Leon Walras (1834-1910)

- Second founder on neoclassical economics
- One of the founders of marginal revolution (with W.S. Jevons and C. Menger)
- *Elements of Pure Economics*, 1874
- Originated General Equilibrium Theory (GET)
Walras’ GET

• GET is the analysis of the economy in which all sectors are considered simultaneously.

• All markets are considered in their interrelationships at once, you can analyze direct and indirect effects of any change in economic system, cross-market changes and the like.

• Walras’s contribution was to model the GE system in a formal, mathematical manner.

• What is the difference between partial equilibrium analysis (PEA) and general equilibrium theory (GET)?
Marshall’s PEA and Walras’ GET

• GE is more abstract than PE – more factors are assumed to be held constant in PE than in GE.

• In PE we allow only a very limited number of variables to vary– all others are assumed constant.
  • For example PE: \[ p_1 = f(q_1, p_2, \text{income}) \]
  • GE: \[ p_1 = f(q_1, \ldots, q_n, p_2, \ldots, p_n, \text{income}) \]

• GE allows many more variables to change, but not all of economic variables.
  • For example, in most of GE models we assume that the preferences, the technology of production, population, institutional framework of the society do not change.

• But all other economic factors, mainly prices and quantities on every market are assumed to be variables to be explained in GET.
Walras and GET

• In GE, a single change in the price of any single commodity will have repercussions in the whole system, in every market.
• Real incomes \((I/p)\) of consumers will change and consumers will respond by changing their consumption patterns, they will change their final demands for all other goods (if only slightly in some cases), \(D_i = f(p_i, \ldots, I/p)\).
• Firms will also change they output (in reaction to changing demand for their products). \(S_i = f(p_i, \ldots)\)
• Prices of factors of production (capital, labour etc.) will also change since firms are changing their demands for factors (e.g., \(w_i = MP_L * p_i\))
• And the distribution of income in the society will also be different.
General equilibrium effects – an example

Why this second-order effect occurs?
Formalization of GE model by Walras

• Walras expressed this interdependence of all markets in terms of mathematical equations.
• Assumed perfect competition; consumers maximize utility, firms maximize profits
• To formulate GE model, he wrote down 4 sets of equations
  – equations describing the conditions for market equilibrium for \( n \) final products (supply = demand, for final products)
  – equations describing determination of market prices for final products (\( p = MC \), no economic profits, no losses)
  – equations describing the conditions for market equilibrium for \( m \) factors of production (supply = demand, for factors of production)
  – equations for optimal employment of factors of production by firms for \( m \) factors (how inputs transform into products)
Walras’ model in mathematical form
\((n\) final commodities, \(m\) factors of production\)

price-cost equalities
\[ p_i = \sum_j b_{ji} w_j = B_i w \]
(n equations)

output market equilibrium:
\[ x_i = D_i(p, w) \]
(n equations)

factor market equilibrium:
\[ v_j = B_j x \]
(m equations)

market factor supplies:
\[ v_j = F_j(p, w) \]
(m equations)

so we have \((2n + 2m)\) equations. The unknowns are:

quantity of produced goods:
\[ x_i \]
(n unknowns)

quantity of factors:
\[ v_j \]
(m unknowns)

output prices:
\[ p_i \]
(n unknowns)

factor prices:
\[ w_j \]
(m unknowns)

so we have \((2n + 2m)\) unknowns.

\(B_i\) are production coefficients – amount of a given factor necessary to produce a unit of final product \(i\).
Research questions in GET asked by Walras

• Walras asked, is general equilibrium theoretically possible? Is there a set of prices and quantities, which clears all markets at one time (supply is equal to demand)?
  – This is the problem of the existence of solution to GE model. (1)

• But there are also other important questions for GE theory, in which Walras was interested in.
  – 2) Is there only one set of prices and quantities that is the solution of GE model? This is the so-called problem of uniqueness (of GE solution)
  – 3) Will the solution be a stable equilibrium or an unstable equilibrium? This is the problem of stability of GE solution.

Why stability is important?
Walras’ ‘solution’ to the existence of GE problem

• Thought that it is enough to count the number of variables to be calculated in the model and the number of independent mathematical equations in the model.

• If the number of variables (prices and quantities of final goods and factors of production -- 2m +2n) equals the number of independent equations (2m +2n), then there is one solution of a GE model.

• Is this proof correct?
Walras’ proof of the solution to the GE system of equations

• No, Walras’ proof is mathematically wrong (not rigorous), since
  – 1) there might be no solution to such a system (the system of equations can be contradictory)
  – 2) there may be more than one solution (maybe infinitely many),
  – 3) the solution can be economically meaningless (negative prices or solution not in the domain of real numbers).

• It took about 80 years to provide a rigorous proof (Arrow and Debreu 1954)
Walras’ views on economic policy

- Wanted to use abstract GE model in economic policy
- Argued that free competition results in a greatest possible satisfaction of wants, so he urged states to attempt, through, legislation, to create systems of perfectly competitive markets.
- But he also argued that
  - „It is quite clear that if one imagines that commodities were sold at high price to the rich and a low price to the poor, the former would only have to give up superfluous goods, while the latter would be able to afford necessities. Consequently, there would be a large increase in utility”
  - It is consistent with unrestricted markets? What social welfare criterion is he using here?
Walras on policy, cont.

• He thought of himself as (non-Marxian) socialist, and proposed that government intervention is desirable in many areas. Might be called an advocate of *market socialism*.

• For example, he demanded that state should take away all land rents from the landowners, because they represent *une earned, unjust income*.

• Thanks to this nationalization of land, there would be no need for taxation of income from labour and capital.

• If that would happen, Walras thought, the distribution of income would not be so unequal in the (corrected) capitalism.

• *Are his proposals internally consistent? Would they work in practice?*
Vilfredo Pareto (1848-1923)

• extended the analysis of Walras and applied it to welfare economics to analyze the welfare implications of various policies

• In the 1890s Pareto formulated a formal criterion to be used in evaluating economic outcomes and policies. This criterion is very-well known today, and named as Pareto optimality criterion.

• Pareto optimum is defined as an allocation of resources in an economy, in which it is impossible to make someone better off without making someone else worse off.
Pareto optimality.
We have the following allocations in two-person society. Which is Pareto optimal?

• A) (5,6)
• B) (3,5)
• C) (1000,5)
• D) (5,10)

Problems with Pareto optimality
• Are Pareto-optimal states unique?
• Would you like to live in C)?
• Are Pareto improvements (movements to Pareto-optimal states) often found in reality?
Pareto on optimality criterion

• Pareto wanted to prove that the allocation, which is the solution to the general equilibrium model, is Pareto optimal.
• This proposition – the competitive equilibrium in GE model is Pareto optimal allocation – has later (since 1950s) became to be known as the First Fundamental Theorem of Welfare Economics (FFTWE)
• FFTWE is sometimes described as the formalization of the invisible hand mechanism of Adam Smith
  – Is this correct?