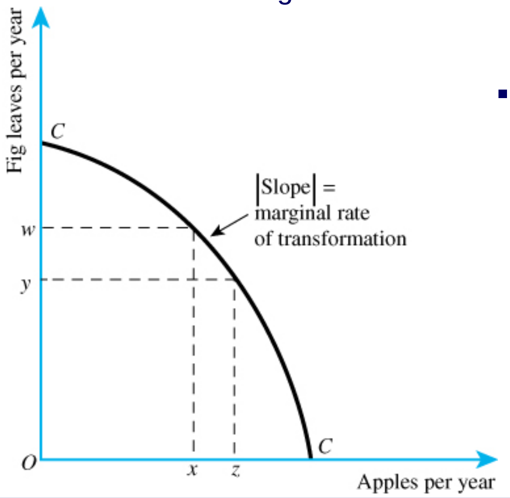
- Pure Exchange Economy

- The figure shows that each of the Pareto efficient points is where an indifference curve of Adam is tangent to an indifference curve of Eve.
- Mathematically, the slopes of Adam's and Eve's indifference curves are equal.
- The (absolute value of) slope of the indifference curve indicates the rate at which the individual is willing to trade one good for another, know as the *marginal rate of substitution (MRS).*
- Pareto efficiency requires:

$$MRS_{af}^{Adam} = MRS_{af}^{Eve}$$

- Production Economy

- In a pure exchange economy, assumed supplies of commodities were fixed. ⇨ Now consider a scenario where quantities can change.



- The *production possibilities curve* shows the maximum quantity of figs that can produced with any given quantity of apples.

- Production Economy

- For apple production to be increased, fig production must necessarily fall.
- The *marginal rate of transformation (MRT)* of apples for figs (MRT_{af}) shows the rate at which the economy can transform apples to fig leafs.
  - It is the absolute value of the slope of the production possibilities curve.
- The marginal rate of transformation can be written in terms of marginal costs:

$$MRT_{af} = \frac{MC_a}{MC_f}$$

Production Economy
- Efficiency with Variable Production

- With variable production, efficiency requires:

$$MRT_{af} = MRS_{af}^{Adam} = MRS_{af}^{Eve}$$

- If this were not the case, it is possible to make one person better off with an adjustment production. Rewriting in terms of marginal costs, we then have:

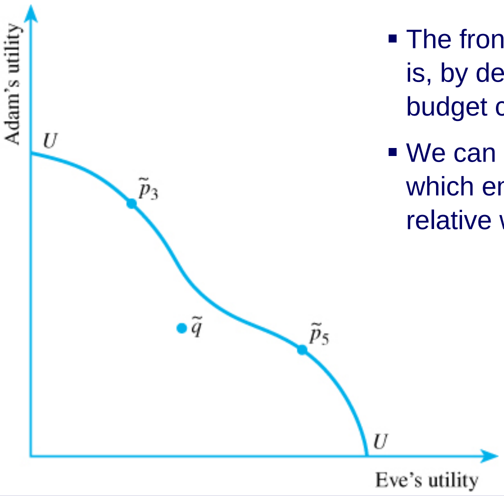
$$\frac{MC_a}{MC_f} = MRS_{af}^{Adam} = MRS_{af}^{Eve}$$

- 1st Fundamental Theorem of Welfare Economics

- Assume that:
  - All producers and consumers act as perfect competitors (e.g., no market power)
  - A market exists for each and every commodity
- Under these assumptions, the *1st fundamental theorem of welfare economics* states that a Pareto efficient allocation will emerge.
- Implication: Competitive economy automatically allocates resources efficiently, without central planning.
- Conclusion: Free enterprise systems are amazingly productive.
- Note that Pareto efficiency (and the 1st fundamental welfare theorem) does not mean fairness.
- Either the northeast or southwest corner of the Edgeworth Box is Pareto efficient, but very unequal distribution.

- 2nd Fundamental Theorem of Welfare Economics

- From the contract curve in the Edgeworth Box, we can map or derive the relationship between Adam's and Eve's utilities, on the *utilities possibilities curve*.

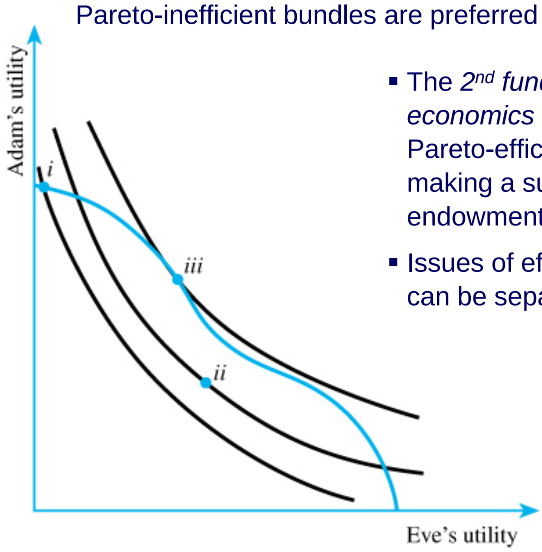


- The frontier of the utilities possibilities curve is, by definition, attainable. Similar to a budget constraint.
- We can postulate a *social welfare function*, which embodies society's views on the relative well-being of Adam and Eve:

$$W = F(U^{Adam}, U^{Eve})$$

- 2nd Fundamental Theorem of Welfare Economics

- We can then maximize society's preferences, or demonstrate that some Pareto-inefficient bundles are preferred to some Pareto-efficient ones



- The *2nd fundamental theorem of welfare economics* states that society can attain any Pareto-efficient allocation of resources by making a suitable assignment of initial endowments and then allowing free trade.
- Issues of efficiency and distributional fairness can be separated.

Review and Discussion Questions

6. Explain the concept of resource scarcity.
7. Name and briefly explain the various types of market failure.
8. What is the "free-rider" problem? When does it arise?
9. Use a graph to explain the effect of a negative or positive externality on the efficient level of production.
10. a) What do economists use the concept of elasticity for?
    b) How is elasticity defined?
    c) Which factors influence the size of price elasticity?
11. a) What is welfare economics about?
    b) When do we call an allocation as Pareto optimal?
    c) Do you think that the assumptions of the Pareto approach are realistic? Discuss briefly.