PARADIGM SHIFT IN MAINSTREAM ECONOMICS STUDIES

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Abstract: This paper analyzed the paradigm structure of economics studies, summarized five different forms of paradigm shifts in past economics studies, and revealed the conditions and timing of paradigm shifts in economics studies. If a new research paradigm entailed a broader logical space than the old one or could adapt to the socio-economic development level and the pattern of vested interests, it would form and replace the old one. However, the paradigm shift of economics is complicated and repetitive, sometimes even backward, rather than straightforward.

Keywords: economics studies; paradigm structure; paradigm shift.

INTRODUCTION

As a prominent discipline in the modern era, the reach of the economics empire has extended into various fields of social sciences and humanities, and this is an undeniable fact. However, can economics reflect or reveal objective laws? In the first half, based on the fact that economics failed to predict the economic (/financial) crisis, we sketched out the economic thought history with a playful tone combined with the economic history, indicating that the debate between neoclassical and Keynesian economics exposed the paradigm crisis of mainstream economics. We advocate that shifting the focus from methods and means to values and goals, and transforming political matters into scientific affairs, may be a viable attempt to alleviate and eliminate the war between Keynesianism and (neo)liberalism.

In economics, the core lies in the hypotheses that embody values, while the methodology and primary hypotheses that reflect the logical framework of economic theory assume a subordinate role. We explored the interplay between the development and transformations of comparatively autonomous theories throughout modern economic thought, seeking to unveil the underlying principles. Employing the paradigm analysis method from the philosophy of science, we embarked upon this discourse, guided by the developmental logic that governs paradigm shifts in economics studies.

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From the perspective of the philosophy of science, the development of science will present a logical evolutionary pattern of "paradigm → normal science → crisis → revolution → new paradigm". The core of this pattern is the formation and transformation of the paradigm. By considering economics as a science, the paradigm theory in the philosophy of science exerts a vast and profound influence on the progress of contemporary economics. It offers a fresh and compelling perspective on the historical trajectory of economic development. Since the 1990s, notable scholars have made significant contributions to this field. Prominent representatives include Mark Blaug, Daniel Hausman, Lawrence Boland, Thomas Boylan, and Paschal O'Gorman. Mark Blaug examined the impact of philosophy of science methodologies on advancing modern economic theory and its latest developments.[1] The methodologies derived from Karl Popper and Imre Lakatos encapsulate the philosophical foundations of science. Blaug contended that the legacy of falsificationism endures as it continues to shape, critique, and reinterpret the prevailing ideas that dominate economic methodologies.[2] Lawrence Boland delved into the ongoing debate regarding research methodologies within various schools of modern economics.[3] This includes criticism of positive economics, the neoclassical equilibrium interpretation, the mathematical application of neoclassical economics, the critique of idealized reality, and idealized methodologies.

Apart from the comprehensive works conducted by esteemed scholars, scattered inquiries illuminate the nexus between the economics paradigm and the advancement of economic theory from diverse viewpoints.[4] Some have undertaken analyses of the impact exerted by different economic schools within the paradigms of economic studies.[5] Others have delved into the intricate structure of the economics paradigm itself.[6] Some have explored the association between the core tenets and the safeguarded boundaries within the paradigm framework of economics studies, drawing upon Imre Lakatos' methodology of scientific research programs.[7] Certain scholars have deliberated on the dynamics of paradigm movement in economics and the prerequisites essential for a paradigm shift in conventional economic thought.[8]

[1] Mark Blaug, *The methodology of economics: Or, how economists explain*, Cambridge, Cambridge University Press, 1992.

[2] Brian Snowdon, Howard R. Vane, *Conversations with Leading Economists*, Edward Elgar Publishing, 1999.

[3] Lawrence A. Boland, *Foundations of economic method: A Popperian perspective*, Routledge, 2020.

[4] Falahati, Kazem. *New paradigms in financial economics: how would Keynes reconstruct economics?*. Routledge, 2012.

[5] Roderick J. Macdonald, "On the Role of Paradigms in Finance; From Economics Imperialism to Freakonomics: The Shifting Boundaries between Economics and Other Social Sciences; Economics Versus Human Rights.", in *Review of Social Economy*, 70 (1), 2012, pp. 134–141.

[6] Ron Martin, Peter Sunley, "Towards a Developmental Turn in Evolutionary Economic Geography?", in *Regional Studies*, 49 (5), 2015, pp. 712–732.

[7] John Pheby, *Methodology and economics: a critical introduction*, Routledge, 2015.

[8] Claude Menard, Mary M Shirley, "The Future of New Institutional Economics: From Early Intuitions to A New Paradigm?", in *Journal of Institutional Economics*, 10 (4) 2014, pp. 541–565.

These studies deepen our comprehension of the logical relationship between the economic paradigm and the evolution of economic thinking. However, when viewed holistically, the field remains fragmented, underscoring the imperative of systematically investigating the internal logical relationship between paradigm shifts in economics studies and the unfolding of economic thought. This paper examined the paradigm structure of modern economics and its evolution. We provided a method to study the history of economic thoughts and tried to rearrange and explain the history of economic thoughts from the perspective of the philosophy of science.

PARADIGM STRUCTURE OF MAINSTREAM ECONOMICS

Mainstream economics is a broad term encompassing various literature, data, and statistical reports on economic issues. It generally includes both applied economics and theoretical economics. This paper refers explicitly to theoretical economics. John Keynes advocated for the focus of economic research on paradigms, as they represent various avenues through which the macroeconomy can be examined.[9] Similarly, Milton Friedman showed a keen interest in researching the philosophy of science and rational methodologies for effective analysis.[10] The paradigm theory in the philosophy of science, put forth by Thomas Kuhn[11] and Imre Lakatos[12], has gained widespread usage among mainstream economists. Despite the controversy surrounding its inception[13], no other analytical framework has achieved consensus[14], leading us to employ it in our analysis. Several influential books have also utilized the interpretations of economics through the perspectives of Kuhn, Lakatos, or Popper, such as Wade Hands' *Reflection without Rules*, John Davis and Marcel Boumans' *Economic Methodology*, and Neil De Marchi's *Post-Popperian Methodology of Economics*.

The paradigm structure of mainstream economics can be shown below.

[9] Snowdon Brian, Howard R. Vane, Peter Wynarczyk, *A modern guide to macroeconomics : an introduction to competing schools of thought*. Aldershot, Hants, England; Brookfield, Vt., USA: E. Elgar Pub. 1994.

[10] Snowdon Brian, Howard R. Vane, *Conversations with leading economists: interpreting modern macroeconomics*. Northampton, MA, Edward Elgar, 1999.

[11] Thomas S. Kuhn, *The structure of scientific revolutions*, Chicago, University of Chicago Press, 1962.

[12] Imre Lakatos, *The methodology of scientific research programmes*, *His Philosophical papers v 1*, Cambridge, New York, Cambridge University Press, 1978.

[13] Craig Dilworth, "Popper, Lakatos, and the Transcendence of the Deductive Model", in *Scientific Progress: A Study Concerning the Nature of the Relation Between Successive Scientific Theories*, Dordrecht, Springer, 1981, p. 52–59.

[14] Massimiliano Simons, "The many encounters of Thomas Kuhn and French epistemology", in *Studies in History and Philosophy of Science, Part A* 61, 2017, pp. 41–50.

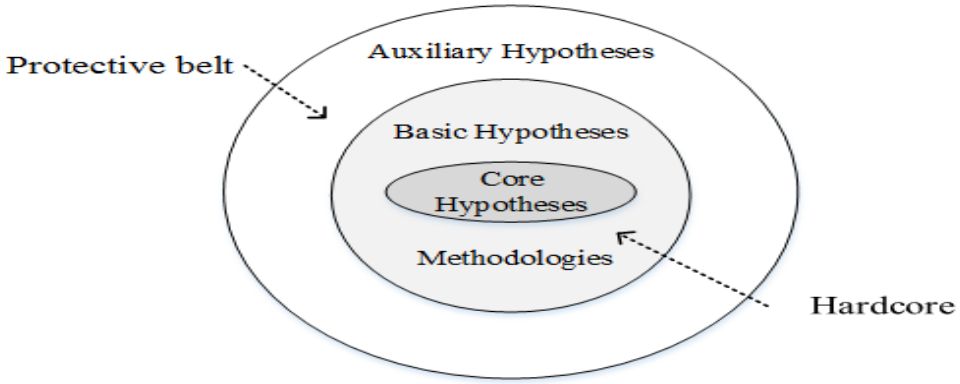

Fig. 1. The paradigm structure of economic research.

The paradigm, viewed through the lens of system theory, is a hierarchical framework comprising the conceptual paradigm, method rules, and primary hypotheses. The conceptual paradigm is the "center", while the method rules and basic hypotheses occupy the "periphery". Similarly, the paradigm structure in economic research can be classified into different hierarchical levels. The core hypotheses within this structure encompass the foundational judgments concerning economic concepts, reflecting the values embedded within the economic knowledge system of a specific historical era. In contrast, the peripheral hierarchy represents the logical framework of economic theory, encompassing the basic hypotheses and methodologies derived from the core hypotheses. The fundamental distinction between mainstream and non-mainstream schools of economics lies in their disparate understanding and positioning of these core hypotheses. For example, the mainstream school advocates for the core hypothesis of rational economic individuals, while the non-mainstream school emphasizes the core hypothesis of institutional and cultural influences on economic behavior.

Furthermore, there are also disparities between the two in peripheral aspects. For instance, within neoclassical economics, there is an emphasis on utility value theory, whereas the history school places importance on productivity theory. Classical and neoclassical economics endorse the method of equilibrium analysis based on rational deduction, while the history school favors analytical methods rooted in historical induction. The fundamental distinction among various mainstream (or non-mainstream) economics schools lies in their divergent primary hypotheses and methodologies. For example, both belong to mainstream economics, yet the classical school advocates "Say's Law of Market", which posits that supply automatically generates demand. Conversely, the Keynesian School asserts that demand determines supply and highlights the issue of inadequate effective demand.

Citing Lakatos' scientific research programs, the structure of economic research can be categorized into the "hardcore" and the "protective belt". The "hardcore" represents the stable core of the paradigm, comprising the fundamental

hypotheses and methodologies as previously mentioned, such as the economic man hypothesis and equilibrium analysis methodology in mainstream economics. The "protective belt" pertains to the auxiliary hypotheses beyond the "hardcore", possessing adaptability. It can expand outward when new experiences test existing theoretical hypotheses or contract in response to contradictory cases. The "protective belt" utilizes its elasticity to shield the "hardcore" and directly withstands the scrutiny of empirical testing. This represents the progressive evolution of conventional economics. For instance, in economic agents, the initial hypothesis of complete information was refined into the subsequent hypothesis of limited information. The original hypothesis of perfect competition in markets was adjusted to acknowledge imperfections. The hypothesis of a frictionless environment was substituted with the friction hypothesis, incorporating transaction costs. These adjustments enhance the realism of theoretical hypotheses. As another example, mainstream economists initially applied the complete information hypothesis to derive deterministic decisions for economic decision-making under uncertainty. However, when this was refuted, the rational expectation school introduced probabilities and transformed decision-making under uncertainty into deterministic economic decisions.

Furthermore, information economics introduced the concept of information costs and utilized information asymmetry as a new hypothesis. This suggests that economic agents can acquire complete information by being willing to incur sufficient costs. Consequently, the challenge of limited cognitive ability in uncertain circumstances was transformed into a constraint of information costs. Kenneth Arrow affirmed that such adaptations effectively protect the theoretical "hardcore"[15].

DIFFERENT ECONOMIC SCHOOLS STICK TO DIFFERENT PARADIGMS

As an independent discipline, economics begins with hypotheses and deductions of well-known propositions, so different economic schools have different paradigm structures. As pointed out earlier, because of the different analysis paradigms they follow, different economic schools have drawn different conclusions when analyzing the same economic phenomena. Therefore, they lived in different scientific communities of the theoretical world in the development process of economics.

Different economic schools stick to different paradigms. The internal changes in a paradigm structure are mainly reflected in the constant adjustment of its "hardcore" and "protective belt". The development process of the Keynesian School of Economics is a good example of this. In the paradigm structure of Keynesian economic research, the primary hypothesis, as one of the peripherals of the "hardcore", is the principle of insufficient effective demand. In other words, the

[15] J. Eatwell, M. Milgate, P. Newman, *The new Palgrave: a dictionary of economics*, 4 volume set, 2003.

effective demand can be represented by the total demand at the intersection of the total supply and demand functions. Effective demand consists of effective consumer demand and effective investment demand. The total income and total employment depend on effective demand. The level of income and propensity to consume determine consumer demand. The marginal efficiency of capital and the cost of borrowing funds (i.e., the interest rates) determine the investment demand. In the paradigm structure of Keynesian economic research, the auxiliary hypotheses in the "protective belt" are the three major laws of psychology. The three major laws of psychology – diminishing marginal propensity to consume, decreasing marginal efficiency of capital, and currency liquidity preference, are the basis for demonstrating the principle of insufficient effective demand. Keynes asserted that the lack of effective demand is mainly caused by the effects of these three basic psychological laws. On the one hand, with the increase in income, consumption will also increase, but the rise in consumption is often not as fast as income, which leads to insufficient consumer demand. On the other hand, people's uncertainty about future expectations led to the strengthening of flexible preferences, the suppression of falling interest rates, the stickiness of interest rates, and the decline in expected capital gains. These factors were intertwined and led to insufficient investment demand.

Uncertainty is the premise of the above three psychological principles. This is different from Marshall's neoclassical analysis paradigm. It presented different research directions. Keynes commented on his "General Theory" like this "The work of this book is a long-term struggle for the author, to get rid of traditional ideas and statements."[16] Keynes believed that the mistake of classical economics was that the research paradigm's basic hypotheses were incorrect. This mainly refers to the fact that the principle of "total supply equal to total demand" proposed by the classical School based on "Say's law of market" is inconsistent with the reality encountered at that time.[17] Therefore, in theory, Keynesian abandoned the basic hypotheses and methodologies of classical economics, like Say's law of the market, micro-individual analysis, equilibrium analysis, and deterministic analysis, and replaced them with new basic hypotheses and methodologies, like the principle of insufficient effective demand, macro-total analysis, non-equilibrium analysis, and expected uncertainty analysis. In terms of the policy, Keynesians denied the idea that free competition alone could achieve the perfect equilibrium and advocated cooperation between the authority of the state and the power of the private. Keynesians proposed the national intervention theory based on total demand analysis and total demand management. They advocated using the visible hand of

[16] John Maynard Keynes, *The general theory of employment, interest and money, His Collected writings of John Maynard Keynes*, London, New York, Macmillan; St. Martin's Press for the Royal Economic Society, 1973.

[17] John Maynard Keynes, *Essays in persuasion, His Collected writings of John Maynard Keynes*, London, New York, Macmillan, St. Martin's Press for the Royal Economic Society, 1972.

state intervention to make up for the weakness of the invisible hand of the market. The Keynesian revolution broke the dualistic structure of the monetary and physical economies in classical economics and formed the economic model system of monetary and economic integration. Moreover, the Keynesian revolution brought mainstream economic research from the micro to the macro level and ushered in a new era of macroeconomics.[18]

In the paradigm structure of Keynesian economic research, the auxiliary hypothesis of "the market can't clear out" constituted the "protective belt" of the principle of insufficient effective demand to protect its theoretical "hardcore" from infringement. Some other auxiliary hypotheses include investment multiplier, currency non-neutrality, wage rigidity, and price rigidity. When the principle of insufficient effective demand was challenged, Keynesian members protected the "hardcore" from being overturned by adjusting some auxiliary hypotheses. James Tobin believed that Keynes' theory of wages and unemployment had another supporting argument, suggesting upward elasticity in monetary wages.[19] In the 1970s, when "stagflation" challenged Keynesian economics, the Keynesian School tried to adjust these auxiliary hypotheses and eliminated the "abnormal" and crisis in the theory to defend the "hardcore".

The positive heuristics and the negative heuristics by Lakatos can also explain the development of Keynesian economics. The positive heuristics mainly enrich the research programs by modifying or improving auxiliary hypotheses to promote the deepening and progress of research programs. Joan Robinson declared her research was how to generalize *The General Theory*, that is, how to expand Keynes's short-term analysis into the long-term analysis[20]. The negative heuristics mainly manifest that "the scientific community members" often guided the spearhead of rebuttal in the study to the "protective belt" and protected the "hardcore" by adjusting auxiliary hypotheses. Through the positive and negative heuristics, the Keynesian school members developed Keynesian economic theory into systematic research programs of macroeconomics, which has specific explanatory power for the real economy. For example, the analysis of the non-equilibrium state of the market caused by uncertainty has made the research paradigm of the Keynesian revolution constantly improve.

Keynes emphasized in *The General Theory* that the market is often imbalanced between supply and demand due to uncertainty, and the non-equilibrium School made further developments. The dualistic decision hypothesis[21] and the unbalanced

[18] Fred R. Glahe, John Maynard Keynes, *Keynes's The general theory of employment, interest, and money: a concordance*, Savage, Rowman & Littlefield, 1991.

[19] J. Tobin, P. M. Jackson, *Policies for prosperity: essays in a Keynesian mode*, 1st ed., Cambridge, MIT Press, 1987.

[20] Joan Robinson, *The accumulation of capital*, 3rd ed., Philadelphia, Porcupine Press, 1986.

[21] Robert W. Clower, "The Keynesian Counter-Revolution: A Theoretical Appraisal", in *The theory of interest rates*, 1965, pp. 103–125.

unemployment theory[22], which emerged in the mid-1960s, can be regarded as the representatives of positive heuristics. The dualistic decision hypothesis assumed that there were two departments (enterprises and households), and their consumption decisions and production decisions usually had to use the planned income and actual income as the budgetary limits and make two decisions. The situation where the quantity of the plan is inconsistent with the actual amount is the product of the monetary economy. The non-equilibrium School argued that the diversity and complexity of the monetary market make it fraught with economic fluctuations. Under the condition of the monetary market, the total unemployment would be more than that under the condition of the barter economy. Therefore, the current monetary economic system cannot achieve general equilibrium through self-regulation. The perfect self-adjustment ability of the market mechanism emphasized by the traditional general equilibrium theory cannot be used as an effective analysis tool to describe the real economic world. It must be replaced by non-equilibrium analysis. This non-equilibrium analysis convincingly explains the difference between the Keynesian research paradigm and the classical research paradigm.

The birth of the new Keynesianism results from the combined effect of positive and negative heuristics. Since the 1970s, Keynesian economics has been challenged by the persistent phenomenon of "stagflation" and the denial of the Phillips curve. The Keynesians constantly modified their auxiliary hypotheses and tried to explain these anomalies better to consolidate and develop Keynesian economic theories. They revise the auxiliary hypothesis of nominal wage rigidity in *The General Theory* and put forward the hypothesis of "price of non-market, and wage stickiness under incomplete information condition". The price stickiness was divided into the nominal price stickiness, which is based on menu cost, staggered adjustment cost, and the actual price stickiness, which is based on firm reputation, input-output table, and demand asymmetry. The existence of price stickiness makes the market unable to clear out, failing the market mechanism and the necessity of government intervention. Keynes's principle of insufficient effective demand was therefore maintained. In the model emphasizing sticky prices, the currency was no longer neutral, and the capitalist market economy was bound to have instability (that is, the market has always been challenging to clear out and has been in a non-equilibrium state), and a large amount of involuntary unemployment. In response to the criticism of Keynesian economics by neoclassical macroeconomics, the new Keynesian School maintained market uncertainty, the non-equilibrium market, and the necessity of state intervention. Joseph Stiglitz pointed out that Keynesianism showed strong vitality in the mid-to-late 1980s. This vitality should be attributed to the ability of Keynesianism to adapt to theoretical innovations and new empirical evidence. Keynesianism can not only absorb natural rate hypotheses and additional

[22] Axel Leijonhufvud, *On Keynesian economics and the economics of Keynes: a study in monetary theory*, New York, Oxford University Press, 1968.

expected Phillips curves but also adapt to rational expectations. The new Keynesianism has been trying to rebuild the micro-foundation of Keynesianism. Its advocates regarded the new Keynesianism as an exciting and dynamic research program, emphasizing labor, product, and capital market inadequacies.[23] James Tobin argued that Keynesian economics could explain the characteristics of the economic cycle that have been observed repeatedly.[24] Brian Snowdon also believed that the new Keynesianism had established a research program by reconstructing the micro-foundation of Keynesianism and focusing on removing the theoretical shortcomings of supply in the original Keynesian model. He thought the new Keynesianism effectively responded to the crisis of Keynesian internal theory elaborated by Lucas in the 1970ˢ.[25]

DIFFERENT FORMS OF THE PARADIGM SHIFT IN ECONOMIC RESEARCH

The economic theory system had several different research paradigms in the same historical period. The competition between them often promoted the progress of economic theory. The history of economic thought can be seen as the history of an economics studies paradigm that has constantly revolutionized and continuously improved through the crisis. The emergence of a new analytical paradigm often leads to a revolution in economic theory.[26] From the perspective of paradigm evolution, there are five different forms of paradigm shifts in past economics studies[27], listed as follows.

ADJUSTING THE AUXILIARY HYPOTHESES TO ADHERE TO THE EXISTING RESEARCH PARADIGM

The first form of paradigm shift is to inherit and protect the "hardcore" of the existing paradigm structure by adjusting the auxiliary hypotheses. Besides the development of the Keynesian School as discussed above, classical economics and neo-classical economics have also demonstrated that a perfectly competitive market

[23] Brian Snowdon, Howard R. Vane, Peter Wynarczyk, *A modern guide to macroeconomics: an introduction to competing schools of thought*, Aldershot, Brookfield, E. Elgar Pub., 1994.

[24] J. Tobin, P. M. Jackson, *Policies for prosperity: essays in a Keynesian mode*, 1st ed., Cambridge, MIT Press, 1987.

[25] Brian Snowdon Brian, Howard R. Vane, Peter Wynarczyk, *A modern guide to macroeconomics: an introduction to competing schools of thought*, Aldershot, Brookfield, E. Elgar Pub. 1994.

[26] Thomas S. Kuhn, *The structure of scientific revolutions*, Chicago, University of Chicago Press, 1962.

[27] Tao Ma, *The evolution of the economic paradigm (in Chinese)*, edited by National Office for Philosophy and Social Sciences, *National Achievements Library of Philosophy and Social Sciences*, Beijing, China Higher Education Press, 2017.

economy can achieve optimal allocation of resources (i.e., Pareto optimality) based on the persistence of the "hardcore" of "economic man". Edward Chamberlin and Joan Robinson respectively proposed the theories of monopolistic competition and imperfect competition by modifying the premise of entire market competition by adhering to the "hardcore" of the "economic man" of neo-classical economics. Similarly, Ronald Coase initiated a new field of research in property rights economics by revising the hypothesis of no transaction costs in the market of neo-classical economics. Every progress in enterprise theory also begins with the amendment to the hypotheses of the traditional enterprise theory. There was no independent enterprise theory in neoclassical economics. In the manufacturer theory, the firm was assumed to be material elements' technological relationships or production functions. One of the contributions of modern contract theory is to explain the nature of enterprises clearly. It presupposed the existence of transaction costs and innovatively proposed that an enterprise is a group of contracts. Based on the uncertainty and the revision of the contract theory on the equality and homogeneity hypothesis of all members of enterprises, Frank Knight proposed the hypothesis of heterogeneity of the internal members of enterprises and the hypothesis of the uncertainty of the external environment that enterprises face. Frank Knight regarded the enterprise as a personified device and created his enterprise and entrepreneur theories.[28] From the perspective of the development process of the historical School, the institutional School, the neo-institutional School, and evolutionary economics, they consistently adhered to the core hypothesis of cultural man and the methodologies of the history approach, institution approach, and evolution approach. This confirmed the way of the paradigm shift in mainstream economics.

Since the 1970ˢ, Avinash Dixit and Joseph Stiglitz adjusted the auxiliary hypotheses of diminishing marginal returns and perfect competition in mainstream economics. They proposed the theories of increasing returns, imperfect competition, and product differentiation (i.e., the Dixit-Stiglitz Model). It laid the foundation for the breakthroughs of a series of "new economics" and fully confirmed the characteristics of the first form of the paradigm shift. Paul Krugman divided these "new economics" into four stages.[29] The first stage is the new industrial organization theory that emerged in the late 1970ˢ, which constructed the "increasing returns and imperfect competition model" for analyzing the organization and structure of industries. The second stage is the new trade theory since the early 1980ˢ, which constructed the theoretical model of international trade under the conditions of increasing returns. The third stage is the new growth theory since the mid-1980s, which emphasized endogenous technological progress and knowledge innovation and established many theoretical models of economic growth under the conditions

[28] Frank H. Knight, "Risk, Uncertainty, and Profit", Boston, Houghton Mifflin Co., 1921, http://www.econlib.org/library/Knight/knRUP.html.

[29] Paul Krugman, "Space: the final frontier", in *Journal of Economic Perspectives* 12 (2), 2001, pp. 161–174.

of increasing returns. The fourth stage is the new economic geography since the late 1980s, which tried to make new explanations for the spatial structure of the economy based on the "increasing returns and imperfect competition model". The new economic geography has dramatically deepened the theoretical study of economics. It incorporated the economic geography analysis into the research category of mainstream economics and overcame the shortcomings of its long-term neglect of spatial factors. This made breakthroughs in the economics of space and promoted the further deepening of the study of new trade theories. With the advancement of economic globalization, the leading players in economic competition are no longer the competition between countries but rather the competition between regions. The new trade theory thus promoted the development of regional economics.

ADJUSTING THE PERIPHERALS TO IMPROVE THE EXISTING RESEARCH PARADIGM

The second form of paradigm shift is to inherit and protect the core hypotheses of the current paradigm structure by modifying the basic hypotheses and methodologies. For example, Herbert Simon proposed as early as 1947 that economists should focus theoretical attention on the boundary between rational and irrational aspects of human social behavior, and the entire rationality of economic man should be changed to bounded rationality.[30] Simon argued that it is difficult for people to understand and correctly predict each measure's outcome in real market transactions. People often make decisions based on subjective judgments when they have a limited understanding. Such decisions must also be influenced by people's skills, values, understanding of goals, the depth of relevant knowledge that should be possessed, and the completeness of the information required. To understand the behavior of "economic man", economists must understand the limits of the internal environment, especially the cognitive ability of manufacturers and consumers to gather information, make inferences, perform complex calculations, etc. The essence of "*The Keynesian Revolution*" is to adjust the basic hypothesis of entirely foreknowing for the uncertain future in traditional neoclassical economics to the primary hypothesis of bounded foreknowing.

The non-equilibrium School of Keynesian economics argues that most economical life is in non-Walrasian equilibrium. They thus adjusted the traditional general equilibrium analysis paradigm and used the non-equilibrium analysis paradigm based on the price-quantity adjustment mechanism. It emphasized the spillover effect in the economic process, that is, the imbalance of a market will be transmitted to other markets. Thus, the equilibrium of all markets will be changed.[31]

[30] Herbert A. Simon, *Administrative behavior: a study of decision-making processes in administrative organizations*, 4th ed., New York, Free Press, 1997.

[31] Jean-Pascal Benassy, *Macroeconomics: an introduction to the non-Walrasian approach*, Academic Press, 2014.

The non-equilibrium School emphasized that the essence of Keynesian economics is "non-equilibrium". Robert Barro and Herschel Grossman proposed the famous general disequilibrium macroeconomic model and further extended and developed the Keynesian economic theory and methodology. The information and information costs, the uncertainties, and the expected roles emphasized by the economic analysis of the non-equilibrium School provided some inspiration and prerequisites for the later development of information economics and economic game theory. After the 1980s, the new Keynesian economics theory's development benefited primarily from some theoretical ideas and methods of the non-equilibrium School.

ADJUSTING THE CORE HYPOTHESES TO CREATE A NEW RESEARCH PARADIGM

The third form of paradigm shift is to create a new research paradigm by integrating the research paradigms of different schools. The new institutional economics is a successful case of this paradigm shift. The analysis paradigm of the new institutional School integrated the marginal analysis paradigm of the neoclassical School and the evolutionary analysis paradigm of the institutional School. Compared to the institutional School represented by Thorstein Veblen and John Galbraith, the new institutional School inherited the core hypotheses, methods, and tools of neoclassical economics, such as the rational man hypothesis, stability preferences, equilibrium, and maximization analysis. Meanwhile, the new institutional School also drew on the institutional traditions and the evolutionary analysis paradigm of the institutional School. For example, Olive Williamson repeatedly mentioned the impact of John Commons (i.e., conflict, mutual aid, and order are trinity) on the governance of contract relations in neo-institutional economics. In *The Firm, the Market, and the Law*, Ronald Coase made it clear that the new institutional economics was such a doctrine that used the mainstream economic theory to analyze the structure and operation of the system. The purpose was to find out the status and role of the institution in the economic system. In *Structure and Change in Economic History*, Douglass North emphasized that the new institutional economics was based on neo-classical theory, and it revised and developed the neo-classical theory and allowed it to discuss and solve the unrecognized problems so far freely. He said that the new institutional economics aimed to study how people make decisions in the real world and how these decisions change the world in the context of institutional evolution. John Commons put forward the concept of transaction costs in the transaction-based institutional analysis. Ronald Coase absorbed the concept of transaction costs and took it as the core paradigm of the new institutional economics and further elaborated its basic connotations. Douglass North took the institutional evolution approach proposed by the institutional School, used it to analyze the institutional changes, created a new economic history, and became one of the five branches of the new political economics reform movement. (It should be

pointed out here that the five branches of the new political economics reform movement included the new economic history, the new institutional economics, the public choice school, the regulation economics, and the property-rights economics. In the neo-classical economics system, the institutional factors were assumed to be already established and efficient, and the economics studies were only to analyze the behavior of individuals and their results under a given system. However, the new political economy argued that institutional factors are endogenous economic activity variables and must be incorporated into the economic analysis framework. The new political economy is regarded as the transcendence of neoclassical economics.)

Neo-institutional economics also borrowed the cultural man hypothesis from the institutional School to amend the economic man hypothesis of neoclassical economics. It criticized that the market entity in the neo-classical economics system is the market entity in ideas that are out of touch with reality. It is said that, in many cases, human behaviors are far more complicated than the wealth maximization hypothesis in mainstream economic theory. It emphasized that the non-wealthy maximization motives and other cultural factors often restricted people's behavior and advocated internalizing the external social system factors. Neo-institutional economics tended to regard the external social system factors as endogenous variables for a rational choice of economic man. Douglass North also introduced the non-wealthy maximization factors such as ideology into its personal expected utility function. He argued that people often have to balance the value of wealth and non-wealth and established a more complex and close-to-realistic model of human behavior. The economic man whom the new institutional economics has revised is no longer aiming solely at purely material interests but explicitly includes non-economic benefits and spiritual satisfaction. Instead of making decisions with “cost-benefit” accounting, this type of economic man tended to choose between several trade-offs (including values and ideology), and the results of various choices will have different effects on individual economic behavior. What specific goals people will pursue depends entirely on their values. We believe that the analysis of values and how they affect human behavior should be included in the economic analysis. Otherwise, the rationality of the theory will be greatly reduced, and the reality cannot be fully explained. From the economic man hypothesis of classical economics to the culture man hypothesis of the institutional School to the economy-culture man hypothesis of the neo-institutional economics school, the paradigm shift in economics studies reflects the deepening of economists’ knowledge about our human self and the circumstances we live. It is on this understanding that Ronald Coase criticized neoclassical economics as blackboard economics and called his School real-world economics.[32]

[32] J. Eatwell, M. Milgate, P. Newman, *The new Palgrave: a dictionary of economics*, 4 volume set, 2003.

THE INTEGRATION OF DIFFERENT RESEARCH PARADIGMS

The fourth form of paradigm shift is represented by integrating the research paradigms of the different schools within the mainstream economy, which finally forms a "unified" economic framework system. The research paradigm of economics has evolved in continuous development. Several theoretical systems of research paradigms can coexist in the same historical period. Some of them can be blended and reconciled. Some of the differences and contradictions between them can be blended and reconciled. The competition or integration between different economic theories is one of the driving forces for the paradigm evolution of economics studies. There have been three major integration movements with significant influence on the development of mainstream economics in the past two centuries. The primary representative includes the *Principle of political economy with some of their applications in social philosophy* by James Stuart Mill, published in 1848; the *Principles of Economics* by Alfred Marshall, published in 1890; the *Economics* by Paul Samuelson, published in 1948 (first edition).

In the era of James Stuart Mill, the British industrial revolution was in full swing. The contradiction between the traditional feudal lords and the emerging industrial capital has reached a rather sharp level. On the one hand, James Stuart Mill tried to maintain the market economy principle of the invisible hand. On the other hand, he tried to absorb the theoretical achievements of Ricardo School and Nassau Senior. He proposed to improve the capitalist market economy by reforming income redistribution.

Alfred Marshall tried to integrate various popular theories in economics studies at that time, such as supply and demand theory, abstinence theory, production cost theory, marginal utility theory, etc., to enrich his theory system and form his neo-classical economics. One of the effects of "Marshall Integration" is that he developed an analytical framework that is still the structural basis of modern mainstream economic theory through the complementary integration of the objective value theory of classical economics and the subjective utility value theory of the marginal School. The objective value theory emphasized the supply analysis and formed the supply theory with production cost as the core. The utility value theory emphasized the demand analysis and formed the demand theory centering on utility analysis. In the *History of economic analysis* (Volume 3), Joseph Schumpeter pointed out that the economics of Alfred Marshall attempted to reconcile the analysis principles of the British classical School (mainly Ricardianism) and the analysis principles of the marginal utility school (mainly William Jevons & the Austrian School).

The "Samuelson Integration" in the development of modern mainstream economics attempted to integrate the theoretical achievements of the different schools formed in the past half-century into Keynes's economic system. Paul Samuelson tried to reconcile the two mutually exclusive theoretical paradigms of Keynesian

macroeconomics and classical microeconomics. In *Economics* (the 12th edition), Paul Samuelson admitted that economics is an evolutionary science in its essence. It changed itself to reflect changes in the social and economic direction. For example, compared with the previous 12th edition, *Economics* (the 14th edition) in 1992 has undergone important revisions and integration. In the face of the new changes in the world after the disintegration of the Soviet Union, Paul Samuelson emphasized the universal applicability of the market economy in various countries of the world. He put forward the point of view of market rediscovery. The *Economics* (the 17th edition) in 2001 integrated the schools of classical economics, neoclassical economics, Keynesian, modern monetarism, supplyism, and rational expectations. Paul Samuelson also emphasized the innovation in economic and economics studies caused by computer information technology, the impact of network economy on economic efficiency, and market forces. Moreover, he paid some attention to environmental issues - as a global public product. In his preface of *Economics* (the 14th edition), he declared that he had become the spokesperson of mainstream economics in the late 20th century.

Every time economics studies developed to a certain stage. Different schools would be integrated within the discipline, trying to organize, discard, supplement, and renew the previous theories, thereby nurturing economic ideas' greater innovation and development. This form of economics studies paradigm shift may be a way for economists to construct new theoretical systems. However, whether this type of "integration" really raised the level of understanding of human economic activity is probably still questionable.

THE OPEN MOVEMENT OF RESEARCH PARADIGM BASED ON CROSS-DISCIPLINE

The fifth form of paradigm shift is the open movement of the research paradigm based on cross-discipline. The research methods of other subjects were introduced in the research paradigm of mainstream economics, which is one of the most significant features of the history of economic development since the 1980s. Interdisciplinary economics studies may become the direction of future economics paradigm movement because of the breadth and complexity of economic practices and the openness and innovation of economic theories. The emerging behavioral economics, experimental economics, evolutionary economics, and social capital theory in development economics, etc., indicate the diversified trend in the research paradigm of economics.

Behavioral economics combined economic science with the behavioral analysis theory in psychology to find errors or omissions in the current economics studies paradigm. It attempted to amend the hypotheses of economic man, self-interest, complete information, utility maximization, and consistency of preferences

in mainstream economics. Behavioral economics revealed that people often underestimated the impact of their behaviors, and exogenous variables on future utility often exaggerated the similarity between future preferences and current preferences, thus generating prediction biases. The present welfare is affected not only by current consumption but also by other factors such as past behavior, temporary changes in preferences, and environmental changes. Given the wide prevalence of prediction bias and the diversification of the environment, the utility of the forecast does not have to be consistent with the actual utility, and human behavior does not necessarily coincide with the correct utility maximization. The research results in behavioral economics confirm that future events cannot be calculated as a certain risk probability as neoclassical economics assumed. People's expectations for the future tend to be quite subjective, so people's behaviors tend to have a robust and irrational color. People in real life may not be able to make the best choice even if they know the best choice. Moreover, people often make decisions based on short-term gains rather than long-term benefits. These facts revealed by behavioral economics do not conform to the rational-economic man hypothesis in mainstream economics. Behavioral economics has made an essential expansion of mainstream economics' research paradigm, making economics more realistic and explanatory.

For the first time, Vernon Smith, the leading representative of experimental economics, introduced experimental methods in natural sciences into economics studies and put forward five principles for the experimental design of economics. The rich connotation of experimental economics revealed the necessity of experimental testing and successfully changed the long-held belief that economics is not an experimental science. Experimental economics has made economics studies unprecedentedly replicable and controllable. Since the late 1960^{s}, the influence of experimental economics on economics studies has become more and more profound and extensive.

Evolutionary economics challenged the general equilibrium theory of mainstream economics by introducing the methods of complexity science and biological evolution.[33] Its research paradigm emphasized the eternal nature of historicity and the change process. Evolutionary economics used the evolutionary model with the concept of historical time to replace the equilibrium model of neoclassical economics. It replaced the optimal theory with the non-optimal theory and perfect rationality with bounded rationality. Moreover, evolutionary economics incorporated the factors ignored by mainstream economics, such as institutions, cultures, habits, etc., into the economic analysis and tried to provide another framework for developing economics. Evolutionary economics has interpreted a world of economics differently from the neoclassical. It is increasingly concerned with the academic world because it is closer to the real economic world.

[33] Ulrich Witt, *Evolutionary economics: an interpretative survey*, in Kurt Dopfer (ed.), *Evolutionary economics: program and scope*, Springer, Dordrecht, 2001.

The social capital theory in development economics is the theoretical result of the interdisciplinary cross-section of the economics open movement. Development economics has undergone major changes in three phases. From the structuralism and inward development strategy in the early 1950^{s} to the neo-classical renaissance and export-oriented development strategy in the early 1970^{s} and then to the new institutionalism and the tide of system reform of the planned economy states in the early 1990^{s}, development economics evolved from "planning is essential" to "market is essential", and then to "institution is essential". Since the 1990^{s}, development economics has become the intersection of multidisciplinary research. Economists have expanded the research horizon to the issues studied traditionally by sociology and political science, like social networks, common norms, trust, and civil society systems. Development economics put forward the argument that human relations in society are of vital importance. It has entered the development stage of emphasizing social capital. The social capital theory initially proposed by Pierre Bourdieu is an essential supplement to mainstream economics that only pays attention to the two-tier organization of the state and the market while ignoring the community organizations. It has thus advanced the research of development economics.

French regulation school that has become popular since the 1980^{s} also demonstrated cross-disciplinary characteristics. They argued that the existing economic theories have their defects. For example, the neo-classical School abandoned the elements of time and space. It provided only a non-historical economic law that could not explain the historical evolution of the capitalist economy. The Keynesian economic theory focused on studying short-term macroeconomic policies and lacked research on the contradictions brought about by economic growth. Although Marxism economics emphasizes the historical particularity of social relations and capital accumulation, the subject concept used is too abstract. Suppose the value is used instead of the price. Applying it to specific studies is challenging because it can only be applied to the overall analysis and general calculation. Using value instead of price, which can only be applied to the overall analysis and general calculation, is challenging to apply to specific research. The regulation school tried to develop Marx's institutional analysis and attempted to integrate it with Keynesian macroeconomic theory and neoclassical microeconomic theory. From the bottom up, the regulation school used the differences and linkages between the industrial (or technological) production paradigm, regulation mode, accumulation regime, and development pattern as the basic analysis tools. They distinguished between the cyclical and structural economic crises from the multiple and integrated perspectives of monetary and credit relations, labor relations, forms of competition, state intervention, and international relations. They further raised the theory of development pattern crisis and the dominant production mode ultimate crisis, which are different from the aforementioned two forms of crisis, in an attempt to create a new economic theory system. These theoretical perspectives and research methods have had certain implications for understanding the worldwide capitalist economic crisis since 2008.

THE CONDITIONS AND TIMING OF A PARADIGM SHIFT IN ECONOMICS RESEARCH

According to the different analysis paradigms, the development of mainstream economics has roughly gone through three historical periods: the former economics period, classical economics, and modern economics. Among them, modern economics has experienced three periods: neoclassical economics, Keynesian economics, and new classical macroeconomics. The economic analysis paradigm in the former economics period is in gestation and has not yet formed a systematic economic knowledge system. Thinkers usually expressed opinions and shaped ideas on various economic issues based on their own economic life experience and intuition in this period. Still, they lacked a set of stable analysis paradigms. Classical and modern economics have normative analysis paradigms and are systemic economics theoretical systems. During the period from the Physiocrats to Adam Smith, the research paradigm of classical economics was gradually formed and consolidated. After that, classical economics developed steadily from Jean Say and David Ricardo to John Mill. The core of the research paradigm of classical economics focused on the objective value theory. Based on the logic of this paradigm, "Say's law of market", the dichotomy of physical economy and currency phenomenon, and the theory of the quantity of money, etc., gradually developed and eventually formed a system of classical economics. The core of the marginal revolution in 1870 was to replace the objective value theory of classical economics with the subjective value theory. Mathematical methods were introduced into economic analysis, and marginal incremental utility analysis extended to value theory and distribution theory. The research paradigm of mainstream economics has changed from the classical analysis paradigm to the modern analysis paradigm.

The core hypothesis in the paradigm structure of economic research is relatively stable. It is also the basis for deducing the ideological system of different economic schools. Once a specific paradigm has been established in a certain period of history, it will be recognized and continued as long as the existing logical systems and methodological principles can reasonably explain economic phenomena with the help of specific economic analysis tools. Suppose the logical conclusion of economic analysis is inconsistent with the actual economic experience. In that case, the scholars who worship this paradigm often correct their understanding of it and try to incorporate the abnormal economic phenomenon into the logical space contained in the old paradigm and explain it. In this way, the stability and even rigidity of economic thought led to the relative quiescence of its development. It shows that the economic research paradigm has arrived at a healthy development time, judging from the logical evolution of the economic thought calendar. At this point, this economic research paradigm is deducing and perfecting its internal structure. It is manifested as a gradual expansion from the core to the peripheral hierarchy, forming a stable economic knowledge development period. However,

with the development of conventional economics, new situations, and problems have occurred and accumulated outside the logical space of the original paradigm due to changes in the actual economic development process. The ability of the original economic knowledge structure is declining to explain or predict the real economy. The revolutionary period of paradigm shift will come when people broadly attribute the failure of the theoretical explanation and the inability to anticipate practical economic problems to the knowledge structure of the current analysis paradigm itself. Therefore, the constant emergence of new situations and new issues in economic development practice, as well as the efforts to try to answer them better, are the causes of the paradigm shift in economic research.

The continuous verification of economic theory by empirical facts of the objective economic process broke the relatively static state of mainstream economics during its regular development period. An economics revolution will happen when the existing economic theory fails to explain the new problems in the objective economic process fully. When people finally attribute the failure of theoretical explanation and prediction to the defects of the existing analysis paradigm, many beliefs, viewpoints, and academic factions will compete. Every economic School constantly analyzed the true foundations of other economic schools.[34] From the perspective of the development of the history of economic thought, a new research paradigm would form and replace the old one when the following two conditions were satisfied.

First, the new research paradigm entailed a broader logical space than the old one. It can solve all or almost all quantitative problems that old theories have dealt with, or it can absorb previously unsuitable experiences and most or all of the previous experience. Changes in norms have brought scientists and those who learn from them closer and closer to the truth. If an economic school's research paradigm/program was even better, it could solve problems and anticipate new facts better. Its application could bring more value to production. Then this School would be able to gain the upper hand in the competition. The new research paradigm must also fit into the central beliefs of the thought-form outside the economics knowledge system that guides the people who use different standards.

Second, the new research paradigm must adapt to the socioeconomic development level during the paradigm shift and the pattern of vested interests, whose theoretical perspectives were supported by most people then. Whether consciously or not, different theoretical systems of economists always represented different economic interest groups. They took different research tasks assigned by the times and chose the most favorable theoretical hypotheses and research paradigms for the interest groups that defended them. The specific economic research paradigm is the product of particular historical conditions and periods.

[34] Thomas S. Kuhn, *The essential tension. Selected studies in scientific tradition and change*, Chicago, University of Chicago Press, 1977.

The roots of every change in the economic research paradigm are in the era's significant economic issues and social practices.

The development of realistic economic practices implied the historical inevitability of the evolution of the economic research paradigm. This fully proved that the economic theory could not exceed the reality of history to design problems and objects out of thin air, and economics is always a discipline that continues to innovate and develop with human economic activity. The economic paradigms on which different economic schools are based reflect their respective subjective conditions on real-time practice and space-time differences.

CONCLUSION

Economics refers to many literature, data, and statistical reports on economic issues. It generally includes applied economics and theoretical economics. Mainstream economics is usually a vast and loose concept, which may have different definitions for different schools of thought. The modern mainstream economics mentioned in this paper refers mainly to theoretical economics with leadership and discourse hegemony in economist communities. It plays a significant role in formulating and implementing government economic policies. So, mainstream economics here refers to neoclassical macroeconomics and Keynesian economics. Strictly speaking, Kuhn and Lakatos have separate ideas of paradigms and research programs. They cannot be treated synonymously. However, in terms of the theme of whether economics can discover/reflect objective laws, they are not rigorously distinguished in this article. Then there are issues with how the schools are framed. For instance, not all Keynesians reject the concept of equilibrium. Keynes himself was a proponent of equilibrium thinking. Similarly, it is not accurate to say that all neoclassical economists accept the validity of Say's Law. Additionally, it is important to note that neoclassical economics is distinct from neoliberal economics.

A research paradigm is a thinking tool invented by economists that seeks to reveal and grasp the laws of simple invariance contained in the highly complex uncertainty of economic activity. It is, therefore, impossible to exhaust the full understanding and grasp of current and future economic changes, and it is only possible to have the relative or partial truth. No historical period can have just a single research paradigm for economics. Nor can any one of the research paradigms of economics ever exist in all historical periods. When significant changes in the primary economic structure occur in a country or even the world, many major economic problems that cannot be genuinely explained or solved by existing economic knowledge or theory will continue to emerge. The more fundamental and thorough the economic structural reform is, the more subversive and revolutionary the paradigm shifts in economics. The new historical conditions and period call for a new and appropriate research paradigm for economics. The social practices of human economic history are complex and changeable. Their relationship with the

development logic of economic thoughts and the research paradigm of economics will also be complicated and repetitive, sometimes even backward, rather than straightforward. Finally, what needs illustration is that the five types of a paradigm shift are: adjusting the auxiliary hypothesis to protect hardcore, adjusting the basic hypothesis and methodologies to improve the paradigm, adjusting the core hypothesis but creating a new paradigm, integrating different research paradigms, adopting the research paradigm of another science. The last two do not sit well with Lakatosian or Kuhnian analysis. To be honest, we feel a little out of our depth to discuss such grand topics as the paradigm of mainstream economics and its transformation in a limited space. We simply hope this shallow article can inspire more in-depth discussions to foster the ongoing prosperity of the economic research community.