### HISTORY OF ECONOMIC THOUGHT Lecture Notes for Week 6

Tomáš Cahlík

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## Neoclassical School in the Anglo Saxonian World and its Neighborhood before Keynes

#### British Thought

Belle Epoque in the United Kingdom was characterized by economic prosperity, advancements in technology, and a flourishing of the arts and culture. This period also witnessed the rise of the suffrage movement, as women campaigned for voting rights, reflecting broader social changes. Nonetheless, this era was also marked by social inequalities and underlying tensions.

The United Kingdom was one of the key Allied Powers from the outset of World War I in 1914. The war effort had a profound impact on British society and economy. The nation mobilized millions of soldiers, with significant battles fought on the Western Front. The war led to major social changes, including increased roles for women in the workforce to fill gaps left by men who went to fight. Rationing and economic strain were part of daily life. Politically, the war prompted shifts, leading to the Representation of the People Act 1918, which expanded voting rights.

After World War I, Britain faced significant economic difficulties, including high unemployment and debt, as the country rebuilt and adjusted to post-war conditions. The 1920s were marked by a brief period of economic recovery, followed by the General Strike of 1926, a major industrial action by workers. The global Great Depression in the 1930s further exacerbated economic challenges. Politically, Britain saw the expansion of social welfare programs and the rise of the Labor Party as a significant political force. The interwar years also saw increasing political tensions in Europe, to which Britain responded with a policy of appeasement towards emerging threats like Nazi Germany. **Phillip Henry Wicksteed (1844 – 1927)** was a theologian and economist. From 1867 to 1897 he was minister in the Unitarian Church, then he became a freelance writer and lecturer in the fields of philosophy, literature and economics. The current British economist Ian Steedman marked him as Jevon's only disciple and the Cambridge economist Pierro Sraffa marked him the purist of marginal theory.

Wicksteed emphasized the subjective nature of value and the importance of individual choice in economic decision-making. He criticized the Marx's theory of value that is based on the objective abstract value and stressed that abstract utility, not the abstract labor is the common element behind exchanges. His work extended the application of marginal analysis from the analysis of consumer choice to the allocation of scarce resources, which is currently one of central themes in microeconomics. He developed the idea that the wage rate, profit rate and rent are based on the marginal productivity of the factors of production - labor, capital and land.

**Francis Ysidro Edgeworth (1845** – **1926)** was an Anglo-Irish economist and statistician. He was professor at Oxford since 1891 and editor and coeditor of the "Economic Journal" since 1891. In his seminal work, *Mathematical Psychics* (1881), Edgeworth applied mathematical techniques to economics. He had a passion for mathematical economics, which he considered essentially a qualitative discipline.

Edgeworth is best known for his work on utility theory, where he introduced the concept which is today known as the "Edgeworth Box" (Figure 6-1) (the author of this name was the Italian economist Wilfredo Pareto, Edgeworth is the author of the name "Pareto optimality") - a graphical representation used in microeconomics to illustrate the benefits of trade and allocation of resources between two parties. This tool remains fundamental in current microeconomics: based on indifference curves for two individuals, it shows that bargaining negotiations bring them to some point on the contract curve in the exchange lens.



Figure 6-1: Edgeworth Box

Alfred Marshall (1842 – 1924) graduated in mathematics at Cambridge in 1863 and from 1884 to 1908 was there an elected professor of political economy. His *Principles of Economics* (1890) *served* as a basic reference text for generations of students (8th edition in 1920). In 1890, he was one of the grounders of the British Economic Association and the "Economic Journal".

In his *Principles of Economics*, he uses the "partial analysis". Instead of analyzing a general equilibrium on all markets, he analyzes equilibrium on one market (Figure 6-2). He uses the ceteris paribus assumption; everything that is not explicitly in the diagram does not change.



Figure 6-2: Partial Analysis in the Demand – Supply Diagram.

Basic questions in partial analysis are: Does an equilibrium exist? Is there only one equilibrium? Is it stable? What mechanism brings the system back to equilibrium if it happens to be out of equilibrium? We distinguish static analysis as in Figure 6-2 and comparative statics that involves comparing the static equilibria before and after a change, e.g. a shift of the demand curve.

In his last work *Money, credit and commerce* (1923), he introduced the Cambridge Equation M=kPY, that looks formally as the Quantity Equation of Money Mv=PQ but is interpreted as money demand. His student Keynes built up on this later.

Arthur Cecil Pigou (1877–1959) is known for his work in welfare economics and his influence on the study of public finance. He served as a professor of political economy at the University of Cambridge, succeeding his teacher, Alfred Marshall.

In his book *The Economics of Welfare* (1920) he opened the field of "Welfare Economics". He developed the concept of externalities—costs or benefits incurred by third parties not directly involved in a transaction. He argued that these externalities could lead to market failures, as markets do not always allocate resources efficiently or equitably. To address this, Pigou advocated for government intervention, such as taxes or subsidies, to correct these market failures, a concept now known as "Pigouvian taxes."

In his *Theory of Unemployment* (1933) he presented the idea that the decrease of prices during recession increases the real money balances, this increases the aggregate demand and, in this way, solves the problem of unemployment. Today we call this the "Pigou effect." In was in sharp contrast with Keynes's ideas in his *General Theory* (1936). Interesting is that both approaches were developed at Cambridge almost parallelly.

Lionel Robbins (1898–1984) graduated at the London School of Economics (LSE) and is perhaps best known for his influential work, *An Essay on the Nature and Significance of Economic Science* (1932), where he provided one of the most widely accepted definitions of economics. Robbins defined economics as "the science which studies human behavior as a relationship between ends and scarce means which have alternative uses." This definition emphasizes the role of scarcity and choice in economic analysis. He built up on Ludwig von Mises and Phillip Wicksteed. Let us present some of his ideas:

- The definition of a science has almost invariably not preceded, but followed the creation of the science.
- The best definition of economics relates it to disposing of scarce means.
- This definition does not limit the subject-matter of economic science.
- Definition of economics must be also applicable to the behavior of Robinson Crusoe, not to the exchange economy only.
- Definition of economics must be also applicable to the behavior of a communist executive, not to the exchange economy only.
- Economics is more than just the study of the causes of material welfare.

Robbins was also involved in policy and academic roles, serving as a professor at the LSE from 1928 to 1960, where he played a crucial role in shaping the institution's development and reputation.

### American Thought

The Belle Epoque in the USA was marked by rapid industrialization, economic growth, and technological advancements, such as the expansion of the railway system and the widespread use of electricity and the telephone. It was a time of great wealth for industrialists and entrepreneurs, like John D. Rockefeller and Andrew Carnegie, but also one of stark income inequality and challenging living conditions for many workers. Socially, the period was characterized by significant movements for reform, including labor rights, women's suffrage, and efforts to address corruption and social injustices.

Initially, the United States maintained a stance of neutrality in World War I. However, in 1917, it entered the war on the side of the Allies, motivated by issues such as unrestricted submarine warfare by Germany and the Zimmermann Telegram in which Germany proposed a military alliance to Mexico. American involvement provided a significant boost to the Allies in terms of manpower and resources. The war effort led to economic changes, with increased industrial production. Domestically, the war also accelerated social movements, including women's suffrage, which culminated in the 19th Amendment in 1920.

The United States experienced a period of significant economic growth in the 1920s, known as the "Roaring Twenties", characterized by industrial expansion and cultural change. However, this prosperity ended with the stock market crash of 1929, leading to the Great Depression. This economic crisis brought about widespread unemployment and poverty. In response, President Franklin D. Roosevelt implemented the New Deal in the 1930s, a series of programs and reforms designed to provide relief, recovery, and reform. The interwar period also saw significant social changes, including the prohibition era and the beginning of the civil rights movement's momentum.

John Bates Clark (1847 - 1938) graduated at Amherst in 1872 and did some post gradual work in Germany and Switzerland. Since 1895, he was professor at Columbia University in New York. Clark's most notable works are *The Philosophy of Wealth* (1886) and *The Distribution of Wealth* (1899) where he independently on Wicksteed in Britain elaborated the theory that wages and capital returns are determined by the marginal productivity of

labor and capital, respectively.

Clark also played a role in advancing the professionalization of economics as an academic discipline in the United States, helping to establish economics as a cornerstone of social science research. He was a key figure in the formation of the American Economic Association, serving as its president from 1893 to 1895.

In recognition of his profound impact on the field, the American Economic Association established the John Bates Clark Medal in 1947. It is awarded annually to an American economist under the age of 40 who has made significant contributions to economic thought and knowledge. This medal is considered one of the most prestigious awards in the field of economics, second only to the Nobel Prize in Economic Sciences.

**Irving Fisher (1867 – 1947)** is regarded as one of the major American economists and statisticians. He studied and worked at Yale, eclectically in economics, statistics, mathematics, physics, social sciences and philosophy. His seminal economic book *The Purchasing Power of Money* appeared in 1911.

Fisher made significant advances in understanding the relationship between inflation and interest rates, formalized in the Fisher Equation, which describes the connection between nominal and real interest rates and expected inflation. He was a pioneer in index numbers and contributed to the creation of reliable statistical methods for measuring economic variables, especially variables in the Quantity equation of money Mv=PQ.

He was co-founder of the Econometric Society in 1930. Despite his academic successes, he is famously known for incorrect optimism before the 1929 stock market crash, which dampened his reputation during his lifetime.

### Swedish School

The Belle Époque in Sweden was marked by significant societal transformation and modernization. It was a time when Sweden transitioned from a primarily agrarian society to a more industrialized and urbanized nation. Economic growth during this era was fueled by advancements in industries such as steel, timber, and manufacturing. This industrialization led to improvements in infrastructure, including the expansion of railways and the

introduction of electricity and telecommunication systems. This period also witnessed the early stages of the Swedish welfare state, with social reforms aimed at improving living conditions and addressing issues such as labor rights and education. Politically, Sweden experienced increased democratization, with movements advocating for expanded suffrage and political representation gaining traction.

During World War I, Sweden remained neutral, though it was economically impacted by the conflict. The war led to trade disruptions but also opportunities for Sweden to supply goods to the warring nations. Domestically, the war years saw increased political activity and social unrest, partly due to economic hardships and food shortages. The war period contributed to political changes, including moves towards a more democratic society with the introduction of universal suffrage in the years following the war.

Despite being neutral during World War I, Sweden faced economic challenges during the interwar period, particularly during the Great Depression. However, Sweden responded with innovative social and economic policies that laid the foundation for its modern welfare state. The Social Democratic Party came to power and implemented programs to reduce unemployment and improve social welfare. Politically, Sweden maintained its neutrality and avoided the political extremism that characterized much of Europe in this era. The interwar years were a time of social and political stability, allowing Sweden to position itself as a progressive and prosperous nation.

**Knut Wicksell (1851 – 1926)** was a Neo-Malthusian polemicist, a freelance lecturer and journalist, and finally professor in Lund, Sweden from 1899. In 1887, he gained a scholarship abroad, and he spent some time in London, Strasbourg, Vienna (he met Menger and Boehm-Bawerk there) and Berlin. He was the key person for the establishment of the Swedish economic school: Gunnar Myrdal, Bertil Ohlin and others developed later various aspects of his theory and used his methodology – sequential analysis.

Sequential analysis means the logical development of ideas and economic models built upon prior assumptions and conclusions in a step-by-step manner to reach broader conclusions. It focuses on the dynamic process rather than static equilibrium, considering how economies adjust over time rather than settling into a steady state. We see here a similarity with the methodology of the Austrian School, concretely Ludwig von Mises. Keynes used sequential analysis in his *A Treatise on Money* (1930) but later rejected it and returned to equilibrium analysis. His explanation of this change was the difficulty of timing different steps in sequences.

Wicksell in his essay *Value, Capital and Rent* (1893) developed before Wicksteed in Britain and Clark in the USA the theory that income distribution among factors of production is based on their marginal productivities.

Wicksell is best known for his work on the natural rate of interest—the rate at which savings and investment are in equilibrium, and which neither accelerates nor decelerates inflation. In his book *Interest and Prices* (1898) he developed the cumulative process for the explanation of inflation and deflation. If the market rate of interest is below the natural rate, borrowing becomes cheaper, leading businesses to invest more. This increased investment stimulates economic activity, raising demand for goods and services. If production does not keep pace with this heightened demand, prices begin to rise, leading to inflation unless corrective measures are taken. Conversely, if the market rate is above the natural rate, borrowing is discouraged, reducing investment and potentially leading to decreased economic activity. This can result in lower demand for goods and services, causing prices to fall, leading to deflation. Falling prices can lead to a decrease in production and economic stagnation, exacerbating the deflation unless adjustments are made.

Concerning capital, Wicksell was influenced by Eugen von Böhm-Bawerk, He adopted the idea that more "roundabout" methods of production—those that involve more stages, time, and capital—are more productive. The decision to use these methods depends significantly on the interest rate; lower interest rates make more capital-intensive production methods more attractive. Concerning the measurement of capital, he tried to base the aggregated capital on Bohm-Bawerk's average period of production. He did not succeed and later switched to working with disaggregated capital.

Wicksell also made significant contributions to fiscal theory and public finance. He analyzed different voting method and their efficiency. American economist James Buchanan built heavily on Wicksell's ideas while developing the Public Choice Theory in the second half of the 20ies century.

#### Summary

The Belle Epoque in the UK was a time of economic prosperity and cultural flourishing, coinciding with the rise of the suffrage movement, yet marked by social inequalities that contributed to World War I in which Britain was a key Allied Power. Post-war Britain faced economic difficulties, exemplified by the General Strike of 1926 and the impact of the Great Depression, even as it saw political developments like the rise of the Labor Party and increased social welfare.

Following influential economists are introduced: Phillip Henry Wicksteed, who critiqued Marx's value theory and extended marginal analysis in economics; Francis Ysidro Edgeworth, known for his development of the utility theory and the Edgeworth Box, used in microeconomics to show benefits of exchanges; Alfred Marshall, who developed partial analysis and influenced Keynes; Arthur Cecil Pigou, who introduced welfare economics and developed the concept of externalities; and Lionel Robbins, who provided a widely accepted definition of economics emphasizing scarcity and choice. Robbins also played a significant role in shaping the London School of Economics. These figures contributed foundational ideas in economic theory, influencing both policy and academic thought.

The Belle Epoque in the USA was marked by rapid industrialization, economic growth, and technological advancements, including the expansion of railways and the use of electricity and the telephone. This era saw significant growth of wealth for industrialists like John D. Rockefeller and Andrew Carnegie but also stark income inequality and poor living conditions for many workers. It was a period of significant reform movements, such as labor rights and women's suffrage.

Initially neutral in World War I, the US entered the conflict in 1917 on the Allies' side. The 1920s, known as the "Roaring Twenties," were a period of economic growth and cultural change, but this prosperity ended with the 1929 stock market crash, leading to the Great Depression. In response, President Franklin D. Roosevelt's New Deal in the 1930s provided relief and reform. The interwar period also saw significant social changes, including prohibition and the beginnings of the civil rights movement.

John Bates Clark was a key figure in American economics, notable for his work on

marginal productivity theory and professionalizing economics as a discipline. He helped form the American Economic Association, which created the John Bates Clark Medal in his honor. Irving Fisher was another major American economist, known for his work on interest theory and the quantity theory of money. Fisher's contributions included the Fisher Equation and advancements in index numbers and statistical methods, though his pre-crash optimism in 1929 overshadowed his reputation.

The Belle Époque in Sweden was a period of significant transformation from an agrarian to an industrialized and urbanized society, driven by advances in steel, timber, and manufacturing industries. This era saw improvements in infrastructure, including railways, electricity, and telecommunications, and marked the early stages of the Swedish welfare state with social reforms. Increased democratization led to expanded suffrage and political representation. Despite remaining neutral in World War I, Sweden experienced economic impacts. The interwar period tested its economy during the Great Depression. Sweden's response involved innovative social policies, strengthening its welfare state and achieving social and political stability.

Knut Wicksell, a pivotal figure in Swedish economics, influenced various economists and contributed to fiscal theory, public finance, and the natural rate of interest concept. He introduced the cumulative process theory for inflation/deflation and emphasized sequential analysis in economic modeling. His work on capital was influenced by Eugen von Böhm-Bawerk, focusing on production methods and interest rates' role in economic decision-making. Wicksell's ideas have informed later developments, including the Public Choice Theory.

# Theories of Economic Growth and Development in Historical Perspective

Since Adam Smith, economist have been always analyzing the "wealth of nations". Today, we measure it usually by Gross National Product (GDP) and its growth – economic growth - is in the center of interest for both economists and politicians. GDP per capita (per head) has been in the last century the basic measure of the standard of life.

Nicholas Kaldor (1908 Budapest – 1986) was a prominent British economist which became an influential figure in the post-war economic landscape. He insisted that theorists should always begin with a summary of facts a theory is supposed to explain. At a conference on capital accumulation in 1958 he formulated a set of stylized facts on economic growth: Rates of economic growth vary substantially across countries. Growth rates are not constant over time. Countries can move from "being poor" to "being rich" and vice versa. There is enormous variation in the standard of life measured by per capita income among countries.

A similar set of stylized facts could have been formulated in classical time as well, of course with the use of a different terminology.

Stocks of factors of production generate GDP as a flow of final goods and services. We can consider some of following factors:

- Physical capital K,
- Labor L (depends on population),
- Technology A,
- Human capital H,
- Institutions,
- Land,
- Natural Resources.

Classical economists usually discussed the role of capital, labor and land.

To illustrate the importance of natural resources, we can mention:

- William Stanley Jevons's *The Coal Question: An Inquiry Concerning the Progress of the Nation, and the Possible Exhaustion of our Coal Mines* (1865),
- The Club of Rome, an influential think tank that focuses on addressing global challenges, published in 1972 *The Limits to Growth*. The report aimed to explore the long-term consequences of exponential economic and population growth in a world with finite resources. It was based on a computer simulation study conducted by a team of researchers at the Massachusetts Institute of Technology (MIT). It predicted:
  - Food crisis,
  - Natural resource exhaustion,
  - Environmental degradation due to overexploitation and waste of natural resources resulting from the exponential growth in economic activities,
  - End of industrialization and death rate increases in the first two decades of this century.

#### Population Growth and Income per Head

Population growth has two economic effects. It increases the stock of labor but the created product must be divided among more people. Before Thomas Malthus, low population had been considered as a barrier to economic development (and military success). Nowadays, we basically see the negative effects of population explosions.

The rate of population growth is the difference between the birth rate and the death rate. In the first phase - before the increase of economic performance in the capitalist era, both the birth and the death rate were high and the rate of population growth low. In the second phase, demographic transition starts with economic growth, the birth rate stays high but the death rate decreases and the rate of growth of population increases. In the third phase, birth rate decreases and in the fourth phase both the birth rate and the death rate are low and the rate of growth of population is low again as in the first phase.

In the history of European economies developing in the 19<sup>th</sup> century, the scissors between the birth and the death rates were not opened too much. In developing countries

in the 20is century, with the import of new medicines and better nutrition, the death rate decreased quickly and the birth rate stayed on the customary level. This is the basic explanation for population explosion.

Thomas Malthus in his *An Essay on the Principle of Population* (1798) describes how any increase of wages just leads to higher number of children. He believes that people have an instinct that leads them to the maximization of the number of children. This keeps income on the subsistence level. He believes he proves scientifically the impossibility of amelioration of social conditions. He believes that population grows exponentially and subsistence goods (food) arithmetically. The only check are disasters of various types. **Sequence:** Wages in a family bring the subsistence level of income to the family => Increase of wages => increase of income per head above the subsistence level per head => increase of the number of children => income per head returns back to the subsistence level => when children grow up, higher supply on the labor market decreases wages to the subsistence level again.

This model is not realistic for current situation. The experience shows that families can control the number of children. We can use a "neoclassical "model in Figure 6-1 instead. This model compares marginal utility (MU) of children with marginal disutility (MD). Children can be a form of social insurance, can work, can bring pleasure. They are costly, not only direct costs but especially opportunity costs can be very high. In the early stage of economic development (from 0 to 1), marginal utility increases because of the possibility of child labor and marginal disutility increases because of rising opportunity costs. This explains rising population. In the later stage of economic development (from 1 to 2), marginal utility decreases because of the development of systems of social insurance and ban on child labor and marginal disutility increases because of rising opportunity costs. This explains declining population.



Figure 6-1: Optimizing the Number of Children.

### **Economic Development Models**

#### David Ricardo's Model of Development:

We can describe this model verbally in the following sequence:

On the labor market, wages are on the subsistence level and supply of labor is fixed in the short run => accumulation of capital increases demand for labor => Increase of wages above the subsistence level => increase of the number of children (Ricardo applies here Malthus's population theory) => increased demand for agricultural products => price of agricultural products increases because worse pieces of land start being used and it increases the marginal costs in agriculture => subsistence level of wages increases => profits decrease while rents of the owner of better than the worst piece of land increase (Ricardo applies here Malthus's theory of extensive differential rent) => when children grow up, we get higher short run supply on the labor market on that new subsistence level of wages.

Another possibility is its presentation in Figure 6-2. Ricardo could not have used this graphical presentation, in which some marginalist features are present, e.g. the declining slope of the demand for labor curves.



Figure 6-2: Ricardo's Model of Development. (SS short run supply, LS long run supply, K capital, WS subsistence wage, N population, HS food supply)

Accumulation of capital shifts demand for labor from D0 to D1, in the short run wages increase, population grows, demand for food grows but not so much as to push agriculture to start to use land of worse quality. Continuing accumulation of capital shifts demand for labor from D1 to D2, in the short run wages increase, population grows, demand for food grows and pushes agriculture to start to use land of worse quality. Price of corn increases and subsistence wage must increase as well. This causes the decrease of profits. Rents of owners of land that is better than the land of the worst quality increase (Malthus's theory of extensive differential rent is applied here).

Ricardo realized that the decrease of profits decreases both the motivation for entrepreneurs (capitalists) and the sources for the accumulation of capital. He assumes that landlords use their rents for consumption, not for accumulation. Nowadays, we call this mechanism the Ricardian trap. In the long run, this process leads to the so-called secular stagnation.

Ricardo's remedy was the abolition of corn laws that made the import of cheaper corn impossible and kept the price of corn high. It would break the trap. Malthus was against the abolition; he stressed that for avoiding depressions, the rental income of landlords is important as part of aggregate demand.

Weak point in Ricardo's model is the Malthusian mechanism behind the long-run labor supply being on the subsistence wage level. It pushes us to mix together different time horizons and makes the sequence clumsy. Other development models keep the basic logic of the Ricardo's model but explain why wages are kept on the subsistence level differently. Before Ricardo, Adam Smith explained wages on the subsistence level stemming from different bargaining positions of workers and capitalists.

#### Karl Marx's Model of Development

Karl Marx explained the weak bargaining position of workers with the existence of the industrial reserve army. The existence of this army guarantees that it is always possible to find workers willing to work for the subsistence wage. In Ricardo's model, there are three classes: capitalists, workers and landlords. Marx used only two classes: capitalists and workers. Instead of being afraid of secular stagnation, he believed that the scissors between the shares on income of workers and capitalists are opening more and more. This intensifies the class struggle and inevitably leads to a socialist revolution.

#### Lewis – Ranis - Fai Type Model of Development:

Sir William Arthur Lewis (1915 – 1991) was a Saint Lucian economist. He got his Nobel Prize in Economics in 1979, sharing it with Theodore Schultz, for their pioneering research into economic development issues, particularly concerning developing countries. Lewis introduced his "dual-sector model" in the 1950s. This model describes a developing economy with two sectors: a traditional agricultural sector and a modern industrial sector. Lewis argued that transferring labor from the overpopulated agricultural sector, where the marginal productivity of labor is approximately zero, to the industrial sector could drive economic growth without initially reducing agricultural output; that is without the decrease of the supply of food and increase of its price. Increase of food prices would necessitate the increase of wages in the industrial sector and decrease profits and sources for the accumulation of capital and accompanying economic growth. The logic behind this model is Ricardo's logic. Gustav Ranis and John C. H. Fei were economists known for their contributions to the field of development economics. Their collaboration resulted in the development of what is sometimes referred to as the "Ranis-Fai Model," which builds on and refines the Lewis model by incorporating additional real-world factors that impact economic development. Their ideas were published in 1964 in *Development of the Labor Surplus Economy: Theory and Policy*.

They warn against the "shortage point", in which further decrease of workers in agriculture decreases agricultural production. Food prices start to increase, subsistence wage must increase and economy gets into the Ricardian trap. Their remedy was technical progress in agriculture and the real development in many countries really took this direction.

The transformative period in agriculture after World War II, extending into the late 1960s, is called "The Green Revolution". It increased significantly food production through innovations such as improved seed varieties, chemical fertilizers, pesticides, irrigation, and mechanization. These advancements enhanced food security in parts of Asia and Latin America. However, the revolution also brought challenges like environmental degradation from chemical use, loss of biodiversity due to monocultures, and increased economic disparities between large and small farmers. Despite these issues, the Green Revolution played a crucial role in transforming global agriculture and creating the necessary condition for industrialization.

#### Economic Growth Models

The Harrod-Domar Growth Model was developed independently by the British economist Sir Roy F. Harrod (1900 – 1978) and the Russian-American economist Evsey Domar (1914 – 1997). Harrod's relevant publication is *An Essay in Dynamic Theory* (1939), Domar's is *Capital Expansion, Rate of Growth, and Employment* (1946). Their model emphasizes the role of investment in driving economic growth and highlights the conditions necessary for an economy to maintain steady growth over time. At the core of the model are two key concepts:

• Demand effect of investments:

S (Savings) = I (Investments): This equation is the basic macroeconomic identity.  $\Delta$ Y (Increase of Income) = s (saving rate) times I: This equation applies the key Keynesian concept, the multiplier.

• Supply effect of investments:

 $\Delta Y = (1/c)$  times I: This equation applies another key Keynesian concept, the accelerator. c = accelerator effect, 1/c is marginal productivity of capital.

"The Knife – Edge Problem": We start in equilibrium between demand and supply. This equilibrium is unstable. If demand effect is higher than supply effect, productive capacity lags. This implies an increase in investments by entrepreneurs, the demand effect is higher than supply effect again. We move more and more away from the original equilibrium. We stay in equilibrium only if demand effect equals the supply effect; only if s = 1/c, which is really a very strict condition.

The neoclassical criticism of the Harrod-Domar model attacks its assumption of constant marginal productivity of capital, in other words the fixed capital-output ratio. Nonetheless, its insights are useful for developing countries and are further developed in the frame of the Post-Keynesian Economics.

**The Solow-Swan model**, also known simply as the Solow growth model, is a foundational framework in current economic growth theory developed independently by the American economist Robert Solow (1924 - 2023, Nobel Prize in Economics in 1987) and the Australian economist Trevor Swan (1918 - 1989) in the 1950s. One of the assumptions of this model is the decreasing marginal productivity of capital. With this assumption, model converges to an equilibrium, called the steady state.

This model uses the Cobb – Douglas production function, a widely used mathematical model in economics that describes the relationship between inputs and outputs in production processes. It is expressed in the form:

 $Y = A \cdot K^{\alpha} \cdot L^{\beta}$ 

Where:

• Y is the total output or production,

- A represents total factor productivity, which captures the effects of technology,
- K is the input of capital,
- L is the input of labor,
- $\alpha$  and  $\beta$  are the output elasticities of capital and labor, respectively.

The Cobb-Douglas production function was introduced in 1928. Charles W. Cobb (1875–1949) was an American mathematician and economist, Paul H. Douglas (1892–1976) was an American economist and politician, serving as a U.S. Senator from Illinois.

This model is the basic growth model taught in current mainstream Macroeconomics courses. Post-Keynesian economists are critical to the whole concept of production function and to the neoclassical understanding of capital. So, they are critical to the Solow growth model, too.

#### **Comparison of models:**

**Ricardo's Model** converges to a steady state of secular stagnation. Accumulation of capital – investment – decreases because of the decreasing share of profits that leads to decreasing motivation of capitalists to accumulate. Aggregate demand does not play any role, Ricardo accepts the Say's law ("supply creates its own demand ").

**Marx's Model** stresses the growing exploitation of workers and the instability resulting from it. This instability leads inevitability to a socialist revolution.

Lewis – Ranis – Fai Type Model is a Ricardo type model with application of marginalist concepts. It stresses the importance of agriculture, for generating both labor and demand for industries. It continues to be used in "Development Economics ".

**Harrod – Domar Growth Model** is a Keynesian model; it uses Keynesian tools – multiplier and accelerator - and shows the instability of a capitalist economy. It is criticized for the assumption of constant marginal productivity of capital. It shows the importance of aggregate demand, the Say's law is refused.

**Solow (Solow-Swan) Growth Model is** a neoclassical growth model. It explains the long run stability of a capitalist economy, with a growing standard of life. It uses the assumption of decreasing marginal productivity of capital. The Say's law is accepted.