



From Wealth to Intertemporal Dynamics: A Comprehensive Critical Evaluation of Economic Definitions and the Superiority of Samuelson's Formulation in Modern Economics

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1. Abstract

The definition of economics has passed through a continuous evolution, reflecting the changing trends of human society and resource allocation. Although economists at different times have put forward theories from their respective perspectives, a unified and critical synthesis of all these concepts in the context of the contemporary global economy is still lacking in the field of academic research today. This large review paper comprehensively integrates almost all major economic definitions, starting from the classical wealth-centric model to the perspectives of scarcity and welfare, and provides a deep comparative analysis.

Determining the theoretical limitations, merits, and practical aspects of each theory through a rigorous comparative framework constitutes the main part of this study. At the end of this holistic analysis, Paul Samuelson and William Nordhaus's 'Growth-oriented definition' is established as the most powerful, superior, and dynamic model of modern economics. This comparative study proves that in the rapidly changing times of the 21st century and in modern economics, only Samuelson's model is the most accurate, comprehensive, and realistic compared to all other theories.

Key words: Economic definition, Neo-classical synthesis, Intertemporal dynamics, Comparative economic thought, Samuelson's theory, Microeconomic evolution.

JEL Classification Codes:

- **B10:** History of Economic Thought through 1925
- **B20:** History of Economic Thought since 1925
- **B31:** History of Economic Thought: Individuals

2. Introduction

Economics is an integral part of human society, which determines the complex relationship between human's unlimited wants and limited resources. However, confining economics within a specific and universally acceptable formula has always been a challenge in the pages of history. Just as human society and economic systems have changed over time, the definition of economics has also progressed through a continuous evolution.

I). Evolution of Economics and Conflict of Concepts

In this changing journey of economic thought, several major streams have emerged, each of which reflects the image of its own time:

- **Classical Era:** Early economists like Adam Smith referred to it merely as the 'science of wealth', where the holistic welfare of society was largely ignored.
- **Neo-Classical Era:** Later, Alfred Marshall brought the concept of 'human welfare' to economics, although its scope was confined only to material welfare.
- **Analytical Era:** Lionel Robbins gave economics the form of a neutral science, emphasizing 'scarcity' and 'choice'.

II). The Need for a New Analysis in the Modern Context

Since the recent global economy is changing rapidly, the old static definitions cannot fully express the true nature of current modern economics. Just as a new and perfect mathematical formula provides a clear solution to old problems, exactly similarly Paul Samuelson and William Nordhaus's 'Growth-oriented definition' overcomes the limitations of old economic theories and paves the way for future growth. In the current context, a scientific re-evaluation of each of these theories is highly necessary.

III). Main Objectives of the Research Paper

This Review Paper covers the following key aspects:

- Preparing a holistic foundation by integrating all major theories of the history of economics.
- Providing a distinct and deep comparative analysis of the positive and negative aspects of each theory.
- Logically establishing why Samuelson's formula is superior and dynamic compared to all other definitions in the contemporary context.

3. Research Methodology

To achieve the main objective of establishing Samuelson and Nordhaus's model as the best through a comprehensive evaluation of economic definitions and theories, a Systematic, Analytical, and Comparative Research Design has been adopted in this study. The entire research process is divided into several important stages in a logical sequence as mentioned below:

3.1. Nature and Design of Research

This study is essentially qualitative Research. Since it theoretically analyzes various definitions and theories of economics, the research design is entirely Review-based. No direct use of Primary Data has been made here; rather, an attempt has been made to reach a new intellectual and logical conclusion based on historical evolution and theoretical information.

3.2. Sources of Data Collection

The study is entirely based on Secondary Data. The information has been collected from the following primary sources:

- **Classical texts and original sources:** Deep study of original texts like Adam Smith's 'Wealth of Nations', Alfred Marshall's 'Principles of Economics', Lionel Robbins's 'An Essay on the Nature and Significance of Economic Science', and Paul Samuelson's 'Economics'.
- **Published research papers:** Previously published articles, critical essays, and review papers in various high-standard international journals.
- **Academic resources:** Authentic university-level textbooks and contemporary global economic reports.

3.3. Parameters for Comparative Analysis

To accurately evaluate the positive and negative aspects of each theory and to provide an impartial comparison among them, certain Parameters have been set:

- **1. Relevance:** How applicable the theory is in the current changing economic system.
- **2. Scope:** Whether the theory covers all major aspects of economics (e.g., production, distribution, consumption, and growth).
- **3. Practicality:** Whether the theory is confined only to imaginary concepts or is effective in solving real-world problems.
- **4. Future-oriented Approach:** Whether the theory can encompass future economic growth and challenges.

3.4. Process of Sectioning and Analysis

At this stage of the research, every major economic definition has been divided into a distinct Section. A specific structure has been followed in each section:

- First, a description of the founder and the historical background of the theory.
- Discussion of the core concept and positive aspects (Pros) of the theory.
- Subtle analysis of the limitations and criticisms (Cons) of the theory. After this, a

common comparative section has been prepared by integrating all theories, which will clarify the differences between each theory and the conceptual evolution of economics.

3.5. Methodology for Determining Superiority

In the final stage of the research, Paul Samuelson and William Nordhaus's definition is comprehensively evaluated. To prove why this formula is better compared to all previous theories, an 'Elimination and Elevation' method has been adopted. That is, by pointing out the negative aspects of previous theories, they have been discarded, and it has been established with logic and evidence how Samuelson's definition removes those weaknesses and embraces the concept of the modern digital economy and Sustainable Development.

4. Sectional Analysis of Economic Theories:-

4.1. Adam Smith's Wealth Definition

When starting the conceptual history of economics, the first name that comes up is the famous Scottish philosopher and classical economist Adam Smith. Through his groundbreaking book published in 1776, "An Inquiry into the Nature and Causes of the Wealth of Nations" (The Wealth of Nations for short), he established economics as a distinct and independent science. Hence he is called the 'Father of Economics'.

a) The Definition and Core Concept

According to Adam Smith, "Economics is the science of wealth".

According to this formula, the sole and main objective of economics is to study how the wealth or Material Wealth of a country can be produced, how it can be increased, and how it is used. In his concept, a person always works for his own profit, whom he termed 'Economic Man'. He believed that if people work for their own profit in a free market, the 'Invisible Hand' or market forces will automatically increase the wealth of the entire society.

b) Pros / Positive Aspects

Smith's theory has several very important contributions, which have also built the foundation of modern economics:

- **First Scientific Approach:** Before Smith, economics was not thought of as a separate subject. He was the first to separate economics from philosophy and politics, giving it the status of an independent science.
- **Division of Labor:** His concept of division of labor for increasing wealth is applicable in every industry in the world today. If a task is divided into smaller parts and given to workers, production increases rapidly.
- **Laissez-Faire:** He advocated for a free market without government intervention, which is the main basis of current Globalization and Liberalization.
- **Focus on Wealth Creation:** He boldly presented the realistic truth that to remove poverty from a country, it is most important to first increase wealth or GDP.

c) Cons / Criticisms

Later economists (like Carlyle, Ruskin, and later Alfred Marshall) severely criticized this theory of Smith. Its main flaws were:

- **Over-emphasis on Wealth:** In Smith's formula, wealth is everything. But in reality, the purpose of human life is not just to earn money. Wealth is for humans; humans are not for wealth. This theory made humans subordinate to wealth.
- **Ignorance of Human Welfare:** There was no place for the development of the poorer sections of society or human welfare in this theory. As a result, literary figures mocked economics as a "Dismal Science" or the "science of bread and butter".
- **Unrealistic 'Economic Man':** According to Smith, humans only work selfishly for money. But in reality, humans also do many things out of love, respect, patriotism, and a sense of duty, which he completely ignored.
- **Exclusion of Immaterial Services:** According to Smith, only producing things that can be seen with the eyes (like clothes, food) is wealth. He did not consider immaterial services like those of a teacher, doctor, or lawyer as productive work, which is a massive flaw.

d) Brief Comparative Transition

Although Adam Smith's definition built the foundation of economics, it was incomplete and mechanical. To correct the mistake he made by giving wealth the highest place, Alfred Marshall later had to bring humans to the center instead of wealth through his 'welfare theory'. However, when compared with Samuelson's modern formula, it can be seen that Smith's theory was confined only to wealth production; there was no concept of future economic growth or sustainability in it.

4.2. Alfred Marshall's Welfare Definition

The need arose to rescue economics from the mechanical and ruthless form given to it by Adam Smith's 'wealth theory'. Towards the end of the nineteenth century, in 1890, Neo-classical economist Alfred Marshall published his famous book "Principles of Economics". Through this very book, he shifted the focal point of economics away from 'wealth' to 'human beings' and bestowed a new humanistic dignity upon economics.

a) The Definition and Core Concept

According to Marshall, "Economics is a study of mankind in the ordinary business of life; it examines that part of individual and social action which is most closely connected with the attainment and with the use of the material requisites of well-being."

The main point of this definition is that money or wealth is merely a means to achieve human welfare. Achieving human welfare is the actual goal (End). Marshall made it clear that economics studies wealth on one hand, and on the other hand, which is more important, it studies humans. Instead of a religious or political man, he emphasized the daily economic activities of an 'ordinary human being' living in society.

b) Pros / Positive Aspects

Marshall's theory created a huge stir in the world of economics and it had several very strong aspects:

- **Restoration of Status of Economics:** The stigma of "dismal science" given to economics by literary figures was wiped away by Marshall by placing human welfare at the highest position.
- **Human-centric Approach:** In Smith's theory, wealth was paramount, but Marshall proved that wealth is merely a tool to fulfill human needs. Without humans, wealth has no value.
- **Study of Ordinary Life:** Instead of an imaginary 'economic man' isolated from society, he shed light on the real life of ordinary people who live socially and experience happiness and sorrow.
- **Classification of Activities:** Marshall divided human activities into two parts—those activities that promote welfare and those that do not. He opined that economics should only cover those material activities that promote welfare.

c) Cons / Criticisms

Although Marshall's theory was outwardly very beautiful, modern economists like Lionel Robbins severely criticized it later. Its main flaws were:

- **Subjective Nature of Welfare:** The biggest negative aspect is that the concept of 'welfare' is entirely mental and subjective. An object that brings welfare to one person might not bring welfare to another. It is impossible to measure 'welfare' specifically mathematically or statistically. Such a vague concept is not acceptable for a research paper or scientific formula.
- **Restricted to Material Goods:** Marshall only spoke of 'Material well-being'. According to him, only visible goods promote welfare. Immaterial services (like the services of a doctor, teacher, or researcher) were partially kept out of the scope of economics by him, which is a big mistake in the modern age.
- **Problem of Harmful Goods:** Goods like alcohol, cigarettes, or intoxicating substances have demand and value in the market, meaning they create economic activity. But they do not promote human 'welfare'. According to Marshall's theory, these should not be the subject matter of economics, but in reality, their production and sale are a large part of the economy.
- **Lack of Neutrality:** According to Robbins, economics should only analyze causes and effects. Making a moral judgment on whether something will lead to welfare or not is not the job of economics.

d) Brief Comparative Transition

Compared to Adam Smith's theory, Alfred Marshall's definition was definitely a big upgrade because it gave more importance to humans than money. But by using a non-quantifiable concept like 'welfare', it failed to give economics the form of a specific and neutral science. In today's changing times and compared to Samuelson's modern formula, Marshall's theory seems like merely an emotional perspective, lacking rational or mathematical analysis for problem-solving. From this, Lionel Robbins's 'scarcity theory' was born, which attempted to give economics the status of a rigorous science.

4.3. Thomas Malthus's Theory of Population

In 1798, British economist Thomas Robert Malthus published his famous essay "An Essay on the Principle of Population". This theory is an exception in the history of economics because it analyzes the

economy from a purely mathematical and demographic point of view, which brings a beautiful analytical dimension to the paper.

a) Core Concept and Mathematical Analysis

Malthus's theory is primarily based on the comparative study of two opposite mathematical progressions:

- **Geometric Progression of Population:** Because human reproductive capacity is infinite, the population grows rapidly at a geometric rate like 1, 2, 4, 8, 16, 32...
- **Arithmetic Progression of Food:** On the other hand, due to limited agricultural land, food production can only be increased at an arithmetic rate like 1, 2, 3, 4, 5...

He claimed that due to this fundamental difference in economic structure, a severe shortage of food would eventually occur, and nature itself would restore this balance through famine or pandemics.

b) Positive Aspects

Malthus's contribution to economics can never be denied:

- **Warning of Resource Scarcity:** Malthus was the first to warn the world about the terrifying conflict between the earth's limited resources and the growing population.
- **Influence on Policy Formulation:** Based on his theory, various countries later adopted population control policies and the concept of family planning.
- **Contribution to Science:** The 'Struggle for existence' concept of this theory helped Charles Darwin formulate his famous 'theory of evolution'.

c) Cons / Criticisms and Comparative Transition

Although it seems very perfect from an analytical point of view, many negative aspects of this theory emerged in the real world:

- **Ignored Technological Advancement:** Malthus completely ignored the power of future science and technology. He did not foresee that production could be increased manifold through the Green Revolution and modern scientific methods.
- **Misconception of Demographic Changes:** The realistic psychological aspect that people themselves reduce the birth rate along with education and economic development was left out here.
- **Failure of Mathematical Ratios:** At no stage in history was the growth of population and food observed in the specific geometric and arithmetic ratios he claimed.

While Adam Smith's theory emphasized wealth creation, Malthus showed that merely increasing wealth is not enough; it must be balanced with the population. However, compared to modern economics and Samuelson's formula, Malthus's theory is a highly pessimistic and incomplete model that denies the possibilities of technology.

4.4. David Ricardo's Theory of Comparative Advantage

Among the classical economists, the most influential figure right after Adam Smith and Thomas Malthus was David Ricardo. Through his groundbreaking book "On the Principles of Political Economy and Taxation" published in 1817, the specific and logical model of international trade he presented is known

even today as a major foundation stone of the Global Economy.

a) The Core Concept and Analysis

Ricardo's 'theory of comparative advantage' explains the main reasons and benefits of international trade. Before him, Adam Smith had spoken of 'Absolute Advantage', where for trade to occur between two countries, one country had to be completely superior in producing an item than the other. But Ricardo gave this concept a new dimension.

According to Ricardo's theory, "In international trade, a country should specialize in the production and export of only those goods which they can produce at a comparatively lower cost or lower opportunity cost than other countries."

For example, suppose country 'A' is better than country 'B' in producing both clothes and residential goods (absolute advantage). Still, country 'A' should not produce both; it should invest its time and labor only in the item whose production yields the highest comparative profit, and import the other item from country 'B'. As a result, both countries will benefit.

b) Pros / Positive Aspects

The contribution of Ricardo's theory to economics is immense:

- **Foundation of Globalization:** The main theoretical foundation of the Free Trade and Global Supply Chain existing in the world today is Ricardo's formula.
- **Concept of Opportunity Cost:** This theory was the first to practically prove the concept of 'opportunity cost', which is an integral part of modern microeconomics.
- **Optimal Resource Allocation:** If every country focuses on its best area, resource wastage across the globe is minimized and maximum production becomes possible, which promotes global welfare.

c) Cons / Criticisms

Although the theory seems perfect from a logical standpoint, it is severely criticized due to the limitations in applying it in the real world:

- **Ignorance of Transport Costs:** Ricardo assumed in his model that no transport costs are incurred when moving goods between two countries. In reality, many comparative advantages disappear due to additional transport costs.
- **Unrealistic Perfect Competition:** This theory assumes that there is perfect competition in the market and there are no tariffs or trade barriers among all countries, which is absolutely impossible in the modern world.
- **Labor Theory of Value:** Ricardo assumed that 'Labor' is the only factor of production. He completely ignored the importance of capital, technology, or land.
- **Static Model:** This theory assumes that technology and skills always remain the same. But in reality, a country can change its 'comparative advantage' in the future with new technology, a dynamic aspect that was missed here.

d) Brief Comparative Transition

In contrast to Malthus's pessimistic theory, David Ricardo offered a positive and mathematically supported model of mutual growth through international trade. However, Ricardo's model was also fundamentally static. Even though economists like Paul Samuelson in modern times later improved this theory of Ricardo (e.g., the Heckscher-Ohlin-Samuelson model), Ricardo's original formula lacked the

capacity to encompass the technological development and future-oriented growth of modern economics. How Samuelson's formula gave these static models a dynamic form will be proven in our final conclusion.

4.5. J.B. Say's Law of Market

In the early nineteenth century, through his book "A Treatise on Political Economy" published in 1803, French economist Jean-Baptiste Say put forward the most powerful and controversial concept of the entire classical economy. Say's law theoretically guided the realistic functioning of the free market that Adam Smith and David Ricardo spoke of.

a) The Core Concept and Analysis

The main basis of Say's law of market is a single sentence: "Supply creates its own demand".

The underlying meaning of this formula is very deep. According to Say, whenever any good is produced (Supply) in the economy, the workers, landowners, and capital involved in that production process receive Income as wages, rent, and interest respectively. The total income that goes into people's hands is exactly equal to the value of the goods produced. People spend all this income in the market to buy goods (Demand). Therefore, demand is created proportionally to the supply of goods provided in the market. Consequently, a 'General Overproduction' can never occur in the economy overall.

b) Pros / Positive Aspects

Say's law made several important contributions to economics:

- **Self-regulating Economy:** This theory sought to prove that a free capitalist economy can regulate itself. No external government intervention is needed.
- **Focus on Production:** For a country to become rich, it just needs to keep increasing production. Because if production increases, people's income will increase, and the sale of goods will automatically increase.
- **Denial of General Unemployment:** This formula assumed that there is always 'Full Employment' in the market. If someone is unemployed, it is only due to their own will (i.e., they have refused to work at the prevailing market wage).

c) Cons / Criticisms

During the 'Great Depression' of the 1930s, Say's law was proven completely false. John Maynard Keynes severely criticized it and pointed out the following flaws:

- **Ignoring Savings:** Say assumed that people spend the entirety of what they earn in the market. But in reality, people 'save' a portion of their income for the future. Due to these savings, a demand equal to the supply is not created in the market.
- **General Overproduction is Possible:** As people do not spend their full income, mountains of unsold goods pile up in the market, creating a terrifying crisis in the economy (which was seen in the 1930s).
- **Involuntary Unemployment:** When demand in the market falls, industrialists reduce production, as a result of which people have to lose their jobs even against their will. Say's formula completely denied this real problem.
- **Misunderstanding the Role of Money:** According to Say, Money is merely a medium for buying and selling goods. But in reality, money is also a tool for saving wealth (Store of value).

People can save money without buying goods.

d) Brief Comparative Transition

Just like Adam Smith and David Ricardo, Jean-Baptiste Say's formula was also based on an imaginary 'perfectly competitive' market. They believed excessively in market forces and completely ignored human psychological aspects (like the tendency to save due to future uncertainty). Although Keynes pointed out these mistakes later, Keynes's theory in turn became too dependent solely on government intervention. As the ultimate goal of our research, we will see in Paul Samuelson's modern 'Neoclassical Synthesis' how Samuelson integrated some good qualities of Say's free market and Keynes's realistic concepts to prepare a deep and superior mathematical model.

4.6. Karl Marx's Marxian Economics and Theory of Surplus Value

In the mid-nineteenth century, when the free capitalist market concept of Adam Smith and David Ricardo was exercising a monopoly rule over all of Europe, the German philosopher and economist Karl Marx strongly challenged it. Through his groundbreaking and revolutionary book "Das Kapital" published in 1867, he exposed the inherent flaws of the capitalist economy and advocated for a new economic structure in favor of the working class.

a) The Core Concept and Analysis

The focal point of Marx's economic theory is the 'Labor Theory of Value' and the 'Theory of Surplus Value' derived from it.

- **Labor Theory of Value:** According to Marx, the true value of any product is determined solely by the 'human labor' applied to produce that product. Capital or machinery cannot create any value on their own; they are merely the fruits of past labor.
- **Surplus Value:** In a capitalist system, whatever value of goods a worker produces in a day, the industrialist or owner does not pay him wages equal to that entire value. The owner pays the worker only the minimum wage necessary to survive. The difference between the actual value created by the worker and the wage he receives is the 'Surplus Value'. According to Marx, the industrialist misappropriates this surplus value as 'Profit', which is actually a severe exploitation of the worker.

Marx claimed that as a result of this exploitation, two classes are created in society—the wealthy capitalists (Bourgeoisie) and the exploited workers (Proletariat). He predicted that over time, due to this class conflict, the capitalist system would collapse and a Socialist Economy would rise.

b) Pros / Positive Aspects

Marx's theory initiated a new and humanistic line of thought in the world of economics:

- **Workers' Rights and Social Justice:** Marx was the first to analyze economics not merely as a tool of production but from the perspective of the rights of the poor and working class of society.
- **Prediction of Capitalist Crises:** He pointed out that economic crises (like crises of overproduction) could frequently occur in a capitalist market system. Keynes also accepted this later.

- **Warning of Monopoly:** The warning he gave that in a free market, all wealth would eventually be centralized in the hands of a few capitalists has proven to be largely true in the modern economy.

c) Cons / Criticisms

Although Marx's theory is emotionally and politically very powerful, it had many huge flaws from the perspective of scientific and mathematical economics:

- **Failure of the Labor Theory of Value:** A product's value is not determined solely by labor. In modern economics, value is determined based on demand, supply, technology, and human utility. Marx was completely wrong here.
- **Denial of Capitalist's Contribution:** Marx described industrialists solely as exploiters. But he completely ignored the contribution of risk-taking, management, and innovation involved in starting a business.
- **Failure of Predictions:** Marx thought capitalism would destroy itself, but in reality, capitalist countries transformed themselves. Workers' wages increased, labor laws were framed, and governments undertook public welfare works, as a result of which capitalism was not destroyed.
- **Lack of Incentive:** Because there are no private property rights in a socialist system, people get no personal incentive to pour out their best at work, which hinders economic growth.

d) Brief Comparative Transition

The theories of Adam Smith and J.B. Say viewed the economy only from the perspective of the capitalist, while Marx's theory judged it only from the side of the worker. Both viewpoints were extreme. In modern times, Paul Samuelson has avoided both these extremes in his formula. Samuelson's model has built the foundation of a beautiful balance or Mixed Economy between the efficiency of the free market (which Smith spoke of) and social justice through government control (the lack of which Marx pointed out).

4.7. Léon Walras's General Equilibrium Theory

Towards the end of the nineteenth century, a major change occurred in economics, which is called the 'Marginalist Revolution'. In 1874, French economist Léon Walras published his famous book "Elements of Pure Economics". It was through this book that he first presented the entire economy in the model of a large system of simultaneous equations, which was an unprecedented and revolutionary step in the history of economics.

a) The Core Concept and Analysis

Before Walras, economists (like Alfred Marshall) generally analyzed 'Partial Equilibrium', that is, they only thought about one market at a time (like only the tea leaf market) and assumed that all other markets were constant.

But the main point of Walras's 'General Equilibrium Theory' is that every market in the economy is interconnected with each other. If there is any change in one market, its impact falls on all other markets. According to him, the economy is a massive mathematical web among numerous buyers and sellers. He assumed that there is an imaginary 'Walrasian Auctioneer' in the market. This auctioneer announces the prices of various goods and the buyers-sellers change their demand and supply accordingly. This process (which he called *Tâtonnement* or the 'groping process') continues until demand and supply are not

simultaneously equal (Demand = Supply) in every single market of the entire economy.

b) Pros / Positive Aspects

Walras's theory completely changed the foundation of modern economics:

- **Pure Mathematical Model:** Walras systematically started the application of algebraic equations and Calculus in economics. It gave economics the status of a perfect science just like physics.
- **Holistic View:** He proved mathematically the truth that all parts of the economy (like the labor market, capital market, goods market) work together like various parts of a machine.
- **Foundation of Modern Macroeconomics:** In any current complex computer model or government economic planning, this general equilibrium concept of Walras is used.

c) Cons / Criticisms

Although it is mathematically very beautiful, it is severely criticized due to the limitations in applying it in the real world:

- **Highly Unrealistic Assumptions:** This theory is completely based on a 'Perfect Competition' market and 'Perfect Information'. In reality, people do not have all the information in their hands and monopolies also exist in the market.
- **Fiction of the Auctioneer:** There is no 'auctioneer' in the real world to determine prices. The market process is not as perfect and rapid as Walras thought.
- **Ignoring Time and Uncertainty:** There was no place for 'time' in Walras's mathematical equations. There is no mention here of how much time it will take for a market to come to an equilibrium state or about future uncertainties. It merely presents a lifeless, static picture.

d) Brief Comparative Transition

Karl Marx's theory was completely emotional and social, whereas Walras's theory is completely unemotional and mathematical. Walras perfected economics with the help of mathematics, it's true, but it failed to capture the pulse of the real world. Looking at the ultimate goal of our paper, that is, Paul Samuelson's model, we will see that Samuelson indeed used this rigorous mathematical structure of Walras, but he gave it a dynamic and realistic form. Samuelson's formula achieved an unprecedented synthesis of Walras's mathematical perfection and the real world's economic growth.

4.8. Arthur Pigou's Welfare Economics

Arthur C. Pigou, a worthy student of Alfred Marshall, gave economics a new and practical direction through his famous book "The Economics of Welfare" published in 1920. Walras or Adam Smith had assumed that the free market always does good for everyone, but Pigou pointed out for the first time that the market system can sometimes also cause massive harm to society, which he called 'Market Failure'.

a) The Core Concept and Analysis

The main foundation of Pigou's welfare economics is the concept of 'Externality'. He highlighted the difference between private net products and social net products.

According to him, an industrialist might earn his private profit by producing goods, but the industrialist does not bear the cost of the damage to the health of nearby people caused by the smoke or pollution generated by that industry (which is called Negative Externality). In such a situation, to remove market

failure, the government should impose a tax on such industries, which is known as a 'Pigouvian Tax'. On the other hand, the government should provide a Subsidy for works that benefit society (like research or education).

b) Pros / Positive Aspects

Pigou's theory has had a profound impact on modern policy making:

- **Birth of Environmental Economics:** Pigou opened the very first door to solving serious problems like environmental pollution and climate change from an economic perspective.
- **Realistic Government Intervention:** By proving that Adam Smith's 'invisible hand' is not always right, he provided a scientific rationale for government intervention for public welfare.
- **Specific Measurement of Welfare:** Without being overly emotional like Marshall, Pigou only spoke of the welfare that can be measured through Money.

c) Cons / Criticisms

The biggest flaws of Pigou's theory were exposed by later economists (like Ronald Coase):

- **Complexity in Measuring Damage:** In reality, perfectly measuring environmental damage or societal suffering in terms of money to determine a tax is very difficult and often proves to be wrong.
- **Over-reliance on Government Systems:** Pigou assumed that the government always acts impartially and perfectly. But in reality, political interests, corruption, and government inefficiency can make the problem even more complex.
- **Pressure on Industries:** Imposing excessive environmental taxes increases the production cost of industries, as a result of which employment may decrease.

d) Brief Comparative Transition

Pigou's theory was more effective than Marshall's theory because it provided a specific tool (tax and subsidy) for solving problems. But Pigou also chose an incomplete path of measuring 'welfare' with money. In modern times, through his 'Public Goods' theory, Paul Samuelson arranged these concepts of Pigou into a specific mathematical and perfect model, which made the role of the government more clear and scientific.

4.9. Lionel Robbins's Scarcity Definition

In 1932, Lionel Robbins, a renowned economist at the London School of Economics (LSE), published his groundbreaking book "An Essay on the Nature and Significance of Economic Science". This book rejected all previous classical and neo-classical definitions and brought a completely new, rational, and analytical perspective to economics.

a) The Core Concept and Analysis

According to Robbins, the word 'welfare' is highly subjective and cannot be measured scientifically. Therefore he offered a specific and logical definition:

"Economics is the science which studies human behaviour as a relationship between ends and scarce means which have alternative uses."

This theory is founded on three main Logical Propositions:

1. **Unlimited Ends:** There is no limit to human needs. As soon as one want is fulfilled, another is created.
2. **Scarce Means:** The resources we have to fulfill these unlimited wants (like time, money, land) are always limited. Mathematically speaking, an $\text{Ends} > \text{Means}$ condition always exists in any economy.
3. **Alternative Uses:** A resource is not used for just one task but can be used for various tasks. (For example, a piece of land can be used for cultivating paddy, or an industry can be set up on it).

Since it is not possible to fulfill all wants simultaneously, humans have to make a Choice about the most important want. Therefore, according to Robbins, economics is fundamentally the Science of Choice.

b) Pros / Positive Aspects

Robbins's theory made the theoretical structure of economics very strong:

- **Neutral and Pure Science:** Robbins proved that economics is a neutral science. It only analyzes causes and effects (e.g., if the price of alcohol rises, demand will fall). Making a moral judgment on whether drinking alcohol is proper or improper is not the job of economics.
- **Universal Application:** The theories of Smith or Marshall were more applicable only in capitalist economies. But Robbins's concept of 'scarcity' and 'choice' is equally applicable in any economy of the world (capitalist, socialist, or mixed).
- **Analytical Scope:** Immaterial services (like those of doctors, teachers) were ignored by Marshall, but Robbins's formula brought any scarce good or service inside the scope of economics.

c) Cons / Criticisms

Although it seems perfect from a logical and scientific standpoint, economists of later times found several deep flaws in it too:

- **Static Model:** Robbins's theory assumes that resources are fixed and constant. It only talks about how to allocate current resources. But the dynamic aspect that resources can be increased through technology and invention over time (Economic Growth) has been completely left out here.
- **Ignorance of Macroeconomics:** Robbins's formula is primarily based on Microeconomics. This theory cannot provide solutions to important macroeconomic issues like a country's overall unemployment problem, inflation, or national income.
- **Problem of Abundance:** During the economic depression of the 1930s, it was seen that the problem was not created due to 'scarcity' of resources, but rather due to 'overproduction' or abundance of goods (which no one in the market wanted to buy). Robbins's theory could not explain this situation.

d) Brief Comparative Transition

Robbins definitely rescued economics from the ambiguity of 'welfare' and gave it the status of a perfect science, but he confined it only to a narrow boundary of 'scarcity'. Economics cannot remain limited to merely dividing existing resources; it must also think about future development and growth. The final theory of our research, that is, Paul Samuelson's model, has completely accepted this concept of 'scarcity' and 'choice' of Robbins, but by adding the dynamic dimension of 'Time' and 'Economic Growth' along with it, has given it a comprehensive form.

4.10. John M. Keynes's Macroeconomic Theory

The terrifying economic depression that appeared across the world in 1929 completely shattered Adam Smith's concept of the 'invisible hand' and J.B. Say's concept of the 'free market'. Millions of unemployed people and mountains of unsold goods piled up in the market, yet classical economists had no solution for it. At such a critical time, in 1936, British economist John Maynard Keynes published his groundbreaking book "The General Theory of Employment, Interest and Money". This very book gave birth to modern macroeconomics.

a) The Core Concept and Mathematical Analysis

Keynes rejected the notions of classical economists and proved that a free market cannot always create 'Full employment' on its own. The main focal point of his theory was 'Effective Demand'.

According to him, the national income and level of employment of a country depend on the Aggregate Demand of the entire country. This can be expressed through the following mathematical equation:

$$AD = C + I + G$$

Where,

AD = Aggregate Demand

C = Consumption Expenditure of the public

I = Investment by the private sector

G = Government Expenditure

Keynes pointed out that during an economic crisis, people stop spending and start saving money out of fear (meaning C falls), and businessmen also do not invest fearing losses (meaning I falls). As a result, the overall AD falls and the economy falls into the abyss of destruction. In such a situation, the only way to save the market is to increase government expenditure (G). That is, the government itself should build roads, bridges, etc., and send money to people's hands, so that people start buying goods in the market again.

b) Pros / Positive Aspects

This theory of Keynes worked like magic in saving the real-world economy:

- **Importance of Short-term Planning:** Classical economists said that "In the long run, everything will be fine." But Keynes mockingly said, "In the long run, we are all dead". He offered short-term and realistic policies to solve the present crisis.
- **Active Role of Government:** He established the policy that the government should spend money even by taking loans to remove the unemployment problem (Deficit Financing), which all countries follow even today.
- **Distinct Identity of Macroeconomics:** Robbins's or Marshall's theories were confined only to one individual or one market (Micro). Keynes presented a broad (Macro) picture of the

aggregate income, expenditure, and employment of the entire country.

c) Cons / Criticisms

Even though Keynes's theory removed the depression, many of its negative aspects emerged later (especially from the 1970s onwards):

- **Danger of Inflation:** If the government prints excessive money and releases it into the market to remove unemployment, terrible inflation is created in the country. Keynes feared the unemployment problem more than inflation, as a result of which his theory failed to control inflation.
- **Problem of Stagflation:** In the 1970s, unemployment and inflation increased simultaneously in the world (which is called Stagflation). Keynes's theory had no solution for this, because according to him, both of these cannot increase together.
- **Ignoring Supply-side:** Keynes gave excessive importance only to market Demand. He almost ignored the production capacity or the supply side of industries.
- **Burden of Government Debt:** Following Keynes's policy and constantly preparing deficit budgets resulted in many countries getting caught in a web of massive government debt in the future.

d) Brief Comparative Transition

Economists like Adam Smith and Walras only thought about market Supply and the long run, whereas Keynes only thought about Demand and the short run. Lionel Robbins confined economics to scarcity, and Keynes brought it out to the macro level. But all these theories were fragmented; if one gave importance to micro, the other to macro. The final conclusion of our research, that is, Paul Samuelson's modern 'Neoclassical Synthesis', is exactly where we will see how Samuelson prepared a complete and superior mathematical structure by integrating the micro concepts of classical economics and the macro concepts of Keynes.

4.11. Joseph Schumpeter's Creative Destruction

In 1942, one of the greatest Austrian-American economists of the twentieth century, Joseph Schumpeter, presented a completely new and dynamic model of economic growth to the world through his famous book "Capitalism, Socialism and Democracy". This theory of his completely changed the static concepts of classical economics.

a) The Core Concept and Analysis

The main driving force of Schumpeter's theory is 'Innovation'. According to him, a capitalist economy can never remain calm or stable; it progresses through a continuous evolution. He named this process 'Creative Destruction'.

According to this concept, when an 'Entrepreneur' in the market invents a new technology, new product, or new mathematical method of production, that new invention completely destroys the old and inefficient industries from the market. For example, the invention of the motor car destroyed the horse-carriage industry, or the smartphone destroyed the old camera industry. According to Schumpeter, this continuous process of destroying the old and creating the new is the only and true cause of economic growth.

b) Pros / Positive Aspects

The relevance of Schumpeter's theory is the highest in the modern technology-dependent era:

- **True Evaluation of the Entrepreneur:** Karl Marx had merely called industrialists 'exploiters', but Schumpeter established entrepreneurs as the true 'Heroes' of the economy, due to whose courage and innovative power society progresses.
- **Importance of Technological Growth:** There was no place for technology in the theories of Ricardo or Malthus, but Schumpeter brought technology and innovation to the center of the economy.
- **Realistic Dynamic Model:** Instead of Walras's imaginary 'equilibrium', Schumpeter explained the real 'Instability' of the economy from a positive perspective.

c) Cons / Criticisms

Although theoretically it is very powerful, there are several serious negative aspects in this process of 'creative destruction':

- **Structural Unemployment:** As soon as new technology arrives, old industries close down and thousands of workers working there become unemployed. Schumpeter did not give much importance to the social and mental suffering of these workers.
- **Creation of Monopoly:** The company that first invents something new establishes a monopoly right in the market on the strength of Patents and technology, which can later exploit the consumer.
- **Rise in Inequality:** In this system, the handful of people who can innovate become exceedingly rich and those knowing old skills fall into the grip of poverty.

d) Brief Comparative Transition

John Maynard Keynes wanted government intervention to stabilize the economy, whereas Schumpeter argued that to push the economy forward, the 'instability' created through innovation is more necessary. Economists like Lionel Robbins emphasized how to distribute existing resources, but Schumpeter showed that humans can create new resources and technology with their intelligence. However, this theory of Schumpeter only talks about growth; it does not cover the general rules of daily distribution of wants and resources. In the ultimate goal of our paper, Paul Samuelson's model, we will see that Samuelson beautifully linked this concept of 'growth' and 'technological change' of Schumpeter with Robbins's concept of 'scarcity' to give birth to a comprehensive and modern formula.

4.12. Friedrich Hayek's Austrian Business Cycle Theory

One of the greatest economists of the twentieth century and Nobel Prize winner Friedrich August von Hayek (F.A. Hayek) established the main concepts of the 'Austrian School of Economics'. Through his book "Prices and Production" published in 1931, he presented a specific and distinct reason as to why frequent ups and downs or 'Business Cycles' occur in the economy.

a) The Core Concept and Analysis

The main focal point of Hayek's theory is the policy of the Central Bank and 'Malinvestment'.

According to him, an economic crisis or Recession does not come naturally; it is the consequence of flawed policies of the central bank. When the government or central bank artificially lowers Interest rates in the market, people and businessmen easily obtain cheap credit. This cheap money creates an artificial boom in the market. Businessmen invest money in many such long-term projects (which he called Malinvestment), which are not actually based on people's Real savings. Finally, when the impact of this artificial money in the market diminishes and interest rates start rising again, these fake projects collapse and a terrifying decline or 'Bust' starts in the economy. According to Hayek, this recession is actually a necessary 'treatment' process for the economy, through which the market itself cleans up past wrong investments.

b) Pros / Positive Aspects

Hayek's theory has had a profound impact on long-term economic planning:

- **Accurate Prediction of Bubbles:** Major crises like the 2008 global Housing crash can be explained most accurately through this formula of Hayek. He proved that artificially lowering interest rates creates 'bubbles' in the economy.
- **True Evaluation of Savings:** Keynes had called saving bad, but Hayek proved that the true economic growth of a country can only happen based on people's Real savings, not with artificially printed money.
- **Opposition to Government Intervention:** He pointed out that if the government goes to control the economy, new problems are created instead of solving the problem.

c) Cons / Criticisms

Although Hayek's theory is very powerful from a logical standpoint, applying it in reality makes society suffer massive consequences:

- **Indifference to Social Suffering:** According to Hayek's policy, when an economic crisis hits, the government should sit silently doing nothing, so that the market corrects the past mistakes on its own. But in this 'doing nothing' state, millions of people lose their jobs and suffer from starvation, which is not socially acceptable.
- **Lack of Mathematical Model:** Hayek opposed excessive mathematization of economics. His theory was overly dependent on philosophy and logic, making it difficult to put it into specific macroeconomic equations.
- **Denial of Self-destructive Recessions:** Sometimes market panic can transform even a small problem into a massive depression, where good industries are also destroyed. Hayek ignored the impact of this psychological panic.

d) Brief Comparative Transition

The conflict between Keynes and Hayek was the biggest conflict in economics. Keynes wanted to treat the symptom of the disease (i.e., the unemployment problem) immediately, whereas Hayek wanted to let the root cause of the disease (artificial credit) be destroyed, no matter how much the patient suffered. Both philosophies had their own limitations. In the final conclusion of our research, we will see how Paul Samuelson's formula put an end to this debate. Samuelson's model accepted the long-term efficiency of Hayek's free market, but also kept the provision for short-term government intervention

like Keynes during emergencies, which transformed it into the most perfect and practical theory.

4.13. Milton Friedman's Monetarism

The leader of the Chicago School of Economics and Nobel Prize-winning economist Milton Friedman created a massive stir in the world of macroeconomics through the book "A Monetary History of the United States" published in 1963 (jointly with Anna Schwartz). In contrast to Keynes's government intervention, he placed the highest importance on the Monetary Policy of the Central Bank.

a) The Core Concept and Mathematical Analysis

The main mantra of Friedman's theory was: "Inflation is always and everywhere a monetary phenomenon."

He gave a modern form to the classical economy's 'Quantity Theory of Money'. This concept of his monetarism is expressed through the following famous mathematical equation:

$$MV = PQ$$

M = Money Supply

V = Velocity of Money (i.e., how many times a coin changes hands in a specific time)

P = General Price Level of goods

Q = Quantity of Real Output

According to Friedman, because people's spending habits do not change in the short term, the velocity of money (V) and the country's production capacity (Q) remain almost constant. Therefore, if the government or central bank prints extra money in the market and increases the money supply (M), its direct impact falls on the price of goods (P). That is, if money supply increases, inflation will increase.

b) Pros / Positive Aspects

This theory of Friedman built the foundation of modern monetary policy:

- **Solving Stagflation:** The terrifying inflation of the 1970s, which Keynes's theory could not explain, was successfully brought under control by this strict monetary policy of Friedman.
- **Rule-based Monetary Policy:** He advised that without depending on the whims of political leaders, the money supply should be increased every year at a specific rate (like 3% or 4%) keeping in sync with the country's economic growth. This is known as the 'K-percent rule'.
- **Long-term Realism:** He proved mathematically that in the long run, simply printing money cannot make a country's people rich or permanently remove the unemployment problem; it will only increase the price of goods.

c) Cons / Criticisms

Although theoretically very specific, many limitations of Friedman's formula have been seen in the modern complex market:

- **Complexity in Measuring Money Supply:** In today's digital age, money is not just cash. Due to credit cards, digital currency, and various financial instruments, accurately measuring how much money supply (M) is actually in the market has become almost impossible for the central bank.
- **Instability of Velocity (V):** Friedman assumed that V remains constant. But in reality, especially during economic crises, people do not spend money out of fear, as a result of which V changes rapidly and the entire equation stops working.

- **Neglecting Unemployment:** His main goal was only to control inflation. He completely ignored the terrifying unemployment problem and social suffering that is created in the short term by adopting strict monetary policy and reducing money from the market.

d) Brief Comparative Transition

Keynes only emphasized Fiscal Policy to remove the unemployment problem, whereas Friedman only emphasized Monetary Policy to control inflation. Actually, both theories were one-sided. In the final position of our research paper, that is, in Paul Samuelson's model, we will see that keeping a country stable requires more than just monetary policy or just fiscal policy. How Samuelson integrated these two opposing forces and created a balanced mathematical environment will be the main basis of our analysis.

4.14. John Forbes Nash Jr.'s Game Theory and Nash Equilibrium

In the history of economics, John Forbes Nash Jr. was not any traditional economist; he was a pure mathematician. Through his mere 27-page doctoral thesis "Non-Cooperative Games" in 1950, he gave birth to a revolutionary mathematical concept in the world of economics, for which he was awarded the Nobel Prize in Economics in 1994. Smith or Marshall viewed humans as isolated individuals from society, but Nash proved that in an economy, a person's decision is dependent on others' decisions.

a) The Core Concept and Mathematical Analysis

The main foundation of Nash's theory is the 'Nash Equilibrium'.

In Game Theory, it is assumed that the economy is like a game, where competitors (like two companies) adopt Strategies to maximize their profit. Nash equilibrium is such a mathematical state of the game where every player, after knowing the strategy of the other, shows no interest in changing their own previous strategy.

This can be explained through the famous 'Prisoner's Dilemma'. Suppose two criminals (A and B) are caught by the police and they are kept in separate rooms. They have two options: Confess or Remain Silent.

If both remain silent, both will get 1 year of jail each.

If one confesses and the other doesn't, the one who confesses will go free and the other will get 10 years of jail.

If both confess, both will get 5 years of jail each.

According to logic, both remaining silent was the best for both (total 2 years of punishment combined). But since they do not know the other's decision and do not trust them, both will think, "If I remain silent and he confesses, I will get 10 years of jail." Consequently, to save themselves, both confess to the crime and serve 5 years of jail each. This very state is the Nash equilibrium, where both have taken rational decisions from their own side, but overall the result is not the best.

b) Pros / Positive Aspects

The use of this mathematical model of Nash is paramount in modern economics:

- **Perfect Analysis of Oligopoly:** If there are only a few large companies in the market (like Jio and Airtel in the telecom sector), how they determine prices and how they depend on the other company's strategy, the only mathematical solution to this can be provided by Game Theory.
- **Realistic Strategic Behavior:** Unlike previous theories, it does not treat humans as machines, rather it studies how humans apply their intelligence (Strategy) depending on the

situation.

- **Auctions and Bargaining:** When the government auctions Spectrum or mines, Nash's mathematical model is applied for maximum revenue extraction.

c) Cons / Criticisms

Since it is a pure mathematical theory, it has some conflict with real human psychology:

- **Hyper-rationality assumption:** Nash's theory assumes that humans are always excessively rational, and they can calculate all future possibilities like a computer. But in reality, people often make decisions governed by emotion, belief, and wrong information.
- **Multiple Equilibria:** In many complex economic situations, mathematically more than one Nash equilibrium can emerge. In such a state, it becomes difficult to accurately predict what will actually happen in the market.
- **Impact of Environment and Time:** The mentality of the players can change over time, which cannot be easily expressed in this static mathematical model.

d) Brief Comparative Transition

Nash mathematically proved Smith's concept of the 'invisible hand' wrong. Smith had said that if everyone works for their own interest, it does good for society, but Nash showed through the 'Prisoner's Dilemma' that sometimes working for one's own interest actually harms everyone overall. However, this theory of Nash also completely ignored human 'emotions'. Later we will find Richard Thaler's behavioral economics, which will give importance to these emotions. And finally, in Samuelson's formula, we will see how all these mathematical and emotional aspects have been covered to prepare a broad and realistic economic structure.

4.15. Amartya Sen's Capability Approach

In the 1980s and later through his famous book "Development as Freedom" published in 1999, Amartya Sen brought a revolutionary change to the world of Welfare Economics. He rejected classical economics' concept of 'Utility' or mere 'Income Growth' and established 'Capability' as the main parameter of human development, for which he was awarded the Nobel Prize in Economics in 1998.

a) The Core Concept and Analysis

The main foundation of Amartya Sen's theory is established on two concepts: 'Functionings' and 'Capabilities'.

- **Functionings:** This means what a person actually manages to do or be in their life (What a person manages to do or be). For example—being healthy, being educated, or living with dignity in society.
- **Capabilities:** This means the actual freedom or opportunities a person has to achieve various 'functionings' (The freedom or opportunities to achieve those functionings).

This can be explained with a beautiful example: Suppose, two people are Starving. The first person is voluntarily fasting for religious reasons, whereas the second person is forced to stay hungry because he has no money to buy food. Outwardly, the 'functioning' (staying without eating) of both is the same, but the 'capability' of both is completely different. The first one has the 'freedom' to eat if he wishes, but the second one does not. According to Amartya Sen, the true meaning of economic development is not

merely giving money into people's hands, rather it is increasing this 'freedom' or 'capability' of humans.

b) Pros / Positive Aspects

The impact of this theory of Amartya Sen on the modern world economy is immense:

- **Birth of the Human Development Index (HDI):** The 'Human Development Index' that the United Nations (UN) publishes every year, its main theoretical foundation is this very theory of Amartya Sen. Through this, the practice of measuring development not merely by GDP but by education, health, and standard of living started.
- **Multidimensional Poverty:** He established that poverty does not only mean a lack of money, but a lack of education or healthcare is also a type of poverty.
- **Gender Inequality and Social Justice:** His theory placed special emphasis on the rights and freedom of the backward sections of society and women, which no previous mathematical economist had thought of.

c) Cons / Criticisms

Although the theory is superior from the standpoint of philosophy and social justice, it has some specific flaws from the perspective of statistics and mathematical economics:

- **Measurement Difficulties:** Just as specific data is needed to prove a mathematical formula in a research paper, exactly similarly it is impossible to put 'capability' or 'freedom' into a mathematical equation. Just as income or wealth can be measured in money, there is no specific Unit to measure 'freedom'.
- **Ambiguity in Policy Formulation:** It is easy for the government to set a target merely for income growth, but this theory does not provide any specific and practical mathematical model on how to simultaneously increase all kinds of 'capabilities' of humans. It is excessively broad and philosophical.
- **Lack of a List:** Amartya Sen did not provide any specific list of what 'capabilities' humans actually need, due to which disagreements arise among researchers when applying it.

d) Brief Comparative Transition

Arthur Pigou or Alfred Marshall had tried to measure 'welfare' with money, which was a very narrow boundary. Amartya Sen took it to the vast world of 'capability', but as a result, it lost Mathematical Precision. While Léon Walras or John Nash had transformed economics into pure mathematics, Sen's theory brought it back closer to philosophy again. A scientific balance was needed between these two extreme states. In the final section of our paper, that is, Paul Samuelson's formula, we will find how he beautifully integrated the dynamic aspect of human development into a realistic model without losing mathematical analysis.

4.16. Richard Thaler's Behavioral Economics

American economist Richard Thaler, who won the Nobel Prize in Economics in 2017, brought a massive mental revolution in the history of economics. Classical economists like David Ricardo, Léon Walras, or John Nash had always assumed that humans are perfectly rational machines (Homo Economicus), who always make flawless decisions thinking of their maximum profit. But Thaler proved that humans are actually not perfectly rational, rather humans are emotional, prone to making mistakes, and psychologically weak.

a) The Core Concept and Analysis

The main foundation of Behavioral Economics is the integration of Psychology and Economics. Thaler demonstrated that there are several mental weaknesses in the human decision-making process:

- **Bounded Rationality:** The human brain cannot calculate all information simultaneously to make a perfect decision; we take decisions dictated by available limited information and emotion.
- **Mental Accounting:** While spending money, people do not think mathematically but rather divide it mentally (like easily blowing away money won in gambling compared to money saved in the bank).
- **The Nudge Theory:** Instead of forcing people or changing them by enacting laws, one can compel them to take the right decision by slightly altering their surrounding environment (giving a Nudge). For example—if healthy foods are displayed right in front of the eyes in a canteen, people decide to eat them more rather than eating junk food.

b) Pros / Positive Aspects

This theory has changed the very concept of all modern policy formulation:

- **Realistic Human Behavior:** Instead of imaginary humans locked in a prison, the theory has been built centering around real humans experiencing laughter-tears, fear, and greed in the real world's market.
- **Government Policy and Tax Collection:** Currently, various countries of the world (like the UK and America have a 'Nudge Unit') have successfully applied the method of making people do the right thing merely by mentally 'nudging' them, without giving any punishment, to save money for pension or pay taxes.
- **Explanation of Irrational Market Decisions:** This theory provides the scientific explanation as to why people go to the market and emotionally buy things even without needing them.

c) Cons / Criticisms

Since it is based on human psychology, it also has some limitations:

- **Lack of Mathematical Precision:** It is very difficult to put human 'emotions' into any specific mathematical equation for a research paper or to predict the future of a country's economy.
- **Paternalism:** Many criticize the 'Nudge' process, saying that through this, the government or any agency interferes with the freedom of ordinary people and secretly tries to control their mentality.

d) Brief Comparative Transition

Starting from Adam Smith's 'economic man' to Walras's mathematical precision and Nash's game theory—everyone had assumed humans to be rational like machines. But Thaler proved that humans are emotional. In the final conclusion of our research paper, that is, Paul Samuelson's 'Neoclassical Synthesis', we will see that Samuelson, while integrating the good qualities of all these theories (like free market efficiency, mathematical structure, and modern growth), also accommodated this psychological reality of humans to establish the most superior and comprehensive formula of economics.

4.17. Henry Smith's Definition of Economics

In the history of economics, when Robbins's strict mathematical formula of 'scarcity' was exerting monopoly influence, Henry Smith attempted to explain economics again on the basis of society and human relations. His definition presented economics as a sociological process.

a) The Core Concept and Analysis

According to Henry Smith, "Economics is the study of how in a civilised society one obtains the share of what other people have produced and of how the total product of society changes."

Three very important concepts are hidden behind this definition:

1. **Civilized Society:** He assumed that economic activities do not run by the law of the jungle. A 'civilized society' is needed, where there are laws, Property rights, and a money system.
2. **Distribution and Exchange:** An individual does not produce everything themselves. How they obtain a part of others' production (like getting a salary by doing a job and buying goods with it), i.e., the 'distribution' system of society is its main subject.
3. **Changes in Total Product:** The total production of a society never remains the same. It can increase or decrease over time.

b) Pros / Positive Aspects

This definition of Henry Smith has several highly commendable aspects:

- **Realistic Social Basis:** Instead of thinking of humans as an individual living on an isolated island like Robbins, Henry Smith analyzed humans as an integral part of society. The Exchange process is impossible without society.
- **Hint of Economic Growth:** The phrase "how the total product changes" in his definition beautifully covers the concept of future economic growth or decline.
- **Focus on Distribution:** Adam Smith only emphasized 'production', but Henry Smith brought 'Distribution' of resources to the center of economics.

c) Cons / Criticisms

Although theoretically attractive, it has some major limitations from the perspective of scientific and mathematical economics:

- **Ambiguity of 'Civilized Society':** The term 'civilized society' is highly Subjective. This theory cannot provide any specific scientific answer to questions like what is called a civilized society and whether economics exists in an uncivilized society or not.
- **Lack of Scarcity Concept:** There is no direct mention in this definition of 'Scarcity' of resources, which is the main foundation of economics.
- **Lack of Mathematical Precision:** It is very difficult to express this theory in a Mathematical Model or statistics, due to which its use in modern macroeconomics is limited.

d) Brief Comparative Transition

Just like Adam Smith, Henry Smith's definition is also somewhat Descriptive. The strict scientific logic that was in Lionel Robbins's definition is seen to be lacking in Henry Smith's definition, although it gives more importance to the emotions and structure of society. When comparing with the final conclusion of our research, that is, Paul Samuelson's formula, we will see that Samuelson has accepted this concept of 'changes in production' and 'society's distribution' of Henry Smith, but by adding

Robbins's 'scarcity' and mathematical analysis to it, has given it a specific and modern form. Nevertheless, Henry Smith's definition is of a much superior standard than several other definitions.

4.18. Paul Samuelson's Growth-Oriented Modern Definition

In the history of economics, the intellectual conflict that had been going on starting from Adam Smith's concept of 'wealth' to Robbins's 'scarcity' and Keynes's 'macroeconomics', a perfect and scientific synthesis of all of those was brought about by Nobel Prize-winning American economist Paul Samuelson. Through his groundbreaking and all-time best-selling textbook "Economics: An Introductory Analysis" published in 1948, he bestowed a completely modern and dynamic dimension upon economics, which is known as the 'Neoclassical Synthesis'.

a) The Core Concept and Analysis of Samuelson's Formula

Samuelson did not keep economics confined only to a specific boundary like earlier economists. His formula is comprehensive:

"Economics is the study of how men and society choose, with or without the use of money, to employ scarce productive resources which could have alternative uses, to produce various commodities over time and distribute them for consumption, now and in the future, among various people and groups of society."

The biggest underlying novelty of this definition is—'change of time' and 'economic growth' (Time and Dynamic Growth).

Robbins only spoke of how to divide current scarce resources (in a stable or Static form). But Samuelson showed that economics is not limited merely to fulfilling current wants; it studies the entire process of how the quantity of resources can be increased (Dynamic Growth) by increasing technology, capital, and labor over time.

b) Pros / Comprehensive Strengths of the Theory

The main reasons why this modern formula of Samuelson became the bible of modern economics are:

- **Beautiful Synthesis of Micro and Macro:** Classical economics only looked at Micro and Keynes only looked at Macro. Samuelson tied both of these together to prepare a comprehensive mathematical and theoretical structure.
- **Future-oriented Perspective (Intertemporal Choice):** He clearly explained for the first time in economics the balance between the two times—how much people will spend today and how much they will save for the future.
- **Beautiful Blend of Welfare and Science:** Robbins's concept of neutral science and Marshall-Pigou's concept of welfare—without discarding either, he rather integrated the good qualities of both.

c) Limitations of the Theory

Despite being so superior, there is not an absence of some theoretical challenges in Samuelson's model:

- **Over-reliance on Mathematical Complexity:** Samuelson made economics overly dependent on calculus and algebra like physics, as a result of which it became difficult for ordinary people to understand. But because there is mathematics in economics currently, we are able to study it in minute detail.

- **Neglect of Emotional and Social Truths:** As shown by Thaler's behavioral economics, it is difficult to completely capture the psychological mistakes of humans in this mathematical model.

However, overall this definition is superior to all the definitions described above and is the most acceptable definition in economic science, hence it holds this title. In this research paper, the gradual evolution of economics and the characteristics and explanation of superiority of the best definition standing as a symbol of this evolution have been presented in the current background.

5. Direct Comparative Matrix with Samuelson's Definition

To prove why Samuelson's definition is called the best, its direct comparative argument with the definitions of every previous era must be presented:

a) Adam Smith and J.B. Say's 'Wealth and Supply-centric' Formula vs. Samuelson

- **Difference:** Smith and Say only emphasized goods production and Wealth; they did not talk about human wants or distribution.
- **Samuelson's Superiority:** Samuelson showed that merely producing wealth will not do, the scientific study of how that wealth will be distributed (Distribution) among various individuals of society at present and in the future must also be in economics. He tied wealth with human welfare and needs.

b) Alfred Marshall and Arthur Pigou's 'Welfare-centric' Formula vs. Samuelson

- **Difference:** Marshall and Pigou spoke of 'welfare', but that word was excessively emotional and Non-quantifiable mathematically.
- **Samuelson's Superiority:** Samuelson removed that vague cover of welfare and gave it a Mathematical and Statistical form. He proved that welfare is not just an object to be felt, rather it can be specifically measured and managed through correct resource allocation.

c) Lionel Robbins's 'Scarcity' Formula vs. Samuelson (The Crucial Shift)

- **Difference:** Robbins's formula was the most scientific in the history of economics, but it was 'Static'. Robbins said- "Resources are limited, choose them." Its meaning was to divide whatever is there.
- **Samuelson's Superiority:** This is Samuelson's greatest invention. Samuelson exactly adopted Robbins's concept of scarcity, but added 'Time' and 'Economic Growth' with it. Humans do not merely share and consume existing resources, rather they can also increase the quantity of resources through technology and investment (Dynamic Expansion). This Intertemporal Dimension was not in Robbins's formula, which Samuelson provided.

d) Keynes and Friedman's 'Macroeconomic' Formula vs. Samuelson

- **Difference:** Keynes only spoke of demand and Friedman only spoke of money supply; their formulas were Fragmented in nature.
- **Samuelson's Superiority:** Through 'Neoclassical Synthesis', Samuelson beautifully integrated both—the market efficiency of Microeconomics and the government control of

Macroeconomics—into the same definition.

e) Nash and Thaler's 'Game Theory and Behavioral' vs. Samuelson

- **Difference:** Nash assumed humans to be overly rational, and Thaler said humans are completely emotional.
- **Samuelson's Superiority:** Samuelson's model is so flexible that while capturing the vast mathematical dynamics of the market, it can also encompass the realistic changes of society.

6. The Novelty: Intertemporal Dynamic Synthesis

From all the above comparative discussions, the true Novelty contributed to economics by this research paper becomes clear. So far, all other researchers in the world have looked at definitions merely as an evolution of history, but this paper establishes that- the evolution of economic definitions is a gradual transition starting from philosophy to mathematical scarcity, and from there to 'Intertemporal Growth' that changes with time.

Adam Smith's 'wealth' (which was only a thing of the present) and Robbins's 'scarcity' (which was only a choice of the present)- there was no place for the future in both these concepts. Paul Samuelson, for the first time in his definition, brought in the relationship between present consumption and future investment (Intertemporal Choice).

Therefore, exhausting the limitations of all previous theories, and testing them on the touchstone of logic, one can arrive at this irrefutable conclusion that- because Paul Samuelson's definition corrected all old flaws of economics and provided the sole dynamic model of time and growth, it has established itself at the highest seat as the most superior and indispensable definition in today's global economy.

The evolution of economic definitions is a gradual transition from philosophy to mathematics and from mathematics to future-oriented Eco-Economic & Temporal dynamics, the ultimate form of which is Samuelson's Intertemporal model.

7. Contemporary Relevance of Paul Samuelson's Modern Definition

In this rapidly changing digital, global, and technology-dependent economy of the twenty-first century, earlier classical or neo-classical definitions cannot cover all aspects of the market. In this section, we will see why Samuelson's definition has become so highly effective and modern in the current realistic situation:

a) Compatibility with Current Digital and Global Markets

The current era is not an era merely of producing some local goods or merely accounting for physical currency. Currently, resources are used via Global Supply Chain, E-commerce, Cryptocurrency, and Artificial Intelligence (AI). The phrases "with or without money" and "limited resources having alternative uses" present in Samuelson's definition perfectly explain the current modern financial system and digital economy.

b) Current Sustainable Development and Future Consumption

The biggest problem in the present world is climate change and the destruction of natural resources. There is clearly a term "future consumption" in Samuelson's definition. Its meaning is- people of the present should not consume resources in such a way that causes any harm to future generations. The core principle of the present 'Sustainable Development Goals' (SDG) is established precisely upon this future-oriented perspective of Samuelson.

c) Policy Formulation and Central Bank's Functioning

The financial policies that the governments and Central Banks of every country in the current world (like America's Federal Reserve or India's Reserve Bank) formulate, their main foundation is the blend of micro and macro economics- which is guided by Samuelson's 'Neoclassical Synthesis'. In their market regulation, tax system, and equitable resource distribution process, Samuelson's formula is the only practical one.

8.Limitations of the Study

Every research paper has its own scope and some limitations. This review research paper has primarily emphasized the theoretical analysis of 18 major economists of the history of economics. Its main limitation is that although the theoretical superiority of Samuelson's intertemporal dynamics has been proven here, no specific statistical data (empirical data) or deep quantitative mathematical model has been used to prove it.

9.Future Scope of the Research

This research paper has opened a vast path for future researchers. In the next stage, taking the help of statistical analysis and data, along with applying new fundamental mathematical or geometric formulas, a massive scope is inherent in this research to test this model of Samuelson in a more practical form. In the future, there is full potential to conduct a distinct statistical research on the economic policy formulation of developing countries using this comparative model.

10. Conclusion

The conceptual history of economics is a continuous intellectual journey through philosophy, ethics, and mathematics. The subject, which was merely a simple theoretical form of wealth and free market in the hands of Adam Smith, was expanded towards human welfare in later times by Alfred Marshall and Arthur Pigou. After that, Lionel Robbins's formula of scarcity gave it the dignity of a neutral science, Keynes rescued the market from depression through macroeconomics, and Schumpeter, Nash, and Thaler added new dimensions of technology, game theory, and human psychology.

This research paper, by analyzing the positive and negative aspects of every major economic theory in minute detail, has established precisely this that- no single theory can successfully explain all the complexities of economics. Even if every theory was true in its own short-term or long-term scope, some or other theoretical limitation remained within them.

Against such a historical backdrop, Paul Samuelson's 'Growth-oriented and intertemporal formula' has emerged as the best and most comprehensive definition of economics of today's times. Samuelson, along with bringing about a beautiful synthesis of micro and macro economics, tied Robbins's concept of 'scarcity' with 'Time' and 'Intertemporal Dynamic Growth' to give it a dynamic form. In the present era filled with challenges of digital, global, and Sustainable Development, this modern model of Samuelson has become the most relevant and effective.

Therefore, at the final stage of this long evolution of economic definitions, one arrives precisely at this conclusion that- Paul Samuelson's definition, by successfully correcting the flaws of all previous theories, has been able to establish economics at a scientific, comprehensive, and most modern level. This framework will forever continue to play the role of a guiding light for future economic research and global policy formulation.

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