

Paul Samuelson (1915 - ?)



“Mathematics is Language”



A Famous Joke:

To prove that Wall Street is an early omen of movements still to come in GNP, commentators quote economic studies alleging that market downturns predicted four out of the last five recessions. That is an understatement. Wall Street indexes predicted nine out of the last five recessions! And its mistakes were beauties.

The Life of Paul Samuelson

- Born in Gary, Indiana on May 15, 1915
- Received his B.A. in 1935 from The University of Chicago
- Received his Masters in 1936 from Harvard University
- Received his Ph.D. in 1941 from Harvard University at the age of 26
- Became a Professor at M.I.T. in 1947 and is now an Institute Professor.
- 93 years old



Antoine Augustin Cournot

- Nineteenth century French economist
- Presented his concept of monopoly, oligopoly, and perfect competition



William Stanley Jevons

- English economist and logician
- Came up with the marginal utility theory of value
- The utility or value to a consumer of an additional unit of a product is inversely related to the number of units of that product he already owns, at least beyond some critical quantity



Marie-Esprit-Léon Walras

- A French economist
- He was a mathematical economist associated with the creation of the general equilibrium theory



Vilfredo Federico Damaso Pareto

- An Italian sociologist, economist, and philosopher
- He made several important contributions, particularly in the study of income distribution and in the analysis of individuals' choices
- He introduced the concept of Pareto efficiency and helped develop the field of microeconomics



Francis Ysidro Edgeworth

- Born in Ireland
- Made significant contributions to the methods of statistics during the 1800s
- Edgeworth's conjecture
- Monopoly pricing
- Marginal productivity theory
- Edgeworth's limit theorem



Irving Fisher

- An American economist
- Several concepts are named after him, including the Fisher equation, Fisher hypothesis and Fisher separation theorem.



Contributions:

- Optimal Provision of Public Goods
- Overlapping Generations Model
- Stolper-Samuelson Theorem
- Revealed Preference Theory

Optimal Provision of Public Goods

- A public good has positive externalities
- Consumers make purchasing decisions based on marginal private benefits
- These are lower than marginal social benefits
- Thus, the market produces a lower quantity than the social optimum
- Private benefits may be so low that a good is simply not provided at all, even though production of the good would lead to positive net social benefits

Optimal Provision of Public Goods

- A public good is a good that is **non-excludable** and **non-rival**
- A **non-excludable** good is a good that, once produced, is accessible to all consumers; no one can be excluded from consuming such a good after it is produced

- Examples:

Fireworks

National Defense

Radio Broadcasting



Optimal Provision of Public goods

- A **non-rival** good is a good that when consumed by one person does not reduce the quantity that can be consumed by others
 - Examples:

Public Television



National Defense



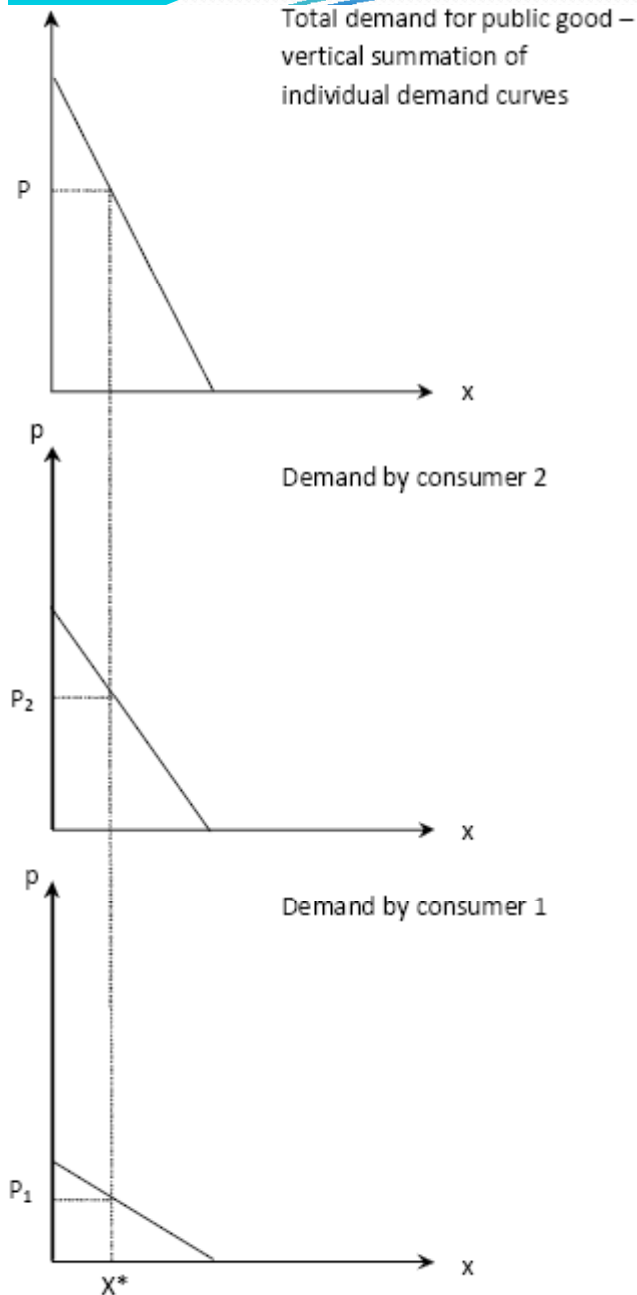
Optimal Provision of Public Goods

	Excludable	Non-excludable
Rivalrous	Private goods food, clothing, toys, furniture, cars	Common goods / (Common-pool resources) water, fish, hunting game
Non-rivalrous	Club goods cable television	Public goods national defense, free-to-air television, air

Private and public goods

Optimal Provision of Public goods

- The cost of the public good is P
- We add the total benefit from the public good to both consumers
- The optimal quantity of the public good (for each consumer and the economy as a whole) is X^*



Optimal Provision of Public Goods

- Suppose that in a two consumer economy, the demand for the public good by each consumer is:

$$D_1 : p_1 = 100 - x$$

$$D_2 : p_2 = 200 - 2x$$

- Determine the optimal quantity of the public good in this economy when the social cost of a unit of the public good is \$60

Optimal Provision of Public Goods

Solution: The total marginal benefit is a vertical summation of the two marginal benefit curves

$$p = \underbrace{100 - x}_{MRS^1_{x,y}} + \underbrace{200 - 2x}_{MRS^2_{x,y}} = 300 - 3x$$

The optimal amount of the public good is given by:

$$\begin{aligned} 60 &= 300 - 3x \\ x^* &= 80 \end{aligned}$$

The economy, and also each consumer, will consume 80 units at the optimum

Optimal Provision of Public Goods

Plug this amount into each demand curve to determine how much each consumer will contribute

$$p_1 = 100 - 80 = \$20 \text{ per unit of public good}$$

$$p_2 = 200 - 2 \cdot 80 = \$40 \text{ per unit of public good}$$

- The total cost to the economy is $80 \times 60 = \$480$
- Of this consumer 1 pays $80 \times 20 = \$160$
- Of this consumer 2 pays $80 \times 40 = \$320$

Overlapping Generations Model

		time period or birth					
		-1	0	1	2	3	4...
<i>t</i> , time period	0	o	y				
	1		o	y			
	2			o	y		
	3				o	y	
	4					o	y
	...						

Overlapping Generations Model

$$\max_{c_t^y, c_{t+1}^o, s_t} U(c_t^y, c_{t+1}^o)$$

s.t.

$$BC^y : c_t^y + s_t = w_t$$

$$BC^o : c_{t+1}^o = s_t(1 + r_{t+1})$$

Overlapping Generations Model

The Budget Constraint in the two periods can be defined as:

With Social Security

Young:

$$C_t + s_t = w_t(1-\tau)$$

Old:

$$C_{t+1} = s_t(1+r_{t+1}) + w_{t+1}\eta\tau$$



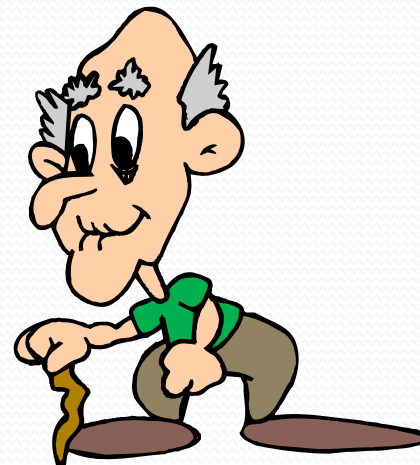
Without Social Security

Young:

$$C_t + s_t = w_t$$

Old:

$$C_{t+1} = s_t(1+r_{t+1})$$



Overlapping Generations Model

Lifetime Budget Constraint

With Social Security

$$c_t + \frac{c_{t+1}}{1+r_{t+1}} = w_t(1-\tau) + w_{t+1}\eta\tau$$

Without Social Security

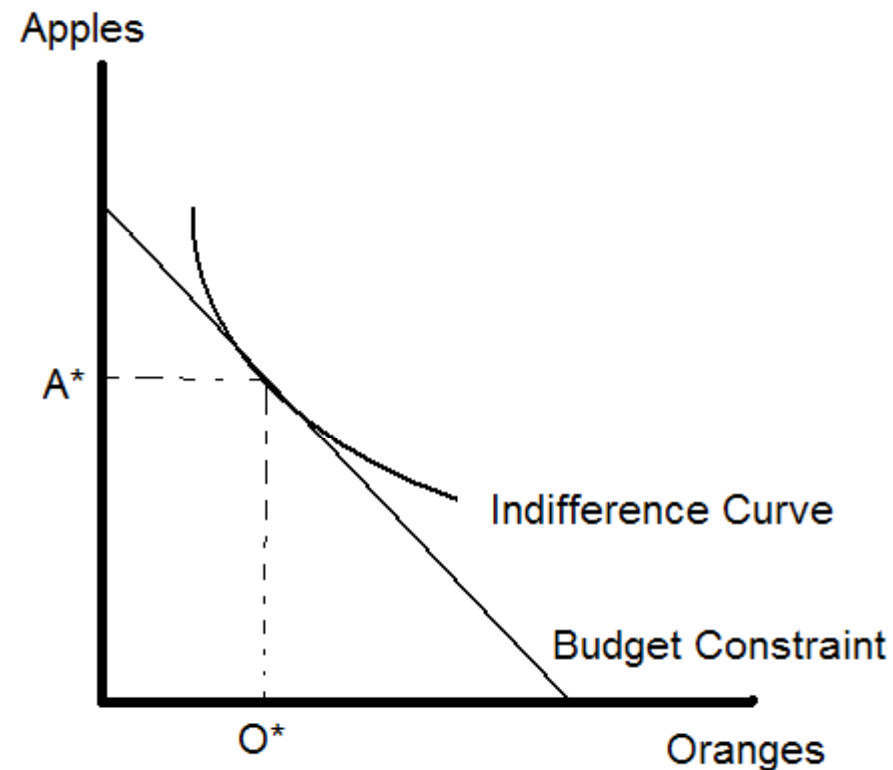
$$c_t + \frac{c_{t+1}}{1+r_{t+1}} = w_t$$

The Stolper-Samuelson Theorem

- The Stolper-Samuelson theorem is a basic theorem in trade theory
- It describes a relation between the relative prices of output goods and relative factor rewards, specifically, real wages and real returns to capital
- The theorem states that — under some economic assumptions (constant returns, perfect competition) — *a rise in the relative price of a good will lead to a rise in the return to that factor which is used most intensively in the production of the good, and conversely, to a fall in the return to the other factor*

Consumer Theory

- Consumer theory is a theory of microeconomics that relates preferences to consumer demand curves



Revealed Preference

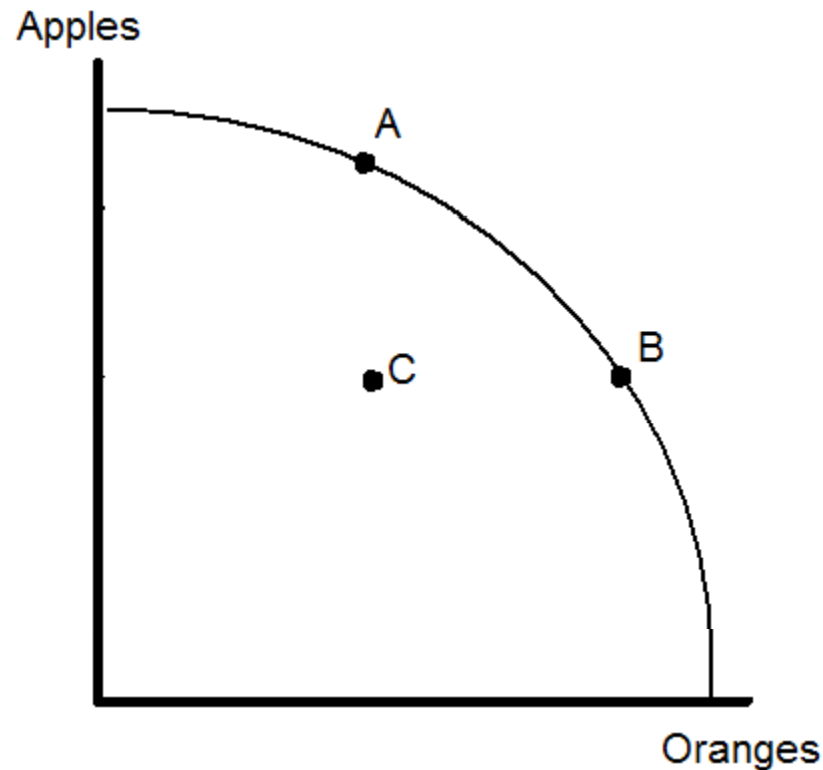
- In the classical consumer choice theory, we assumed that preferences are given and derived by the consumer's demand.
- In practice, preferences are not observed. The **revealed preference** provides the tool to estimate preferences based on observations of the choices made by consumers.



Revealed Preference

- The Theory:
 - If a person chooses a certain bundle of goods (ex. 2 apples, 3 oranges) while another bundle of goods is affordable (ex. 3 apples, 2 oranges), then we say that the first bundle is revealed preferred to the second
 - It is then assumed that the first bundle of goods is always preferred to the second
 - This *implies* that preferences are transitive. In other words if we have bundles A, B, C, ..., Z, and A is revealed preferred to B which is revealed preferred to C and so on then it is concluded that A is revealed preferred to C through Z
 - With this theory economists can chart indifference curves which adhere to already developed models of consumer theory

Revealed Preference



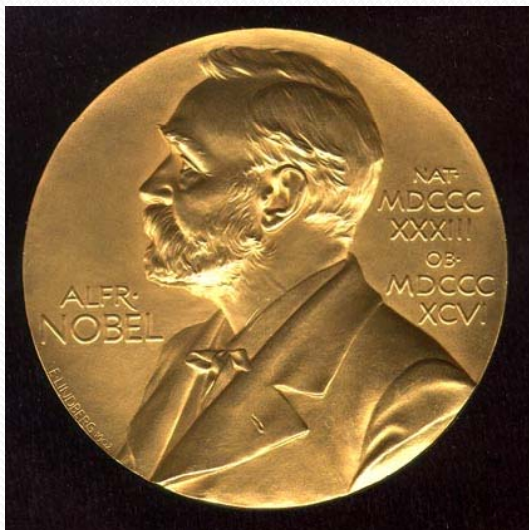
- If we know that bundle A is preferred to B and B is preferred to C, we can say that A is preferred to C

The Impact of Paul Samuelson

- Along with Kenneth Arrow, Samuelson is considered one of the founders of modern neoclassical economics
- He was also essential to creating the Neoclassical synthesis, which incorporates Keynesian principles with neoclassical principles and dominates current mainstream economics
- In 2003, Samuelson was one of the 10 Nobel Prize winning economists signing the Economists' statement opposing the Bush tax cuts

The Nobel Prize

- Samuelson won the Nobel Prize in 1970
"for the scientific work through which he has developed static and dynamic economic theory and actively contributed to raising the level of analysis in economic science"



Critique

- If, in a theoretical model, there exists only an apple and an orange, and that an orange is picked, then one can definitely say that an orange is preferred over an apple. In the real world, when it is observed that a consumer purchases an orange, it is impossible to say what good or set of goods or behavioral options were discarded in preference of purchasing an orange. In this sense, preference is not revealed at all in the sense of ordinal utility.

Marginal benefits of 3 neighbors from streetlights

#of streetlights	Bill	Tom	Fred
1	\$100	80	60
2	50	40	30
3	40	20	20
4	30	15	10
5	20	10	0
6	10	5	0

Questions on marginal benefits

1. If the cost of one streetlight is \$54, what is the socially optimal number of streetlights?
2. Will the market provide the optimal number of streetlights?

Marginal benefits of 3 neighbors from streetlights

#of streetlights	Bill	Tom	Fred	Total
1	\$100	80	60	240
2	50	40	30	120
3	40	20	20	80
4	30	15	10	55
5	20	10	0	30
6	10	5	0	15

Problems with public goods

1. **4 Streetlights**
2. **No, Free riding.** Each person hopes that others will pay for the streetlights. Each person enjoys having a streetlights without paying for it.