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A Reflection on Postwar Neoclassical Economics: The Shift from General Equilibrium Theory to the New Microeconomic Theories

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Abstract

The theoretical focus of neoclassical economics experienced a significant change in the 1970s–1980s. General equilibrium theory lost its dominant position in theoretical economic studies, with its role of setting the research agenda taken over by what this article calls the "new microeconomic theories," principally decision theory, game theory, and mechanism design. Mainstream economists, post-Keynesians, and historians of economic thought each give a different explanation of the hows and whys of that change, but all miss some critical methodological implications. That change, as this article discusses, shows that neoclassical economics has turned from "grand theory" toward "small models" with empirically delimited utility and that the ideology of marketism lacks a valid scientific foundation. This interpretation can help illuminate the deeper dynamics of the postwar development of neoclassical economics and provide insights for a new political economy that can come to grips with political-economic practices that cannot be fully grasped by the neoclassical tradition.

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After World War II, general equilibrium theory, exemplified by the seminal work of Kenneth Arrow and Gerard Debreu (1954), became the most important theoretical topic in neoclassical economics and was deemed a landmark in economic studies for its rigor and logical consistency. However, thirty years later, general equilibrium theory lost its momentum. Its preeminence as the crown of neoclassical economic theory was overshadowed in the 1980s by new theoretical branches of neoclassical economics: decision theory, game theory, and mechanism design in the main.[1] Though the idea of general equilibrium itself is still a key ingredient in modeling in mainstream economics—which is embedded in the practice of requiring "all markets must clear" in building concrete economic models—for economists who consider themselves theorists, theoretical studies essentially mean studies in the three fields of decision theory, game theory, and mechanism design. Rare is the scholar in the neoclassical school who still engages in theoretical studies in the vein of general equilibrium theory of the 1950–1970s.

What accounts for this fundamental shift in the theoretical focus of neoclassical economics? And what explains the rise of the new microeconomic theories to the point where they have come to dominate theoretical economic studies? Different academic traditions have different answers to these questions. Below, we consider the responses of scholars in three traditions: mainstream neoclassical economics, post-Keynesianism, and the history of economic thought.

Mainstream neoclassical economists attribute the decline of general equilibrium theory to its inability to deal with the issue of asymmetric information,[2] and the rise of the new microeconomic theories, especially game theory, to their power to provide a workable framework for analyzing economic realities replete with asymmetric information.

Post-Keynesians, the best-known opponents of neoclassical economics in the Anglo-American economic academy, consider the fall of general equilibrium theory to be a result of its failure to deal with the famous "aggregation problem"—the problem of how to construct meaningful macroeconomic concepts from microeconomic primitives.[3] By turning to game theory, a field that is little concerned with the relations between microeconomic and macroeconomic concepts but instead focuses on studying in a general and formalized way how decision-makers interact strategically with each other in

idealized contexts, neoclassical economists can avoid the difficult task of tackling aggregation problems head-on. These problems are still there, but they have been simply shunted aside.

Finally, historians of economic thought look upon the rise of decision theory, game theory, and mechanism design as an exemplification of the accelerated mathematization in postwar neoclassical economics. Particularly, in their view the rise of these approaches reflects the further triumph of Bourbakism,[4] the most influential school of mathematical philosophy in the twentieth century, in defining how theoretical economic studies should be done. The key idea behind Bourbakism is that the entire architecture of mathematics should be rebuilt into a highly formalized, axiomatized structure. Influenced by Bourbakism, postwar neoclassical economists also began to reconstruct economic knowledge in an axiomatized "definition-proposition-proof" style. That is, the definition of economic concepts must be formulated in rigorous mathematical language, and economic propositions must be articulated mathematically and then proved. The Arrow-Debreu general equilibrium theory was the first successful example of conducting and expressing theoretical economic studies in a Bourbakist manner. But the momentum of mathematization and formalization generated by general equilibrium theory began to dissipate in the 1970s–1980s. Decision theory, game theory, and mechanism design came to the rescue and pushed neoclassical economics into the next stage of mathematization and formalization.

Although all three of these answers provide some insights, they miss some crucial implications of the change in the theoretical focus of neoclassical economics. First, general equilibrium theory, deemed by its founding fathers to be a comprehensive system that explains universal operations and basic laws of the economy, in fact is beset by fundamental intrinsic flaws, as shown by both mainstream economists and the post-Keynesians, and thus failed to work as a scientific grand theory. Consequently, it lost its theoretical centrality in neoclassical economics.

The failure of general equilibrium theory as a grand theory suggests that marketism—the belief that the market acting as a spontaneous mechanism free of intervention can solve most socioeconomic problems—is not viable.[5] At the very core of general equilibrium theory is the conviction that the market is the most efficient mechanism for resource allocation. Built around this assumption is a systematic discourse of how values are formed, how production factors are provided, and how incomes are distributed through markets, all written in a rigorous, logically precise manner using mathematized definitions, theorems, and proofs. This gives marketism the appearance of "scientific" knowledge. However, the intrinsic inconsistency that proponents of

general equilibrium theory encounter when trying to incorporate some important economic concepts reveals that the scientific cover of marketism is in fact not scientific but just a cover.

Second, what has taken the place of general equilibrium theory is not another grand theory, but instead a collection of small models. These models are not overarching law-like explanations for the whole economic system but instead are fully specified and small scale, and come with empirically delimited utility. Such models are intended to formalize stylized facts about human decision-making and strategic interaction. Decision theory, game theory, and mechanism design are the most successful examples of this new path of research using small models. Past studies, especially in the history of economic thought, have correctly identified the rise of the new microeconomic theories and the deepening of mathematization in neoclassical economics but have failed to note this more fundamental dynamic—that is, what replaced a grand theory were small theories.

Furthermore, by turning to small theories, neoclassical economists, incontestably the mainstream in Anglo-American economic studies, have lost the ability to engage in substantial conceptualization of political-social-economic practices. Decision theory, game theory, and mechanism design are good at creating small models that target particular aspects of empirical objects, but the more these models are empirically meaningful, the narrower their scope of application. In fields where the new microeconomic theories can provide a basis for good inferences about the properties of empirical objects and for comparatively precise predictions about the evolution of empirical phenomena, economic research has become increasingly indistinguishable from operations research or applied computer science.

Thus, with the decline of general equilibrium theory, the neoclassical tradition lost the vision of eighteenth- and nineteenth-century political economists such as Adam Smith, David Ricardo, and Karl Marx, all of whom emphasized that the foremost task in economics research is to grasp the essence of the political-economic system. Moreover, their practice of analyzing the relations between state and economy, of explaining the whys and hows of the development of nations, has also faded from the core of theoretical economic studies. Of course, today there remains a large group of economists interested in these issues, but what must be emphasized here is that their interests and concerns are no longer a source of theoretical innovations and creations on the frontier of neoclassical economics. This trend, however, has created an avenue toward a new political economy (Huang, 2021), one that shares the vision of classical political economy but emphasizes grasping actual political-economic practices.

The Change in the Theoretical Focus of Neoclassical Economics: Past Explanations

The fall of general equilibrium theory and the rise of decision theory, game theory, and mechanism design as the new theoretical workhorses in postwar neoclassical economics has drawn the interest of scholars in many different camps. Mainstream neoclassical economists, post-Keynesians, and historians of economic thought have all offered their own explanations for this transition.

Mainstream Neoclassical Economists: Asymmetric Information

French microeconomic theorist Jean-Jacques Laffont, a mainstream economist, considered the fall of general equilibrium theory to be the result of its inability to deal with the issue of asymmetric information, so pervasive and significant in the real world that it calls for an effective analytical framework, which in Laffont's view was game theory. According to Laffont and his coauthor David Martimort,

> general equilibrium theory was capable of producing powerful generalizations and able to deal with uncertainty, time, externalities, and extending the validity of the invisible hand as long as the appropriate competitive markets could be set up. However, at the beginning of the seventies, works by Akerlof (1970), Spence (1974), and Rothschild and Stiglitz (1976) showed in various ways that asymmetric information was posing a much greater challenge and could not be satisfactorily imbedded in a proper generalization of the Arrow-Debreu theory. The problems encountered were so serious that a whole generation of general equilibrium theorists momentarily gave up the grandiose framework of GE to reconsider the problem of exchange under asymmetric information in its simplest form, i.e., between two traders. In a sense, the theorists went back to basics. They joined another group trained in game theory and in the theory of organizations, and together they built the theory of incentives, which we take as encompassing contract theory and mechanism design. (Laffont and Martimort, 2002: 4)

This "much greater challenge" mentioned by Laffont and Martimort is that, when one assumes that different participants in the market—especially traders from different sides of the market, such as buyers and sellers—are privy to asymmetric information, an equilibrium solution according to the Arrow-Debreu model may not exist. If equilibrium cannot be guaranteed, the general equilibrium framework will collapse since all the possible implications of the theory depend on the existence of equilibria. If economists become

increasingly concerned with the issue of asymmetric information—which was in fact the case in the 1970s–1980s—they will no doubt be inclined to abandon any theory that cannot provide an effective way to model information asymmetry. From this perspective, Laffont and Martimort's point makes good sense.

But is it really the case that general equilibrium theory and asymmetric information are doomed to be mutually exclusive, as Laffont and Martimort suggest? Is there any chance of creating an extended framework of general equilibrium that can incorporate at least to some extent asymmetric information? In fact, there is indeed a small circle of economists who have been working toward this goal since the 1980s, which is exactly the time when the tide of general equilibrium theory ebbed so low that most theorists left that field. Representative works in this vein of studies are the two Cowles Foundation working papers of Dubey, Geanakoplos, and Shubik (1989, 2000) and the published paper in *Econometrica* by the same authors (Dubey, Geanakoplos, and Shubik, 2005). Through a long academic journey, the authors found a way to incorporate asymmetric information into general equilibrium theory. They did so by introducing a new concept: "default." They show that two typical phenomena of asymmetric information—adverse selection and moral hazard—can be interpreted as special cases of their new version of the general equilibrium model.[6] They also prove that their model in general has solutions, thus showing that, at least in some cases, general equilibrium models with certain forms of asymmetric information can have solutions. Inspired by these pioneering works, Alberto Bisin and Piero Gottardi (1999) accomplished a similar extension of general equilibrium theory in a dynamic setting, unlike Dubey, Geanakoplos, and Shubik's static setting. Urai, Yoshimachi, and Shiozawa (2018) have gone further by extending Dubey, Geanakoplos, and Shubik's idea from an exchange economy into a production economy.

Nonetheless, all these studies since the 1980s have generated few responses from mainstream economists. Neoclassical scholars in the past three decades by and large have ignored these works. This is because, first, all the works that incorporate asymmetric information in general equilibrium theory have only made limited progress in dealing with the complexity of the phenomenon of asymmetric information in reality. If one insists on working within the framework of general equilibrium, only a few basic cases of asymmetric information can be formalized. Second, as Laffont and Martimort pointed out, game theory is a more flexible and powerful tool for dealing with the complexities of real-world cases of asymmetric information. This has to some extent induced some noted neoclassical theorists to give up general equilibrium theory as their central pursuit and turn to game theory. Aside

from asymmetric information, there are also other reasons why neoclassical theorists have abandoned general equilibrium theory, a subject to which we turn below.

Post-Keynesians: The Aggregation Problem

The fall of general equilibrium theory and the rise of decision theory, game theory, and mechanism design have also drawn the attention of the post-Keynesians, the most influential "heterodox" camp of economists in the Anglo-American world. Unlike mainstream neoclassical economists, post-Keynesians do not believe that it is solely the inability of general equilibrium theory to deal with asymmetric information that led to its decline. They argue instead that the so-called aggregation problem caused general equilibrium theory to lose its momentum.

The aggregation problem in economics refers to the issues of how to formulate macroeconomic concepts and/or quantities from microeconomic primitives—such as preferences, production techniques, endowments, and so forth—and of how to constitute logically valid relations among macroeconomic concepts/quantities, usually in the form of mathematical functions. Even in the heyday of general equilibrium theory, the aggregation problem had already drawn the attention of both neoclassical economists and post-Keynesians. Early in the 1950s–1960s, in the famous "capital controversy,"[7] post-Keynesians and neoclassical economists heatedly debated the aggregate production function,[8] which is the first remarkable aggregation problem that touches on the core question of whether the basis of neoclassical economics is valid. That debate led to the conclusion that the neoclassical assumption of the existence of a well-defined aggregate production function is logically inconsistent and will produce incorrect predictions about many important macroeconomic activities.

In the 1980s, the post-Keynesians perceptively observed that it was another aggregation problem—the aggregate excess demand function[9]—that was responsible for the decline of general equilibrium theory. Precisely because the aggregate excess demand function is not a well-defined macroeconomic construct, as they argued, general equilibrium theory was finally abandoned by neoclassical economists as their core theoretical agenda.

In 1973–1974, three economic theorists—Hugo Sonnenschein, Rolf Mantel, and Gerard Debreu—separately analyzed the properties of the aggregate excess demand function (Sonnenschein, 1973; Mantel, 1974; Debreu, 1974). They found that if one proceeded from ordinary microeconomic settings, one can at most construct an aggregate excess demand function satisfying some rather unrestricted properties,[10] which renders that function almost

meaningless. In other words, aggregate excess demand functions cannot be used to make substantial inferences about how aggregate demand reacts to changes in prices, and about where possible equilibria of the economy might be. Their findings were later summarized as the Sonnenschein-Mantel-Debreu theorem (or, the SMD theorem).

The SMD theorem had three immediate impacts on the study of general equilibrium theory. First, according to the SMD theorem, the textbook example of a market demand curve monotonically decreasing from the upper left to the bottom right corner, showing that a rising price will lead to reduction in demand—also known as the famous "law of demand"—does not always apply. In contrast to the "common sense" endlessly preached in introductory textbooks on economics, the SMD theorem holds that a market demand curve is not in general monotonically decreasing, and in reality, there may be multiple equilibria with rather irregular behavior. Hence general equilibrium theory's great difficulty in predicting the outcomes of the economy.

Second, the SMD theorem implies that, aside from noting the existence of equilibria, one can hardly say anything more about the outcomes of the economy if one proceeds from the standard assumptions of general equilibrium theory. In other words, unless one makes in addition some rather unrealistic assumptions about microeconomic agents, such as assuming all consumers and firms are homogeneous or can be reduced to a couple of representative consumers and firms,[11] one cannot make substantial inferences about how the economy behaves at the macro level. This arbitrariness in macro-level outcomes implied by general equilibrium theory is so significant that in Andreu Mas-Colell, Michael Whinston, and Jerry Green's *Microeconomic Theory*, known as the bible of advanced microeconomic textbooks, the section discussing the main results of the SMD theorem is titled "Anything Goes: The Sonnenschein-Mantel-Debreu Theorem" (Mas-Colell, Whinston, and Green, 1995).

Finally, the SMD theorem can be used to show that there cannot be a general equilibrium framework that incorporates monopolistic competition, an important topic in economics since the 1930s. Monopolistic competition is a kind of market structure that lies in between the two extremes of perfect competition and monopoly. It refers to a situation where many firms in the market compete with each other although their products are slightly different and are not perfect substitutes. Obviously, monopolistic competition is a realistic description of the structure of real-world markets. Nonetheless, general equilibrium theory assumes perfect competition in all markets. Once this assumption is relaxed and monopolistic competition is introduced, solutions to general equilibrium models may not exist. This implication of the SMD theorem also casts doubt on the extent to which the highly idealized general

equilibrium theory can be expanded and reformulated to incorporate as much economic reality as possible. In the fourteenth chapter of the first volume of the *Handbook of Mathematical Economics*, published in 1982, Shafer and Sonnenschein summarize all these important results of the SMD theorem, and since then they have become accepted wisdom among neoclassical theorists (Shafer and Sonnenschein, 1982).

It is through the lens of the aggregation problem exemplified by the SMD theorem that post-Keynesians have endeavored to ascertain why general equilibrium theory declined and why neoclassical theorists turned to the more flexible models of game theory. According to the American post-Keynesian S. Abu Turab Rizvi:

> In part because of a conviction that progress could not be made in general equilibrium theory, there was a substantial redirection in economic theory. As the results in SMD theory became well known, for example through Wayne Shafer and Hugo Sonnenschein's survey (1982), economists began to question the centrality of general equilibrium theory and put forward alternatives to it. Thus in the ten years following the Shafer-Sonnenschein survey, we find a number of new directions in economic theory. It was around this time that rational-choice game theory methods came to be adopted throughout the profession, and they represented a thoroughgoing change in the mode of economic theory. (Rizvi, 2006: 230)

Interpreting the decline of general equilibrium theory from the angle of the aggregation problem is a contribution of the post-Keynesians critical to understanding the postwar development of the neoclassical theory. Post-Keynesians have persistently probed the logical and conceptual dilemma of neoclassical economics via the aggregation problem. Nonetheless, though the post-Keynesians' explanation of why general equilibrium theory declined is convincing, their explanation for why the new microeconomic theories—they take game theory as an example—have replaced general equilibrium theory is weak. Notably, in an earlier paper, Rizvi recounts the history of game theory from the classical works of John von Neumann and Oskar Morgenstern (1944) and John Nash (1950) to the cutting-edge research of the early 1990s and points out that, although there has been remarkable progress in modeling skills, mathematical techniques, and applications, game theory has not made any substantial breakthrough in dealing with the aggregation problem (Rizvi, 1994). Thus, by turning to game theory, neoclassical theorists have merely set their past problems aside and not really solved them. One must ask why it is that game theory, and not any of the other "new directions in economic theory," as Rizvi puts it, has become the theoretical center

of gravity of neoclassical economics. For example, why has evolutionary economics, which also gained a great deal of attention in the 1980s, not become the successor to general equilibrium theory?

On the other hand, there is still a small group of mainstream economists working on the aggregation problem within the framework of general equilibrium as well as a similar small group working on asymmetric information within the same framework. The first group tried to introduce heterogeneous consumers, and then heterogeneous producers based on production networks, into general equilibrium models. Though this did not solve the aggregation problem, it at least shows that it is possible to make limited progress in this line of theoretical studies. But why have these efforts to solve the aggregation problem failed to become the core of neoclassical economics during the past three decades? Why are they deemed to be "applied theory," which the neoclassical community considers inferior to "pure theory," and why are they located on the periphery of the knowledge production system of mainstream economic theory, in contrast to decision theory, game theory, and mechanism design, which are obviously at the center? These questions can only be satisfactorily answered when one adopts a perspective outside mainstream economics or post-Keynesianism.

Historians of Economic Thought: Mathematization à la Bourbaki

Recent studies in the history of economic thought have provided a perspective that has been overlooked by both mainstream neoclassical economists and post-Keynesians. This perspective does not explain the decline of general equilibrium theory and the rise of the new microeconomic theories through factors within the discipline, such as the consistency of conceptual relations and the richness of theory, but instead examines the evolution of postwar neoclassical economics from an angle outside of the discipline, revealing how the postwar development of neoclassical economic theory was deeply influenced by Bourbakist mathematical philosophy. Represented by the work of Nicola Giocoli, this vein of literature emphasizes that the replacement of general equilibrium theory by the new microeconomic theories was in fact part of an ever-deepening process of mathematization à la Bourbaki (Giocoli, 2003).

Bourbakism has shaped modern mathematics by turning previously loosely organized mathematical knowledge into a more structured system. It shows that the various branches of mathematics can all be reduced to three basic structures: order structure, algebraic structure, and topological structure (Bourbaki, 1950). Using a combination of these basic structures, along with

logical deduction and mathematician initiation, Bourbakism reconstructed modern mathematics into an architecture with crystal-clear, axiomized structures. It also created a new, modern style of mathematical writing in the form of "definition-proposition-proof." Pre-Bourbakist academic writings on mathematics were not unified and were heterogeneous among mathematicians. Qualitative proofs of theorems, based more on intuition than logical rigor and formal deduction, were still to some degree tolerated in many fields. Bourbakism swept away this artifact and unified the writing of textbooks, articles, and monographs into a single pattern of "definition-proposition-proof." The Bourbakist magnum opus, *Elements of Mathematics*, would have surprised the older generation of mathematicians in how exactingly it follows such a formalized style of writing.

It is exactly in these two respects that Bourbakism shaped mainstream economists' notions of what mathematics can really provide their discipline. Using mathematical terms as auxiliary devices to help express ideas in economic studies was not itself new. This postwar wave of mathematization, however, was something different. It was not about introducing more mathematical symbols, equations, and formulas into a discipline mainly expressed in terms of qualitative arguments to make it more powerful and flexible. On the contrary, it thoroughly changed the way neoclassical economists do economic theory and compose academic writings. For the new generation of neoclassical theorists influenced by Bourbakism, "doing theory" meant more than anything else building a new model, proposing new propositions based on that model, and proving these propositions. It also meant that academic writings would be structured in terms of "definition-proposition-proof." Giocoli has observed that, under the Bourbakist influence, postwar studies of economic theory moved ever closer to the practice of mathematics (Giocoli, 2003). Today, theoretical economics is no longer "economics with the assistance of mathematical expressions"; it is in effect a branch of applied mathematics with some of its concepts springing from economic contexts.

The first work representative of Bourbakist economic studies is Arrow and Debreu's now classic 1954 article presenting their general equilibrium theory. In its style the article is very much like a mathematical article in a mathematical journal. Until the 1980s, generations of neoclassical economists were trained in the Bourbakist mathematical philosophy, and consequently they theorized by proposing propositions and constructing proofs. Their production of theoretical economic knowledge was just like that of skilled mathematicians. Thus, the dilemma of general equilibrium theory was first of all a crisis of this mode of "knowledge production"—working exclusively within the framework of general equilibrium virtually guaranteed that only a limited number of theoretical publications could be generated, thus impeding the

entire profession of theoretical economic research. The marginal benefit from investing additional intellectual labor in general equilibrium theory saw a considerable decline in the 1970s–1980s, due to the reasons pointed out by mainstream economists and post-Keynesians, as discussed above. The new microeconomic theories—decision theory, game theory, and mechanism design—replaced the declining general equilibrium theory in leading knowledge production in the field of neoclassical economic theory because they can be the basis for theoretical publications structured around definition-proposition-proof. This is because they are fields created mainly by mathematicians, and before being accepted as valid branches of economics, they had long been cultivated in departments of operations research (Mirowski and Nik-Khah, 2017: 76).

To summarize, the story told by historians of economic thought fills in many blanks left by mainstream neoclassical economists and post-Keynesians. It explains why it is that decision theory, game theory, and mechanism design have taken the place of general equilibrium theory from the perspective of methodology and to some extent the sociology of the economics profession. It emphasizes the importance of analyzing the change in the "form" of economics rather than its content alone. Yet, like mainstream neoclassical and post-Keynesian economists, historians of economic thought have also missed an important part of the story, a subject to which we now turn.

What Can We Learn from the Rise of the New Microeconomic Theories?

All three of the explanations discussed above miss the fact that the fall of general equilibrium theory and the rise of the new microeconomic theories entailed a shift from "grand theory" to "small models." The difficulties that general equilibrium theorists faced when trying to build a grandiose framework for economics through the core idea of general equilibrium, as summarized by mainstream neoclassical economists and post-Keynesians, demonstrate that marketism has no valid scientific foundation. Indeed, it is an ideology that takes for granted that markets free of intervention are the best mechanism for resource allocation and that all market trade consists of equal and mutually beneficial exchanges.

They also fail to appreciate a methodological trend behind the rise of the new microeconomic theories—the substantivization of formalist economics. By putting aside the straightjacket of general equilibrium theory, economic theorists can now develop small models that are more flexible and more closely related to the empirical world—but only at a considerable cost. These models have abandoned the dream of generations of economists of a theory

that can grasp the essence of "the economy"—that is, a social system connected with what can be called "economic" activities. By embracing decision theory, game theory, and mechanism design as the theoretical core of the discipline, neoclassical economists have moved their profession even further away from classical political economy and closer to a discipline of formalized studies of human behavior.

From Grand Theory to Small Models

The decline of general equilibrium theory and the rise of decision theory, game theory, and mechanism design involve more than an ordinary shift in hot spots of economic studies. General equilibrium theory and the new microeconomic theories represent research agendas that differ in nature: the former seeks to grasp the economy as a whole, while the latter is much more modest, eschewing the search for big concepts and universalized laws that purport to describe how the economy works as a system.

In this respect, the research agenda of general equilibrium theorists is close to that of the classical political economists, such as Adam Smith, David Ricardo, et al. When Léon Walras first proposed a prototype of the general equilibrium theory in the late nineteenth century, he was searching for an answer to the same core question that had concerned the classical political economists: How does a market economy distribute and determine the value of commodities, products, and production factors?[12] In this sense, general equilibrium theory is *a theory of value*, where the concept of value plays the central role in grasping the essence of the economy.[13] The concept of value will immediately be rendered meaningless once it is removed from the context of the economy, a societal system in which goods are produced, traded, distributed, and consumed. One can talk about value only in relation to the economy, for it is a social construct that depends on the existence of a certain system of economic activities. By establishing this concept, economists also defined a sphere of social reality that can be called "the economy," a space distinguished from all other departments of society. In seeking a logical, consistent, and precise way of showing how value is formed in the market economy, general equilibrium theorists after Walras embraced an everlasting process of mathematization and formalization, leading to the adoption of Bourbakism.

Like classical political economists, general equilibrium theorists must proceed from their version of the theory of value to answer how the products of the economy are distributed and how capital, the single most important good in a modern economy, achieves value in the market and accumulates. Exactly for these reasons, neoclassical economists like Paul Samuelson and

Robert Solow, who work within the general equilibrium framework, must debate with their post-Keynesian counterparts—who are closer to classical political economists both in spirit and in research style—over the nature of value and the conceptualization of capital, exactly because they know these are at the very core of their profession. In this sense, the decline of general equilibrium theory in the 1970s–1980s implies that the theory of value was no longer *the* foremost research agenda of the neoclassical school. Since then, the once intrinsic historical link between neoclassical economics and classical political economy has disappeared. And thus, mainstream economists are no longer concerned with establishing a grand theory to grasp the essence of the economy.

Unlike general equilibrium theory, the new microeconomic theories of decision theory, game theory, and mechanism design are not much concerned with the essence of the economy as a whole and as a societal system with distinguishable empirical particularities. Rather, their focus is on formalizing how human beings make decisions universally and how they interact with each other strategically. They are also concerned with formulating reasonable protocols governing strategic interactions. In other words, these theories are in fact part of a discipline of formalized/mathematized studies of human behavior and can hardly be called "economic" theories in the sense of classical political economy because there is in fact nothing particularly "economic" about the concepts and theorems that have been constructed and derived from them.

In the 1950s the American mathematician Leonard Savage established decision theory in its modern form (Savage, 1954). At its core, the object of Savage's decision theory is to formalize how agents, or decision-makers, make their choices under uncertainty. By representing the beliefs of agents as probability distributions and by requiring agents to modify their beliefs in line with Bayes' theorem, a critical mathematical theorem in modern statistics and probability theory, Savage for the first time constructed a universalized framework to model how agents make choices in the face of uncertainty. In that framework, agents make decisions not by following particular rules, such as "utility maximization," which is linked to the particularity of certain kinds of agents called "consumers," or "profit maximization," which is linked to the particularity of what can be called "firms" or "producers." Savage's theory ignores all these particularities and proposes seven axioms as the principles governing how idealized agents behave when they choose among alternatives. These axioms are so general that they can in theory cover all agents and not solely "economic agents." Savage's work was not immediately recognized by mainstream economists, but it paved the way for economists to eventually consider the study of general decision-making processes a legitimate part of economics.

Savage's work had a far-reaching impact by fueling the development of game theory in the 1960s–1970s. Though game theory had already attracted attention from first-class mathematicians in Europe in the 1900s and had been summarized in von Neumann and Morgenstern's 1944 magnum opus, its real breakthrough for economic application was achieved by John Harsanyi when he solved the problem of how to model strategic interactions in an environment with uncertainty (Harsanyi, 1967). After that, economists could build models to study how agents interact with each other when they have only partial information on how others would gain from the interaction. This paved the way for the first successful application of game theory in a major field of economics—industrial organization, in which asymmetric information abounds (Giocoli, 2008). Consequently, by the 1980s, game theory was transformed from a theoretical toy of mathematicians to a workhorse of mainstream economists.

Paralleling the development of game theory was the rise of mechanism design as another vigorous field of mainstream economics. Mechanism design grew out of social choice theory, founded in the 1950s by Kenneth Arrow (1951). In contrast to game theory, which takes multi-agent interactions as given, mechanism design studies how to design the rules or protocols that agents interacting with each other should follow in order to achieve certain social objectives, especially the maximization of social welfare. In this sense, a good mechanism is one that prompts agents to reveal their true preferences and prevents them from strategically misreporting their preferences, especially in the sense of distortion, where the selected alternative may be of private benefit but does not maximize social welfare. Later, the idea of mechanism design was also used in constructing protocols that can maximize the profit of a certain agent rather than that of society as a whole. Such applications include auction designs, monopolistic pricing, contract design, product bundle design, and so on. Like game theory, mechanism design earned its fame in the 1980s in dealing with these once tricky issues in industrial organization.

Decision theory, game theory, and mechanism design replicate the Arrow-Debreu general equilibrium theory in style: they are all written in terms of formalized definitions, propositions, and proofs. In other words, they are Bourbakist. But in their basic problematique, the new microeconomic theories are sharply distinct from general equilibrium theory, as discussed above. None of the new approaches is a theory of value and none seeks to construct "covering laws" to grasp the essence of the whole economy. Their scope is relatively "small" compared with general equilibrium theory: they are targeted at small systems of multi-agent interactions.

Once these new microeconomic theories gained traction, studies of markets also shifted "from grand to small." While general equilibrium theory formalizes all the markets in the economy in a single model, game theory and

mechanism design study one market or a couple of markets in one model. They are used to analyze particular and concrete markets rather than the overarching, abstract system of markets that is at the core of general equilibrium theory. Studies of these concrete markets quickly became the favorite subject of economic theorists since the pioneering work of George Akerlof on markets with asymmetric information (Akerlof, 1970). Akerlof's new style of theoretical work involves, first, describing stylized facts about a particular market, such as his market for "lemons" (i.e., "bad cars"), then building a model with mathematical rigor to illustrate how this market can be formalized using theoretical language, and finally trying to solve the model or prove some theorems on the major properties of the model. This new style of academic writing was quite unfamiliar to general equilibrium theorists, who treat the market as an abstract object and part of a grandiose theoretical construct rather than as an inspiration for building small models.

The Substantivization of Formalist Economics and the Rise of Economic Engineering

In a previous study, this author discussed the methodological trend of substantivization of formalist economics in postwar neoclassical economics—that is, the mathematization and formalization of neoclassical economics turned to building models with empirically delimited utility (Gao, 2021). Substantivization refers to the march toward the mathematization of neoclassical economics and formalization to building models with empirically delimited utility (Gao, 2021). What must be emphasized here is that the shift in the theoretical focus of neoclassical economics from general equilibrium theory to the new microeconomic theories also exemplifies this trend. In this respect, decision theory and game theory provide basic concepts and an analytical framework, while mechanism design supplies "substantivization"—that is, it functions as an intermediary between pure theory and the empirical world.

Mechanism design in the 1950s–1970s was much like decision theory and game theory, focusing on pure theory, with a research style similar to that of mathematics. It was closer in that period to social choice theory, which is a purely theoretical subfield of postwar mainstream economics. Since the 1980s, mechanism design has become increasingly close to the real world and thus is one of the few fields in economics with relatively solid predictive power when it comes to empirical cases.

The idea of using mechanism design to solve real-world problems was initially driven by the development of studies of industrial organization boosted by the rise of neoliberalism in the 1980s. In line with their agenda of privatizing public services, neoliberal economists asked, What would be an

optimal government design to divide and privatize a public enterprise? And what government-organized bidding procedure would ensure that private firms would compete with one another to provide the goods/services, at reasonable prices, previously supplied by government? Many preeminent economists, including Jean-Jacques Laffont and Jean Tirole, participated in this search, using as their compass, in the main, mechanism design (Laffont and Tirole, 1993).

The second wave of real-world applications of mechanism design arrived in the 1990s and continues to this day. This wave was set in motion by the need to design decentralized mechanisms to allocate resources in realms where efficient institutions of resource allocation have been absent. Mechanism design theorists have pointed to auctions and matching as two principal mechanisms, since they both involve decentralized competitive systems with large numbers of participants. The key difference between the two is that in auctions monetary payments for welfare transfers between participants are allowed, while in matching they are not. Typical applications of auctions have been, first, the selling of the use right of state-owned telecommunication spectrums to private firms, followed by expansion into the realms of selling carbon emission rights, fishing rights, and use-rights for other natural resources. Typical applications of matching have been, first, the assigning of interns to hospitals, followed by organ transplant systems, public housing projects, school choice, and even the settlement of refugees.[14]

The real-world-application side of mechanism design today has earned its own name: "market design." The word "market" suggests that this subfield of economic theory is concerned with designing mechanisms that are at once decentralized and competitive. In auctions, bidders compete to buy the objects for sale, and in matching, agents on one side or both sides compete to match with their best partners. For both mechanisms, resources are allocated not through top-down commands but instead via the search for private benefit. Thus, these mechanisms are in spirit the same as the naturally evolved markets guided by the "invisible hand," though there are no monetary payments and prices. Again, as one can see, these objects of market design are empirically delimited, concrete objects, not an overarching, abstract system of markets as envisioned by general equilibrium theory.

Furthermore, mechanism design/market design has relied on empirical data to calibrate model settings to improve predictive power when studying empirical cases. First, econometrics has been used to estimate key parameters in the model in order to measure the welfare effect the model predicts. Second, methods of experimental economics have been employed to collect field data on agents' behavior patterns—better knowledge of agents will improve design mechanisms. While these two well-developed tools are taken

from empirical economic studies, a third tool, computational algorithms, has been borrowed from computer science, a field that has been tightly imbricated with economics in recent years. Unlike econometrics and experimental economics, which use data to estimate unknown parameters in models, the method of algorithms proceeds instead from the model and seeks to translate the mechanism designed into workable programs in the most economical manner with the help of computation theory. For example, when designing auctions for selling use-rights of telecommunication spectrums or land plots, the mechanism designer needs to first build a model to determine what the best mechanism is when bidders have preferences complicated by substitution and complementarity. Then, she can construct suitable algorithms to find a computationally feasible way to solve the model. Here the researcher needs the help of computer science to deal with the complexity of solving models of mechanism design in applications that have evolved to such an extent that they are far beyond the capabilities of a single personal computer. In short, mechanism/market design has been proceeding toward a field that syncretizes mathematical theory, econometric and experimental methods, and computational algorithms. Its object, aside from the exploration of purely theoretical topics, is to attack practical issues with empirically delimited utility—much like those studied in operations research. It is in this sense that Alvin Roth, who won a Nobel Prize for studies of two-sided matching, calls this practice-oriented trend of mechanism/market design "microeconomic engineering" (Roth, 2002). It is the newest form of what this author has termed the "substantivization of formalist economics" (Gao, 2021).

Insights for a New Political Economy?

Recently Philip Huang (2021) has proposed a path toward a new political economy that can grasp China's evolving political-economic system. Huang's object is to criticize marketism, which, without reflection, equates the various practices of trade with idealized, mutually beneficial exchanges, and to emphasize the combination and interaction between the state and markets/society, a subject overlooked by (neo)liberals as well as most mainstream economists. For Huang's project, the postwar changes in neoclassical economics analyzed in this article can provide some insights.

As already discussed, the failure of general equilibrium theory demonstrates that it is impossible to build a grand theory to grasp the practice of the economy if the theory begins with the proposition that the economic system equates to a universally valid market mechanism. This is because such a theory will inescapably come face to face with logical inconsistencies. Past studies of the difficulties plaguing general equilibrium theory in dealing with

asymmetric information and the aggregation problem have shown that its barebones framework cannot incorporate these practical and meaningful concepts. It can be logically consistent only if it operates in a highly idealized, impractical world. Proving the existence of an equilibrium solution—the holy grail for general equilibrium theory—can be guaranteed only by resorting to idealized assumptions, for example, perfect competition. Since the precondition of a universally valid market mechanism lies at the center of marketism, the decline of general equilibrium theory as the grand theory for grasping the essence of the economy shows that marketism is nothing but an ideology empty of scientific content. Thus, the dynamics behind the postwar change in the theoretical center of gravity of neoclassical economics explored in this article point to the need for a realistic and practical alternative to marketism.

By cultivating decision theory, game theory, and mechanism design as the new core of its theoretical domain, neoclassical economics has in fact severed its historical link with classical political economy on the theoretical front. But in ridding itself of general equilibrium theory, it has given up the search for a grand theory that can grasp the economy as a whole at the societal-system level. The new microeconomic theories have certainly opened the way to many research topics that can combine theory and reality to make better predictions about empirical cases than other approaches to economics, but these topics are by nature similar to those of operations research. On critical issues that have challenged economists since the birth of the discipline of economic studies, such as the relationship between state and society, the new microeconomic theories have made no substantial progress. By embracing these theories as the core of the domain of theoretical innovations, neoclassical economists are more like engineers than classical political economists. This creates an opportunity for a new political economy that emphasizes the interaction between state and society in economic activities. The methodological trends in postwar neoclassical economics, as explored in this article, can also be of use to advocates of a new political economy in thinking about their own methodological advantages over the formalism of neoclassical economics.

Conclusion

In the 1970s–1980s, the theoretical focus of postwar neoclassical economics shifted from general equilibrium theory to the new microeconomic theories, consisting mainly of decision theory, game theory, and mechanism design. This article has examined three past explanations for this shift and proposes its own interpretation.

The decline of general equilibrium theory reveals the failure of the pursuit of a grand theory to grasp the essence of the economy within the paradigm of neoclassical economics. Of all the theories churned out by the neoclassical school, general equilibrium theory may have come the closest to that ideal. Yet, it turned out to be unworkable for the reasons mainstream economists and post-Keynesians have pointed out. Since at the very core of general equilibrium theory is the proposition that competitive markets are the most efficient approach to allocating resources, the decline of general equilibrium theory also implies the failure of the ideology of marketism.

The rise of decision theory, game theory, and mechanism design as the core theoretical innovations in economics suggests that neoclassical economists have lost interest in finding another grand theory. Rather, they have turned to small models that are only locally valid and that have empirically delimited utility. These models cannot address the nature of the economy as a societal system—the key issue in classical political economy and general equilibrium theory—but they can serve as cognitive devices for probing certain patterns of human behavior. By giving up general equilibrium theory as its theoretical workhorse and turning to small theories targeted at explaining human behavior and engineering protocols governing multi-agent systems in very specific contexts, neoclassical economics has moved away from the vision of classical political economy. This has created an opportunity for proceeding toward a new political economy of practice.

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Notes

1. Mainstream economics defines “mechanism design” narrowly. This article uses a broader definition, which refers not only to mechanism design in its narrower sense but also to the subfields of “contract theory” and “market design,” which are juxtaposed to mechanism design in the mainstream classification of the economic discipline. According to the mainstream classification, mechanism design in its narrower sense consists principally of the study of the issue of hidden information (also known as adverse selection), while contract theory consists in the study of the issue of hidden action (also known as moral hazard). In this scheme, market design refers to the more application-oriented practice of mechanism

design. This article instead treats mechanism design as a subfield of economics that studies the design of protocols for multi-agent interactions and as an inverse project of game theory, since the latter views multi-agent interactions as given while the former tries to "design" them. It is in this much broader sense of mechanism design that this article juxtaposes it with decision theory and game theory as one of the three stars in the constellation of the new microeconomic theories.

2. Asymmetric information refers to the situation where two agents have different understandings of how an economic parameter takes values. A famous example of asymmetric information is from Akerlof (1970), who observes that in a used-car market the seller knows the real value of the car, but the buyer does not.
3. For example, constructing the aggregate demand on the market through individual preferences for goods, and aggregate supply through firm-level production functions.
4. Beginning in the mid-1930s, a group of French mathematicians using a collective pseudonym, Nicolas Bourbaki, wrote a series of textbooks on modern mathematics, later known as *Elements of Mathematics*. The mathematical philosophy they shared is referred to as Bourbakism, and their group is usually called the Bourbaki school. For a summary of their key ideas on modern mathematics, see Bourbaki, 1950.
5. For a recent detailed discussion of marketism, see Huang, 2022.
6. Adverse selection refers to a market situation where one agent has information that is unknown to others. For example, in the insurance market, when selling insurance, the insurance company does not have knowledge of private information about potential buyers. This can lead a company to extend insurance coverage to individuals whose actual risk is substantially higher than the risk known by the company. Moral hazard refers to the fact that one agent (usually called the "principal") cannot oversee the action of other agents. For example, in an agricultural co-op, the co-op head does not know the extent of the efforts the co-op members would really make in farming.
7. The capital controversy was a far-reaching academic debate between American economists, represented by Paul Samuelson and Robert Solow, and English economists, represented by Joan Robinson and Piero Sraffa, over the validity of the concept of capital and of the aggregate production function in neoclassical economics. See Cohen and Harcourt, 2003, for a review.
8. The aggregate production function depicts how total factor inputs, especially labor and capital, are related to total outcomes of the economy.
9. The aggregate excess demand function describes how the prices of goods are related to their demanded quantities in the economy.
10. These properties include: the aggregate excess demand function is continuous and homogenous of degree zero, and the values of the excess demand sum to zero (also known as the Walras' law).
11. This is the usual way that neoclassical economists today attack the problem.
12. There is no question that general equilibrium theory has a very different notion of value than that of classical political economy. According to its logic, the

values of goods in a competitive market economy are the "equilibrium prices" that are "dual" to the equilibrium quantities of goods traded in the markets, while classical political economy considers the values of goods to be determined by the (abstract) labor used to produce those goods.

13. Notably, Debreu himself called his masterpiece in general equilibrium theory the *Theory of Value* (Debreu, 1959).
14. For a thorough review of these applications of auctions and matching, see Kominers, Teytelboym, and Crawford, 2017.

References

AKERLOF, GEORGE A. (1970) "The market for 'lemons': quality uncertainty and the market mechanism." Q. J. of Economics 84, 3: 488–500.

ARROW, KENNETH J. (1951) Social Choice and Individual Values. New York: John Wiley & Sons.

ARROW, KENNETH J. and GERARD DEBRU (1954) "Existence of an equilibrium for a competitive economy." Econometrica 22, 3: 265–90.

BISIN, ALBERTO and PIERO GOTTARDI (1999) "Competitive equilibria with asymmetric information." J. of Economic Theory 87, 1: 1–48.

BOURBAKI, NICHOLAS (1950) "The architecture of mathematics." American Mathematical Monthly 57, 4: 221–32.

COHEN, AVI J. and G. C. HARCOURT (2003) "Retrospectives: Whatever happened to the Cambridge capital theory controversies?" J. of Economic Perspectives 17, 1: 199-214.

DEBREU, GERARD (1959) Theory of Value: An Axiomatic Analysis of Economic Equilibrium. New Haven, CT: Yale Univ. Press.

DEBREU, GERARD (1974) "Excess demand functions." J. of Mathematical Economics 1, 1:15–23.

DUBEY, PRADEEP, JOHN GEANAKOPLOS, and MARTIN SHUBIK (1989) "Default and efficiency in a general equilibrium model with incomplete markets." Cowles Foundation Discussion Papers No. 879R. Cowles Foundation for Research in Economics, Yale Univ.

DUBEY, PRADEEP, JOHN GEANAKOPLOS, and MARTIN SHUBIK (2000) "Default in a general equilibrium model with incomplete markets." Cowles Foundation Discussion Papers No. 1247. Cowles Foundation for Research in Economics, Yale Univ.

DUBEY, PRADEEP, JOHN GEANAKOPLOS, and MARTIN SHUBIK (2005) "Default and punishment in general equilibrium." Econometrica 73, 1: 1–37.

GAO, YUAN (2021) "Rethinking the formalism-substantivism debate in social science: a perspective from recent developments in economic methodology." Modern China 47, 1 (Jan.): 3–25.

GIOCOLI, NICOLA (2003) Modeling Rational Agents: From Interwar Economics to Early Modern Game Theory. Cheltenham: Edward Elgar.

GIOCOLI, NICOLA (2008) Three Alternative (?) Stories on the Late 20th-Century Rise of Game Theory. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=1140111.

HARSANYI, JOHN C. (1967) "Games with incomplete information played by 'Bayesian' players, I–III Part I. The basic model." Management Science 14, 3: 159–82.

HUANG, PHILIP C. C. (2021) "Toward a new political economy of practice." Working paper.

HUANG, PHILIP C. C. (2022) "A critique of marketism: varieties of exchanges in China's past and present." Modern China 48, 1: 3–28.

KOMINERS, SCOTT DUKE, ALEXANDER TEYTELBOYM, and VINCENT P. CRAWFORD (2017) "An invitation to market design." Oxford Rev. of Economic Policy 33, 4: 541–71.

LAFFONT, JEAN-JACQUES and DAVID MARTIMORT (2002) The Theory of Incentives: The Principal-Agent Model. Princeton, NJ: Princeton Univ. Press.

LAFFONT, JEAN-JACQUES and JEAN TIROLE (1993) A Theory of Incentives in Procurement and Regulation. Cambridge, MA: MIT Press.

MANTEL, ROLF R. (1974) "On the characterization of aggregate excess demand." J. of Economic Theory 7: 348–53.

MAS-COLELL, ANDREU, MICHAEL D. WHINSTON, and JERRY R. GREEN (1995) Microeconomic Theory. New York: Oxford Univ. Press.

MIROWSKI, PHILIP and EDWARD NIK-KHAH (2017) The Knowledge We Have Lost in Information: The History of Information in Modern Economics. New York: Oxford Univ. Press.

NASH, JOHN (1950) "Equilibrium points in N-person games." PNAS 36, 1 (Jan. 1): 48–49. https://www.pnas.org/content/36/1/48.

RIZVI, S. and ABU TURAB (1994) "Game theory to the rescue?" Contributions to Political Economy 13, 1: 1–28.

RIZVI, S. and ABU TURAB (2006) "The Sonnenschein-Mantel-Debreu results after thirty years." History of Political Economy 38: 228–45.

ROTH, ALVIN E. (2002) "The economist as engineer: game theory, experimentation, and computation as tools for design economics." Econometrica 70, 4: 1341–78.

ROTHSCHILD, MICHAEL and JOSEPH STIGLITZ (1976) "Equilibrium in competitive insurance markets: an essay on the economics of imperfect information." Q. J. of Economics 90, 4: 629–49.

SAVAGE, LEONARD J. (1954) The Foundations of Statistics. New York: John Wiley & Sons.

SHAFER, WAYNE and HUGO SONNENSCHEIN (1982) "Market demand and excess demand Functions." Pp. 671–93 in Kenneth J. Arrow and Michael D. Intriligator (eds.), Handbook of Mathematical Economics, Vol. 2. Amsterdam: North-Holland.

SONNENSCHEIN, HUGO (1973) "Do Walras' identity and continuity characterize the class of community excess demand functions?" J. of Economic Theory 6: 345–54.

SPENCE, MICHAEL (1974) Market Signaling: Informational Transfer in Hiring and Related Processes. Cambridge, MA: Harvard Univ. Press.

URAI, KEN, AKIHIKO YOSHIMACHI, and KOHEI SHIOZAWA (2018) "General equilibrium model for an asymmetric information economy without delivery

upper bounds." B.E. J. of Theoretical Economics 18, 1. https://www.degruyter.com/document/doi/10.1515/bejte-2016-0077/html 20160077.
VON NEUMANN, JOHN and OSKAR MORGENSTERN (1944) Theory of Games and Economic Behavior. Princeton, NJ: Princeton Univ. Press.

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