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BEYOND MARKETS — THE NOTION OF
'SOCIAL INSTITUTION' IN THE WORK
OF ARROW AND
HURWICZ

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Beyond markets – the notion of ‘social institution’ in the work of Arrow and Hurwicz.

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Abstract: This paper challenges the prevailing narrative that mathematical economics, particularly in the post-war era, neglected the study of social institutions. According to the common view, the concept of institutions was largely abandoned following the decline of institutionalism, only to be revived decades later by the new institutionalism. This account, however, overlooks a central ambition of many post-war mathematical economists: to construct a formal framework capable of analyzing the organization of society, including its institutional dimensions. Focusing on the intellectual trajectories of Kenneth Arrow and Leonid Hurwicz—two key figures in the development of general equilibrium theory—this paper traces how their engagement with formal modeling gave rise to distinct yet overlapping efforts to conceptualize institutions.

Rather than discarding the notion of institutions, Arrow and Hurwicz were deeply concerned with it. However, instead of studying the concrete characteristics of economic and social institutions through empirical methods, they sought to formalize institutional questions through mathematical abstraction—recasting institutions as organizational structures amenable to rigorous analysis within a general equilibrium-inspired framework.

By closely examining the work of Arrow and Hurwicz—beginning with their collaboration at the Cowles Commission on general equilibrium theory—this paper supports the broader observation that a central project among post-war mathematical economists was to push economic analysis beyond the market model. Rather than confining their work to supply-and-demand-based frameworks, they sought to expand the scope of formal analysis to encompass a much wider range of social interactions. This expansion was grounded in a focus on fundamental questions of coordination, communication, and control, with particular attention to the role of information in shaping institutional arrangements.

The recent Nobel Prize to Acemoglu, Johnson and Robinson underscored the centrality of the concept of institutions in contemporary economic thinking. According to common narratives, the development of this concept in modern economics follows a familiar arc: the early dominance of the old institutionalism in American economic thought, its displacement by mathematical economics around mid-century, and its eventual revival through the new institutionalism associated with the work of Ronald Coase (Hutchison 1984; Coase 1998; North 1986). In this

story, the rise of mathematical economics in the post-war period is often seen as a phase marked by the neglect of institutions—especially social institutions. The notion of institutions, with its historical (or ‘evolutionary’) character, appeared to be at odds with the mathematical methods then gaining prominence, particularly those centered on equilibrium analysis, epitomized by general equilibrium theory—the crown jewel of post-war neoclassical mathematical economics (Hodgson 2001).

This view, however, fails to account for the intellectual ambitions of many mathematical economists during that period. As historians of economics have shown, the community of mathematical economists—particularly those engaged with general equilibrium theory and affiliated with institutions such as the Cowles Commission and the RAND Corporation—was, in fact, deeply concerned with questions related to the concept of institutions in a broad sense (Mirowski 2002; Amadae 2003). Rather than focusing narrowly on the analysis of markets, many of these economists saw their role as constructing a unified framework for the social and behavioral sciences—an ambition that was widely shared at the time and supported by substantial funding from organizations such as the Ford Foundation, which actively promoted interdisciplinary research through new institutional initiatives and cross-disciplinary projects (Crowther-Heyck 2006; Isaac 2010). This common ambition aimed to develop a shared methodological foundation, combining abstract mathematical formalization with empirical experimentation. This framework was explicitly designed to accommodate a broad notion of social institutions, one that could be applied across disciplines and help blur the boundaries between economics and mathematics on one side, and between economics and the other social sciences on the other.

Thus, rather than neglecting the notion of institutions, mathematical economists aimed to develop an alternative methodology for studying them—one that differed markedly from the institutionalist tradition. At the core of this approach was the formalization of institutional concepts through mathematical abstraction, reducing the complexity of real-world institutions to tractable representations framed in terms of *organizational structures*. Von Neumann and Morgenstern's Game Theory stands out as the most paradigmatic example of this vision (Morgenstern and von Neumann 1953). Yet their work was only the opening act in a series of efforts by mathematical economists associated with Cowles and RAND in the post-war era to extend formal mathematical analysis beyond the market model (Marschak 1954; Morgenstern 1951; Simon 1952). These economists sought to encompass a broader range of social and economic *structures* by adopting a cybernetic view of society, analyzing it through the lenses of decision, control, and information. Collectively, this research agenda left a profound mark not only on modern economics but also on the broader social sciences (Mirowski 2002).

Among the various directions within this expansive project, the present paper focuses on the thread most closely tied to general equilibrium theory. Specifically, it traces the intellectual trajectories of two central figures in post-war mathematical economics, Kenneth Arrow and Leonid Hurwicz, and explores how their engagement with general equilibrium theory gave rise to efforts to conceptualize social institutions and, ultimately, to construct a 'grand' theory capable of analyzing the organization of society.

Arrow and Hurwicz were close collaborators during their time at the Cowles Commission, and they co-authored several influential papers on the dynamics of general equilibrium in the 1950s (Arrow et al. 1959; 1958; Arrow and Hurwicz 1958; 1960b; 1960c). During this same period, however, each began to develop his own methodological approach to the broader problem of

social institutions—an endeavor that would evolve into a lifelong project for both. This paper seeks to reconstruct their distinct approaches to the concept of social institutions and to examine how these emerged from—and remained connected to—their joint and separate work on general equilibrium.

General Equilibrium, Stability, and the Concept of Organization at Cowles

Hurwicz and Arrow first met in the summer of 1946 at the Cowles Commission seminar, then located at the University of Chicago (“Colwes Commision Stafff Meeting” 1946). By that time, Hurwicz had already been affiliated with the Cowles Commission for several years, contributing to its work on structural modeling, statistical identification, and business cycle analysis. Born in Moscow in 1917, Hurwicz had experienced the political upheavals of twentieth-century Europe: his family fled revolutionary Russia for Poland, and as authoritarian regimes rose across the continent, he moved again—passing through London and Geneva—before arriving in the United States in 1940. In a manuscript written in the early to mid-1940s, he would reflect on how Poland’s political instability was deeply rooted in its economic dislocation and ethnographic fragmentation—an early indication of his sensitivity to the entanglement of economic and institutional fragility (Hurwicz 1940b). Arrow, by contrast, encountered instability from within the market system itself. Born in New Jersey in 1921 to Jewish immigrants from Eastern Europe, he saw his family’s fortunes unravel during the Great Depression, when his father lost his job in banking. After wartime service as a weather officer, Arrow was invited to join Cowles by Tjalling Koopmans in 1946, following graduate studies at Columbia. One of his first presentations at the Cowles seminar addressed the stability of competitive equilibrium—a theme that would soon become the focal point of his collaboration with Hurwicz (“Colwes Commision Stafff Meeting” 1946).

At the time of their acquaintance, Arrow and Hurwicz shared a deep belief in the power of formal modeling to address fundamental economic questions, particularly those concerning the ideal organization of the economy. Both were influenced by traditions that emphasized the role of logical structure in scientific reasoning—Hurwicz through his exposure to logical positivism at the London School of Economics, and Arrow through his interactions with the logician Saul Kripke. This orientation, rooted in an intellectual lineage going back to the *Methodenstreit*, treated the clarification of assumptions, internal coherence, and logical implications as central to economic inquiry—distinct from emerging instrumentalist views that prioritized predictive performance. Thus, in an unpublished manuscript from the early-to-mid 1940s, Hurwicz argued that many economic controversies stemmed from differences in basic postulates—such as perfect competition, profit maximization, or the stability of equilibrium. He called for the construction of a logical framework in which both theoretical and empirical results could be integrated, and the implications of foundational assumptions clearly identified (Hurwicz 1940a).

This approach aligned closely with what became the prevailing view at Cowles towards the end of the 1940s, under the leadership of Tjalling Koopmans. Koopmans championed the importance of ‘theory’—understood as logical, mathematical analysis capable of providing structure to empirical findings (T. Koopmans 1957; T. C. Koopmans 1947). His tenure as director (1948–1954) marked a pivotal intellectual transition at Cowles, from an early focus on econometrics and business cycle theory to a new emphasis on rational decision-making procedures and Walrasian general equilibrium theory (Mirowski 2002, 264–65; Düppe and Weintraub 2014). This shift was not merely methodological—from empirical estimation of dynamic macroeconomic systems to the formal analysis of equilibrium conditions—but also conceptual.

The economy was increasingly seen not as a sequence of aggregate fluctuations, but as a problem of *organizational structure* (Mirowski 2002, 355).

The term “organization” was itself productively ambiguous: it could refer to a specific firm, an administrative unit, or an entire economic system understood as a network of decentralized decision-makers. As one Cowles summary would note, the Commission’s work increasingly sought to analyze “economic organizations of various types”—entities in which “the processes of decision-making and adjustment by individuals, firms, or public bodies are interdependent.” In this context, rational decision-making—whether individual or collective—became the central theoretical concern (Cowles Commission for Research in Economics 1951, 15) .

This transition involved two key shifts in the boundaries of economics. First—as has often been emphasized—the Cowles approach marked a decisive move toward a more mathematical style of reasoning, including explicit support for work that could be classified as pure mathematics, particularly in the development of optimization methods (Debreu 1953). Linear programming and activity analysis emerged as central tools, replacing the more traditional calculus-based techniques associated with Samuelson. In this new framework, the very object of economic analysis was redefined around the problem of optimization. As a result, technical investigations into new optimization methods were not merely auxiliary but seen as integral to the economic inquiry itself .

Alongside this methodological shift, there was also a broadening of the object of mathematical inquiry. Rather than focusing narrowly on traditional economic problems—such as analyzing specific markets or resources like labor, capital, and money—Cowles economists increasingly came to see themselves, or at least presented themselves, as engaging with a wider field of social

science (Mirowski 2002, 265). As stated in the Cowles Commission's 1950–1951 Summary Report: “To determine the best economic organization in this wider sense is to study the central problem of our time [...] Thus, the problems that are, in most American universities, artificially split between schools of business administration, schools of public administration, departments of political science, and departments of economics, turn out to be special applications of the same general problem, that of optimal organization” (Cowles Commission for Research in Economics 1951, 14–15).

Interestingly, the Bourbaki-inspired approach to mathematical analysis, as promoted by Koopmans—centered on logic-based inquiry and the clarification of structural relationships—was well suited to a framework aimed at analyzing organizational forms at their highest level of abstraction. The quest for unifying structures, central to Bourbaki's view of mathematics, resonated with the idea that seemingly distinct questions in economics—whether concerning the economy as a whole, the private firm, or public institutions—could share the same underlying structure. While some Cowles affiliates, most notably Gérard Debreu, pursued this project as an exercise in ‘pure’ mathematics, others saw abstraction not as an end in itself but as a tool for grappling with the complexity of real-world economic systems. For these economists, among them Arrow and Hurwicz, the logical—rather than strictly quantitative—foundation of the approach offered a way to move beyond the narrow price-quantity focus of conventional mathematical models, opening space for broader analyses of institutional and organizational forms (Arrow 1951).

Cowles's intellectual agenda at the time is clearly reflected in the presentations given by Hurwicz and Arrow at the Econometric Society meeting held in December 1948, which followed a joint summer they spent in Santa Monica at RAND (Hurwicz 1987, 266). Hurwicz presented a

paper titled “*Linear Programming and the General Theory of Optimal Behavior*,” which aimed to show how the new technique of linear programming could be applied to consumer theory. At the same meeting, Arrow presented his dissertation work on *The Possibility of a Social Welfare Index*, in which he developed what would later be known as the impossibility theorem (“Report of the Cleveland Meeting, December 27-30, 1948” 1949). As Hurwicz later recalled, Arrow’s paper had a profound impact on his own intellectual trajectory. He was particularly impressed by its ability to use mathematical reasoning to define a concept rigorously, formulate a set of postulates, and examine whether they could be logically reconciled—addressing a foundational normative problem in a highly general and abstract way, rather than merely constructing a specific model (Hurwicz 1987, 270). Inspired by this approach, Hurwicz soon began applying similar methods to a topic he found both persistent and intellectually urgent: the theory of economic organization.

While the study of both “organizations” and “economic organization” was a central theme at Cowles and RAND during this period, Hurwicz’s project stood out for its ambition: he aimed to approach the question of optimal organizational structure in the most general and abstract terms, ready to solve the big economic controversies of his time (Hurwicz 1953, 1).

He presented his first attempt in the econometric meeting held in August 1950. At that early point, his “theory of economic organization” was presented quite modestly as an extension of the theory of the firm, where instead of assuming a single manager, there are multiple managers. The problem at this case regarded “the optimal managerial structure of the firm”, where the issue at stake is the ability to process information - on the one hand, a single manager is limited in his (cognitive) capacity to process information, while on the other - multiplicity of manager creates problems of communication:- “which makes excessive decentralization undesirable.” the

approach suggested by Hurwicz was to treat this problem as an optimization problem, where the technological restrictions on the ability to process and transmit information are taken as given and the variable that needs to solve the optimization problem is the managerial structure of the firm, which was, in this case, the number of managers - or the degree of decentralization in the firm's decision making process ("Report of the Berkeley Meeting, August 1-5, 1950" 1951, 54).

At the same 1950 meeting, Arrow presented his own work, "*An Extension of the Basic Theorems of Classical Welfare Economics*"—the first in what would become a foundational series of contributions to Walrasian-inspired general equilibrium theory. While Arrow and Hurwicz appeared to be addressing different problems—Arrow focused on the welfare properties of the competitive market system, while Hurwicz examined the optimal management of a single economic unit—their concerns were, in fact, deeply intertwined.

What connected these lines of inquiry was a shared interest in the conditions under which decentralized systems could achieve coherent outcomes. Long associated with the analysis of perfectly competitive markets, general equilibrium theory was increasingly interpreted at Cowles as an abstract model of decentralized organizational structure (Arrow and Hurwicz 1960a, 35–36). This reinterpretation was closely tied to the intellectual context of the socialist calculation debate, in which theorists like Hayek and Lange had contested whether market prices could effectively aggregate dispersed information and guide economic decisions. Following Lange, Cowles economists came to treat the Walrasian model not only as an idealized description of market economies but also as a stylized representation of how coordination might be achieved in any complex economic system. In this view, the price system was no longer seen merely as a feature of markets but as a general informational device—capable of transmitting signals and

aligning incentives across decentralized units (Boldyrev and Ushakov 2016; Mirowski and Nik-Khah 2017).

Arrow and Hurwicz soon began a long-term collaboration that brought their respective perspectives into a shared research agenda. As Hurwicz later explained, their joint work evolved through three closely connected areas: the mathematics of optimization, the dynamics of equilibrium systems, and the design of economic mechanisms (Hurwicz 1987, 258).

All three elements were already present in their first joint presentation at the 1951 Econometric Society meeting, titled “*Dynamic Aspects of Achieving Optimal Allocation of Resources.*” The paper presented the price mechanism as a decentralized method for achieving an optimal allocation of resources. Building on Samuelson’s reinterpretation of Walrasian dynamics, they adopted the concept of an “adjustment process” to describe the iterative path by which the optimization problem is solved over time (“Report of the Santa Monica Meeting, August 2-4, 1951” 1952).

Their collaboration combined two layers of analysis. On one level, they introduced a novel computational method for solving the optimization problem—Arrow’s contribution—which reformulated it as a saddle-point problem and proposed a new iterative technique. On another level, Hurwicz offered an economic interpretation of this method: the adjustment process could be seen as a formal representation of how prices and quantities adjust over time in a competitive market. After showing that their method converged under certain conditions—specifically, in the case of diminishing returns—they went further. They proposed an alternative adjustment process, one that could be interpreted as a generalized mechanism extending the logic of the

price system to settings with increasing returns, where standard competitive dynamics typically fail to converge (“Report of the Santa Monica Meeting, August 2-4, 1951” 1952, 86–87).

This work can be seen as their first attempt to move beyond the standard market model—using its mathematical and logical structure as a starting point, while modifying its core assumptions to allow for a broader interpretation of decentralized coordination. Although the results would not be published for several years, this collaboration marked the beginning of a sustained effort by both Arrow and Hurwicz to explore and expand the boundaries of the market model, aiming to develop a more general analytical framework—one capable of accommodating a wider range of institutional possibilities.

1950s – Rethinking the Market Model from Within

While Arrow and Hurwicz’s early work proposed alternatives to what they called the “competitive adjustment process,” it remained grounded in the logic of the price mechanism. Even their attempt to extend the model—by identifying an adjustment process that could operate under increasing returns—continued to treat prices as the medium for transmitting information and coordinating decentralized decisions. In this sense, their work, as eventually published, remained largely an exploration of the informational properties of the market mechanism itself (Arrow and Hurwicz 1958; Arrow et al. 1959).

Yet already in 1951, Hurwicz was setting his sights higher. That year, he drafted a research outline for a project titled “Optimal Properties of Decentralized Economic Systems” (Hurwicz 1951). His aim was not merely to refine the competitive model, but to explore the broader question of how decentralized systems could be evaluated and compared—laying the foundation for a more general theory of institutional design.

In an unpublished manuscript from 1953 Hurwicz outlined the conceptual ambitions that would later underpin his theory of economic organization. “We may think of economic organization,” he wrote, “as a set of (legal or customary, say) rules imposed on human behavior” (Hurwicz 1953, 1). While the interest in alternative economic arrangements was not new, he noted that it had often been framed through broad ideological oppositions—“laissez-faire versus intervention,” “capitalism (‘free enterprise’) versus socialism,” or “centralization versus decentralization.” Though, as he observed, “the terms in quotation marks have undergone considerable changes in their meaning, [...] the subject of debate has always been the desirability of alternative economic organizational structures” (Hurwicz 1953, 1).

Hurwicz's goal was to push this conversation onto more abstract and analytical ground. He emphasized that existing efforts to compare organizational forms had taken place “almost exclusively against the background of a particular class of economic structures to which we may refer as that of market structures.” His own objective, by contrast, was “to develop a conceptual and analytical framework for consideration of a broader class of structures.” In doing so, he came to believe that “the theory of market phenomena fits in a natural manner as a special case of a more general theory.” But to make this move, he argued, “it seemed essential that one should be able to formulate the theory of market phenomena in a more abstract and generalized manner than had previously been done” (Hurwicz 1953, 5).

This abstract reformulation, he concluded, would make it possible “to treat the phenomena of the market in what one might call a ‘functional’ (as distinct from ‘descriptive’) manner,” a perspective he believed would be “more suitable for later utilization in the comparative analysis of organizational structures” (Hurwicz 1953, 6).

While Hurwicz was working to develop a framework capable of analyzing a broader range of economic structures beyond the market, Arrow concentrated on solving foundational problems within the theory of the competitive market itself—making two further landmark contributions to general equilibrium theory.

In May 1952, he presented his model of general equilibrium under uncertainty at the International Conference for Mathematical Economics and Econometrics held in Paris (Arrow [1952] 1964). Around the same time, he was engaged in what would become his most famous intellectual collaboration—with Gérard Debreu—on the existence theorem for a general competitive equilibrium. Their joint paper was first presented at the Cowles Commission seminar in December 1952 and submitted to *Econometrica* in May 1953 (Düppe 2012, 492).

Together with his earlier paper on the welfare theorems, these two contributions are often viewed as laying the theoretical foundation for the idea that optimal allocations are most effectively achieved through competitive markets (Blaug 2007, 155; Weintraub 2002, 183–84). Yet Arrow himself was notably cautious about this interpretation.¹

In March 1953, Arrow presented a draft at the Cowles seminar titled “*Why Are There Not More Markets for Future Delivery in Manufacturing Goods?*” (“Cowles Commission Staff Meeting” 1953)– a question that, in his later reflections, Arrow identified as a central challenge to the idealized view of capitalism (Arrow 1974b). Unlike the problem of informational efficiency—which preoccupied many participants in the socialist calculation debate, including Hurwicz—Arrow was struck by the gap between the theoretical model of complete markets and the actual

¹ On Arrow's view of the general equilibrium model and, more broadly, ‘neoclassical’ theory see Maayan Yeshoron (2024).

absence of markets for future goods (Arrow 1974b, 5–6). For Arrow, this observation pointed to a deeper institutional problem: the very conditions required for the competitive model to deliver optimal outcomes were systematically absent from the real economy.

Arrow returned to this concern at the December 1954 Econometric Society meeting, where he presented a paper titled “*The Allocation of Risk-Bearing*” (“Report of the Detroit Meeting, December 27-30, 1954” 1955). At first glance, the paper appeared to be an extension of the general equilibrium model under uncertainty that he had introduced at the Paris conference in 1952. In that seminal model, Arrow incorporated uncertainty by redefining commodities to include not only their physical characteristics but also the state of the world in which they would be delivered. Agents were thus assumed to trade *state-contingent commodities*—contracts specifying delivery of goods conditional on the realization of particular states of the world—rather than physical goods per se. Arrow showed that, under standard assumptions, such a system would result in a Pareto-efficient equilibrium, closely mirroring the optimality properties of the model without uncertainty (Arrow [1952] 1964).

Furthermore, he demonstrated that under certain conditions, these state-contingent contracts could be replaced by monetary transactions in appropriately structured financial markets. In particular, he suggested that institutions such as stock markets could serve as practical approximations of this theoretical ideal—allocating risk efficiently through the trade of securities whose payoffs depend on future states of the world (Arrow [1952] 1964, 92–93).

On the surface, Arrow’s 1954 paper aimed to extend his earlier model to incorporate production. Yet it ultimately centered on an unexpected limitation: “some difficulties arise, however, on the production side not in the formal validity of the conditions for optimal allocation but in their

applicability to the real world” (“Report of the Detroit Meeting, December 27-30, 1954” 1955, 342). The problem, as he described it, was that achieving efficiency in this framework required a high degree of commodity differentiation—every distinct outcome had to be priced separately, reflecting what the model treats as commodity indivisibility. In a world where commodities are defined by their state-contingent characteristics, even minor variations—such as differing probabilities of damage across otherwise identical inputs—would necessitate distinct prices. As these distinctions multiply, the computational burden on agents (e.g., calculating expected profits across large state spaces) becomes unrealistically complex (Arrow 1966).

Although this work was never developed into a full published paper, it reveals an early and growing concern in Arrow’s thinking: that the general equilibrium model, while internally coherent, may fail to capture actual economic processes once uncertainty is taken seriously. This line of critique would become increasingly central in his later work (Arrow 1974b; 1974a; 1974c) and would play a key role in how he came to frame the function and necessity of social institutions—a theme that will be explored in the next section.

At the same 1954 Econometric Society meeting where Arrow presented *The Allocation of Risk-Bearing*, Hurwicz delivered a presentation titled *Decentralized Resource Allocation*, in which he aimed—for the first time—to develop “a rigorous formulation of the concept of decentralization of an adjustment process” (“Report of the Detroit Meeting, December 27-30, 1954” 1955, 342–43). While the content of the presentation itself is no longer available, a 1955 draft titled *An Abstract Adjustment Process* offers a window into the conceptual breakthrough Hurwicz was pursuing at the time (Hurwicz 1955).

In this draft, Hurwicz introduced a fundamental distinction between what he called “concrete” and “abstract” adjustment processes. This marked a departure from his earlier work, which had focused on specific economic mechanisms such as price adjustment. As he explained, “The difference between the two lies in the fact that the language in which the units communicate is specified in the ‘concrete’ but not in the ‘abstract’ process. The present abstract formulation [...] eliminates the arbitrariness present when a specific language (even one ‘natural’ in the context of economics) is used in building a general theory” (Hurwicz 1955, 1).

In essence, while earlier discussions of decentralization treated the adjustment process as an iterative exchange of messages in the form of prices, Hurwicz now explicitly defined an adjustment process more broadly—as an iterative procedure in which distinct units transmit *messages* and respond to them according to pre-specified behavior rules (Hurwicz 1955, 3)

In this framing, prices become just one possible language among many. This shift allowed Hurwicz to finally move beyond the market model, positioning prices not as the universal medium of coordination, but as one particular instance within a broader class of communicative mechanisms. Following this, Hurwicz suggested that “the abstract formulation will be helpful in establishing a bridge between the models of interest to economists and those arising in other fields” (Hurwicz 1955, 1) —though he did not specify which fields he had in mind.

At the time Hurwicz was drafting his theory of abstract adjustment processes, he was serving as a research fellow at Stanford’s newly founded Center for Advanced Study in the Behavioral Sciences (CASBS). CASBS was established in 1954 under the intellectual initiative stemming from the Ford Foundation’s 1949 *Report of the Study for the Ford Foundation on Policy and Program*, which identified “Individual Behavior and Human Relations” as a key priority

(Gaetani 2017; CASBS staff 2018). Designed as a hub for interdisciplinary collaboration, the center embodied the Foundation’s ambition to transform the social sciences through formal, problem-oriented, and ‘scientific’ inquiry (Crowther-Heyck 2006, 440).²

Arrow, who was already based at Stanford, became a formal fellow at CASBS the following year, in 1956–57. During his fellowship, he immersed himself in the psychological literature on learning, particularly studies that employed experimental methods to model learning processes.³ His ambition was to adapt these psychological models to construct an economic framework in which individuals acquire knowledge and revise their decisions under uncertainty (Arrow 1957a). This interest soon developed into a concrete research agenda: the following year, Arrow began conducting learning experiments as part of the Ford Foundation–funded *Project on Mathematical Models in the Social Sciences*, led by philosopher and decision theorist Patrick Suppes at Stanford’s Applied Mathematics Laboratory. His goal was to develop a theory of innovation by investigating how investors form expectations and update their strategies over time.

In 1957, the Stanford Press established a series about Mathematical Studies in the Social Sciences, which was to include Arrow and Hurwicz’s joint work on linear programming, alongside contributions by Hirofumi Uzawa.⁴ At the same year, Suppes and Arrow jointly

² During the 1955–56 academic year, Hurwicz was joined at CASBS by a cohort of scholars who would shape the future of economics, game theory, and decision science. Among them were mathematical economists and game theorists Jacob Marschak, Martin Shubik, Howard Raiffa, and Roy Radner, as well as social scientists such as experimental psychologist William K. Estes, political scientist Vincent Ostrom, and decision theorist and philosopher Patrick Suppes.

³ Arrow was originally expected to write a study comparing psychological and economic models of decision-making under uncertainty and learning. The study was intended for inclusion in a survey on the current status of psychology being prepared by the American Psychological Association. A portion of this work appeared in a review note Arrow published in *Econometrica* (Arrow 1958).

⁴ The *Stanford Mathematical Studies in the Social Sciences* series ran from 1958 to 1964, encompassing nine volumes in total.

submitted a funding application to the Rockefeller Foundation, hoping “to formalize the organizational aspect of social science mathematical work” at Stanford, and “to provide an explicit framework for the various research activity in this area.” (Suppes 1957)

The research proposal specifically focused on the focused on the “ramifications and consequences of uncertainty factors in decision-making.” (Arrow and Suppes 1957, 58323) As indicated in the proposal, “Arrow has been particularly concerned with how investment decisions are made,” and he planned to conduct experiments testing how investors use available information to make choices. Furthermore, the proposal noted that “the experimental findings from the proposed research should illuminate some aspects of the question of the ‘ideal’ economic organization—the optimal degree of decentralization of decision-making in an economy.” To that end, they proposed inviting “Professor Leonid Hurwicz of the University of Minnesota, [who] has worked with Professor Arrow on these questions and hopes to spend a year at Stanford with the group.”(Arrow and Suppes 1957, 5).

The grant was approved, and while Hurwicz noted in a Rockefeller Foundation interview—part of the foundation’s internal assessment of potential grantees—that “his own bent is not experimental” and that such work was “good—like dog-catching—for someone else to do,” (McKinley 1958)the grant nonetheless brought him to Stanford’s Applied Mathematics Laboratory for a semester in 1958 or 1959.

Meanwhile, both Arrow and Hurwicz began exploring the possibility of *applying* their theoretical work on adjustment processes to concrete economic analyses. Hurwicz turned to the context of postwar economic reforms in Poland—led in part by his former teacher, Oskar Lange—using his new framework to evaluate the relationship between decentralization and

efficiency (Hurwicz 1958). Arrow, for his part, adapted the concept of the adjustment process to develop a theory of *dynamic shortage* in the context of a RAND research project. This project investigated whether the U.S. market for scientists and engineers was experiencing a shortage, offering Arrow a case in which to test how disequilibrium could be modeled and measured over time (Capron et al. 1958).⁵

Arrow presented his work on ‘dynamic shortage’ in 1959 at the Conference on Mathematical Methods in the Social Sciences, held at Stanford. At the same conference, Hurwicz delivered a paper titled “*Optimality and Informational Efficiency in Resource Allocation Processes*,” which marked the first published output of his nearly decade-long project to develop a general theory of decentralization (Hurwicz, 1960). In this paper, he introduced his abstract formulation of adjustment processes and proposed how this framework could be used to analyze and compare different economic mechanisms. The presentation is now recognized as Hurwicz’s pioneering contribution to what would soon emerge as the new field of *mechanism design*.

1960s – Expanding the Analytical Frame: Beyond the Market

Hurwicz and Arrow’s collaboration on the question of stability culminated in a series of publications between the late 1950s and early 1960s (Arrow and Hurwicz 1960a; 1960b; 1960c; Arrow et al. 1959; Arrow and Hurwicz 1958; 1962). The two had planned to co-author a book on stability theory that would compile their existing work and incorporate new material (Arrow

⁵ Armen Alchian, Arrow’s co-author on the RAND report, did not like Arrow’s model and explicitly dissented in a footnote, stating that he “dissent[s] in questioning the desirability of using [the] ‘dynamic shortage’ concept as an alternative to the usual analysis.” He argued that conventional models explain price–quantity adjustment through market periods (short-run vs. long-run supply and demand), rather than through individual decision-making (Capron et al. 1958, 12). Notably, Alchian did not join Kenneth Arrow and William M. Capron in the later published version of the work, titled “*Dynamic Shortages and Price Rises: The Engineer-Scientist Case*” (Arrow and Capron 1959).

1957b). However, in a 1962 letter to Hurwicz, Arrow admitted: “The stability book has gotten kind of cold in my mind. I am a little unhappy about thinking it through. [...] My present inclination is, if anything, to do a work on the foundations of the theory of competitive equilibria” (Arrow 1962b).

In this letter, Arrow referenced the newly published works by Aumann, Scarf, and Debreu, which reconceptualized competitive equilibrium using the concept of the core, borrowed from the theory of cooperative games (Aumann 1961; Debreu and Scarf 1963). Reading that letter, one could anticipate that Arrow was also interested in using novel developments in mathematical techniques to create a better theory of markets. However, that was not Arrow’s direction. Neither he aimed to revise the foundations of the competitive model by creating a more general and abstract mathematical framework, as Hurwicz tried to do.

His approach was almost the opposite. Rather than continuing to refine the theoretical apparatus, Arrow increasingly turned his attention to the model’s *applicability* to concrete empirical problems. As noted earlier, concerns about its real-world relevance first surfaced in his 1954 work on the allocation of risk (Arrow 1966). In the latter half of the 1950s, he began to pursue an experimental approach to these issues, including his work at the Applied Mathematics Laboratory at Stanford. During the same period, he also participated in Stanford’s technology and resource allocation project, focusing on questions of innovation (Ballandonne 2015).

But the defining opportunity to explore, in a systematic way, the implications of uncertainty for market theory came in January 1961, when Robert Dorfman invited Arrow to join a newly launched Ford Foundation–sponsored research initiative led by Victor Fuchs (Dorfman 1961).

The project aimed to promote economic analysis of social, governmental, and welfare services and problems. According to Fuchs, these fields were largely neglected by mainstream economists and could benefit from “the unique talents that a well-trained economist can bring to bear on such problems.” These talents included “a set of theoretical concepts such as scarcity, costs, benefits, efficiency, and allocation,” as well as skills in assembling, processing, and interpreting quantitative data, and the ability to formulate analyses in terms of choices, decision-making, and policy implications (Fuchs 1960). The project assigned to each field—welfare, education, and health—two economists: one a practitioner with familiarity in the area, the other a theoretical economist. Arrow was asked to contribute to the volume by playing the role of the latter, focusing on the health care industry. This paper went on to become one of Arrow’s most frequently cited works and a key reference point in subsequent economic analyses of the health care sector.

While this paper is widely recognized as a pioneering contribution to the emerging subfield of health economics, for Arrow it also offered an opportunity to reflect on a question that had preoccupied him for over a decade: What are the implications of uncertainty for the welfare analysis of the competitive market? (Smith, Adam 2008).

Although Arrow stated at the outset that his paper addresses the distinctive characteristics of the medical care industry from the perspective of normative economics (Arrow 1963, 941), the methods and insights he developed in this work reappeared throughout his later research. In particular, the paper offers a valuable window into Arrow’s efforts to conceptualize social institutions. For this reason, it merits closer examination.

Arrow's central analytical argument proceeds as follows: economists tend to value competitive markets because of their desirable properties, particularly in terms of efficiency. The welfare theorems, together with the existence proof, establish that under certain conditions, competitive markets indeed yield efficient outcomes. From this perspective, one may analyze a particular real-world market by comparing it to the competitive model, focusing on its institutional structure and assessing "the presence or absence of the preconditions for the equivalence of competitive equilibria" (Arrow 1963, 944). These preconditions, according to Arrow, include the existence of competitive equilibrium, the marketability of all goods and services relevant to costs and utilities, and the assumption of non-increasing returns.

Arrow's key observation regarding the medical care industry is that it lacks the marketability of many essential commodities, which prevents competitive markets from ensuring efficiency. This, in turn, explains the emergence of alternative mechanisms that Arrow refers to as social institutions. These mechanisms, which include primarily ethical norms and professional associations, are necessary for the proper functioning of the industry (Arrow 1963, 947)..

According to Arrow, the most critical factor contributing to non-marketability in the medical care industry is the high degree of uncertainty it involves (Arrow 1963, 945). To clarify this argument, he presented his model of general equilibrium under uncertainty, in which agents trade *state-contingent* commodities rather than actual goods. As Arrow explains, this formal market in contingent commodities could, in theory, produce an optimal allocation of risk among members of society—parallel to the optimal allocation of resources achieved in the certainty case (Arrow 1963, 942–43).

However, as Arrow noted, this theoretical ideal faces significant practical limitations:

The variety of possible risks in the world is really staggering. The relevant commodities include, in effect, bets on all possible occurrences in the world that impact utilities. In fact, many of these 'commodities'—i.e., desired protections against various risks—are simply not available. Thus, a wide class of commodities is nonmarketable, and a basic competitive precondition is not satisfied (Arrow 1963, 944–45).

To explain why these otherwise desirable protections against risk are unavailable, Arrow pointed to a familiar issue in the theory of insurance: *moral hazard*. According to Arrow, the non-marketability he associated with risk sharing stems from the difficulty in writing insurance contracts that can adequately distinguish among different types of risks. As he put it, “it is impossible to draw up insurance policies that will sufficiently distinguish among risks, particularly since observing the outcomes cannot differentiate between avoidable and unavoidable risks” (Arrow 1963, 945). In this way, Arrow redefined the problem of moral hazard—not as a technical issue in insurance, but as a fundamental barrier to marketability that prevents the realization of a key condition for competitive efficiency (Arrow 1963, 947).⁶

Building on this conclusion, Arrow offered a suggestive proposition: in contexts where competitive markets fail to ensure efficiency—such as the medical care industry—other social

⁶Arrow initially studied statistics with the intention of becoming an actuary and spent a summer working at an insurance company (Arrow 1984, 66). He first introduced the concept of moral hazard in a 1962 paper on economics and invention (Arrow 1962a), and re-conceptualized it in the medical care paper as a problem of indivisibility. In contrast to the standard framing—where moral hazard arises from distorted incentives, such that the ability to insure oneself encourages reckless behavior—Arrow located the problem in the insurer’s inability to distinguish between ‘natural’ risk and risk resulting from behavioral change. In the model, these are treated as distinct commodities and should, in principle, carry different prices.

institutions emerge to fill the resulting “optimality gap” (Arrow 1963, 947). Arrow identified delegation and trust as central institutions “designed to obviate the problem of informational inequality” (Arrow 1963, 965). To support this argument, he drew on sociologist Talcott Parsons’s analysis of the health care system in *The Social System* (Parsons [1951] 1991, 288–322). Based on Parsons’ analysis, Arrow suggested that rigid entry requirements to the medical profession, the ethical code adopted by doctors, and specific pricing practices common in the industry were all intended “to establish and preserve a ‘collective-orientation,’ which distinguished medicine and other professions from business, where self-interest on the part of participants was the accepted norm” (Arrow 1963, 949). In Parsons’s theory, *collective-orientation* refers to an individual’s disposition to act in the interest of the group or society rather than purely in pursuit of personal gain. In this way, the doctor–patient relationship is removed from the profit-driven logic of the market and relocated in the domain of ethical obligation.

Arrow concluded his paper by stating that his main insight was that ‘the failure of the market to insure against uncertainties has led to the creation of many social institutions in which the usual assumptions of the market are contradicted to some extent.’ (Arrow 1963, 967). He emphasized that this insight extends beyond the specific case of the medical care industry, concluding with the general statement that ‘The logic and limitations of ideal competitive behavior under uncertainty compel us to acknowledge the incomplete description of reality provided by the impersonal price system’ (Arrow 1963, 967).

By this point, both Hurwicz and Arrow arrived, each in his own way, to his basic conceptualization of the framework that could deal with social institutions. For each, this framing involved a re-conceptualization of the market itself. Hurwicz viewed the market model as a particular case of the broader framework of mechanism that transmit information to units who

act according to the information they get. Arrow viewed the market as a mechanism for allocating risks among members of society. For each, the normative properites of the market had been shifted - Hurwicz asked for efficiency not only in term of pareto efficiency but also in term of informational requirements, Arrow asked for efficiency in the allocation of risks, rather than just commodities.

Around the same time, Arrow published another paper along a similar line of argument—this time applying the concept of *moral hazard*, to explain why uncertainty imposes serious limitations on the efficiency of the price mechanism in the case of research and development (Arrow 1962a). In the following years, he elaborated on this framework in several venues, explaining the implications of insurance theory on the model of general equilibrium under uncertainty (Arrow 1964; 1965). He also published, in English, his model of general equilibrium under uncertainty from 1952 (Arrow [1952] 1964), and appeared to revisit his earlier effort to extend the model to include production, originally outlined in a 1954 draft (Arrow 1966). According to the same line, he aimed to develop a general theory of the *optimal allocation of risk-bearing*, showing that in the presence of uncertainty, the price mechanism fails to achieve optimality (Arrow 1966).

However, a different direction came to dominate his research agenda. After spending six months at the Council of Economic Advisers in Washington, Arrow turned increasingly to issues of economic development and optimal growth, eventually leading to his collaboration with Robert Solow on the production function.

During these years, Hurwicz was immersed in his long-term project on decentralization and resource allocation. A research report summarizing this work between 1961 and 1966 listed

several collaborations that produced both convergence proofs for certain stochastic adjustment processes and impossibility theorems for cases involving externalities (Hurwicz 1968). In a 1964 commentary on economics education, Hurwicz captured the broader ambition behind this research: “The social sciences have evolved a discipline which, at least in principle, is capable of bringing order out of chaos.” (Hurwicz 1964, 4) Specifically, he argued that disagreements over economic policy might stem not from faulty reasoning or conflicting values, but from differing assumptions about the structure of the economy. As in his earlier work, the key lay in analytically clarifying how different institutional structures shape economic outcomes (Hurwicz 1964, 4).

For Hurwicz, this kind of clarification was not possible without mathematical formalism. In a 1963 paper on the role of mathematics in the social sciences, he explicitly rejected the view that mathematics serves merely as a language. Drawing on the case of general equilibrium theory, he argued that even longstanding economic questions could only be meaningfully addressed once appropriate mathematical tools were developed: the existence of equilibrium, for instance, could not be demonstrated without innovations in topology and fixed-point theorems. In this sense, Hurwicz argued, mathematics was not merely a language of expression but a necessary tool for identifying and clarifying theoretical results (Hurwicz 1963).

We find this clarifying function of mathematics at the center of Hurwicz’s 1969 paper, *On the Concept and Possibility of Informational Decentralization*. In this paper, presented at the AEA meeting, Hurwicz took stock of nearly two decades of formal work on optimization, adjustment processes, and decentralized decision-making to clarify its broader implications. In a manner characteristic of later work in the emerging field of mechanism design, the paper sought to extract general insights from a wide range of technical results—asking what had been learned, in

formal terms, about the conditions under which decentralized systems can achieve desirable outcomes. Hurwicz placed the long-standing debates over markets, planning, and socialism in a new framing, arguing that the core issue was not ownership or ideology, but the informational structure of different allocation mechanisms (Hurwicz 1969, 513). He credited Friedrich Hayek for posing the core challenge: how to coordinate dispersed information held by different agents without relying on centralized knowledge. Hurwicz proposed a precise definition of “informational decentralization,” distinguishing it from central planning by the dimensionality and type of messages communicated among agents (Hurwicz 1969, 514). This formal framework allowed him to reframe a host of classical and contemporary economic problems—externalities, indivisibilities, increasing returns, and missing markets—as questions about the feasibility and performance of different informational structures.

The paper thus stands as a programmatic summary of Hurwicz’s broader project: to develop an analytical framework capable of comparing diverse economic organizational forms, described in their most abstract terms, with respect to their informational requirements and performance criteria—such as stability and Pareto efficiency.

In the same year, Arrow also presented a paper that can be seen as summing up his perspective on the capacity of economic analysis to “make order out of chaos” and guide normative questions about desirable economic policy—this time in the pragmatic context of public administration. His paper, titled “*The Organization of Economic Activity: Issues Pertinent to the Choice of Market versus Non-Market Allocation*,” was delivered at the 1969 Planning-Programming-Budgeting (PPB) conference and later included in a published congressional report (Arrow 1969). The conference was part of a broader initiative to implement PPB across a range of U.S. government agencies. Arrow’s contribution offered a conceptual synthesis of several

emerging themes in the then-developing field of public economics. He began by restating the welfare theorems and used their assumptions as a framework for identifying the conditions under which market efficiency fails. He first reviewed the classical sources of market failure—externalities (stemming from indivisibilities) and monopolies (arising from increasing returns)—before turning to newer issues involving uncertainty and information. In this expanded framework, Arrow incorporated problems of adverse selection and principal-agent dynamics alongside the earlier focus on moral hazard (Arrow 1969, 54–56).

Arrow used these examples—each highlighting the limitations of the price mechanism—to argue for a broader conception of market failure. Rather than restricting the term to externalities, he defined market failure as any situation in which markets fail to exist, such as when future or contingent goods cannot be traded due to informational constraints. He then proposed an even more general framing: missing markets are extreme cases of a wider phenomenon—transaction costs. According to Arrow, transaction costs are costs that can be modified through changes in the organization of society (in contrast to technological production costs), in particular information and communication costs (Arrow 1969, 59–60).

After laying out his analytical framework, Arrow considered two forms of collective action that could substitute for market allocation: the political process and social norms. He suggested that “the State is not an entity but rather a system of individual agents,” and that it is “appealing and fruitful to analyze its behavior in resource allocation in a manner analogous to that of the price system.” Citing Hotelling, Schumpeter, and game theory, Arrow argued that political decision-making—like market behavior—can be interpreted through the lens of individual motives. Political representation, he added, is a classic principal-agent problem: “Representatives are no

more a random sample of their constituents than physicians are of their patients.” (Arrow 1969, 60)

After drawing an analogy between market and political behavior (an idea he had introduced already in his 1950 work on social choice) Arrow turned to the firm as another example of collective action, characterized by hierarchical control. To this triad—markets, politics, and firms—he added a fourth: social norms. These, he argued, could be seen as “reactions of society to compensate for market failures,” especially where trust is required but cannot be contractually enforced. “In the absence of trust,” he wrote, “it would become very costly to arrange for alternative sanctions and guarantees, and many opportunities for mutually beneficial cooperation would have to be foregone.” (Arrow 1969, 62)

Arrow then proposed a theory of norms as internalized agreements. While mutual arrangements are possible, they are often costly to establish and maintain, particularly across generations. As an alternative, society may “proceed by internalization of these norms to the achievement of the desired agreement on an unconscious level.” (Arrow 1969, 62) Customs, in this sense, function as implicit agreements that facilitate efficiency where the price system cannot apply.

In this way, Arrow proposed a general analytical framework: society comprises multiple forms of collective organization—markets, politics, firms, and norms—each with distinct incentives and costs for aggregating individual preferences. Norms, in this view, enable cooperation where markets cannot, making trust not a moral supplement but a necessary condition for efficiency. Arrow thus advanced a functionalist theory of social institutions grounded in the limits of the price system.

Hurwicz's and Arrow's 1969 papers reflect two distinct but fundamentally aligned frameworks. Despite differences in style and emphasis—Hurwicz's formalism and algorithmic focus versus Arrow's institutional and policy-oriented lens—both begin from the benchmark of competitive general equilibrium theory and seek to extend its logic to a wider range of organizational forms. Their analyses move from 'non-classical' market environments (characterized by externalities, increasing returns, or uncertainty) toward non-market institutions such as political processes, firms, and norms. At the core of both frameworks lies a shared conceptual foundation: the centrality of information. Preserving in different ways a cybernetic view of society, they depict economic coordination as fundamentally an informational problem. Hurwicz emphasizes the adjustment process—how decentralized units exchange messages and act upon them to achieve system-wide coherence. Arrow, by contrast, frames society as a space for the allocation and shifting of risk through various institutional arrangements, including markets, state structures, and social norms. Together, their work represents a shared effort to reframe economic organization in informational terms, moving beyond the idealized market model to explore the structural and epistemic conditions under which coordination and collective rationality can be sustained.

1970s - From General Equilibrium to Game Forms

During the late 1960s, the economic analysis of information crystallized through several major contributions—from Akerlof's analysis of adverse selection, to Harsanyi's formalization of games with incomplete information, to Radner's reformulation of general equilibrium under uncertainty to account for private information (G. A. Akerlof 1970; Harsanyi 1967; Radner 1968).

In the early 1970s, both Arrow and Hurwicz reached high points in their careers: Arrow

received the Nobel Prize in 1972 for his work on welfare economics and general equilibrium theory, while Hurwicz introduced the concept of *incentive compatibility*—a principle that would lay the groundwork for the emerging field of mechanism design (and would ultimately earn him the Nobel Prize as well).

As Hurwicz later reflected, while his work during the 1960s and early 1970s focused primarily on communication and information transmission—under the assumption that agents were willing to cooperate—the issue of compliance and truthful behavior emerged as a central concern in normative economics during the early 1970s (Hurwicz 1987, 272).⁷ This shift led him to explicitly incorporate the requirement that agents should have no incentive to misrepresent their preferences. In doing so, Hurwicz arrived at a framework that addressed both informational constraints and incentive compatibility, offering a generalized formulation for analyzing the problem of optimal economic organization (Hurwicz 1971).

Reflecting on the trajectory of their work, Hurwicz offered in his 1973 Ely Lecture a clear articulation of what had been accomplished. The central move, he argued, was to treat the institutional structure of the economy not as a fixed background, but as an object of analysis—and, more radically, as a design problem. This shift made it possible to ask which institutional arrangements might perform better under specified criteria, while acknowledging the informational and incentive constraints that limit idealized solutions. For Hurwicz, this marked the emergence of a new “analytical approach” to institutional questions—one that refused to

⁷ Alongside Hurwicz’s introduction of the formal concept of incentive compatibility, other works—most notably those by Gibbard and Satterthwaite—brought the problem of strategic manipulation to the forefront of economic analysis (Gibbard and Varian 1978; Satterthwaite 1975).

accept the status quo yet steered clear of utopian thinking. Drawing on tools from game theory, control theory, and information economics, this approach helped bridge the older divide between formal economic analysis and institutional inquiry. According to Hurwicz, this new vision represented a step toward the synthesis of two traditions that had long stood apart: the formalist and the institutionalist (Hurwicz 1973).

Yet while framed as a reconciliation, it in fact marked the triumph of a mathematical and abstract mode of reasoning over the historically grounded, empirically oriented methods associated with the institutionalist tradition. The “institution” had been redefined—not as a social or historical formation, but as a formal mechanism governed by informational constraints and incentive compatibility.

However, just as mathematical economics had finally moved beyond the confines of the market model—developing an analytical framework capable of encompassing complex aspects of organizational structure—it encountered a different kind of limit. The ambition to identify an optimal mechanism capable of generating an ideal form of social organization was shown—by Hurwicz himself—to be impossible. Even the perfectly competitive market, long regarded as a theoretical benchmark if not a realistic model, was revealed to be incentive *incompatible* in many cases (Hurwicz 1972). The result was a sobering realization: neither markets nor centralized planning could reliably deliver first-best allocations.

For Arrow, this recognition of the “limits of organization”—the idea that economic analysis reveals fundamental constraints on all forms of coordination—helped explain why norms and ethical codes remain indispensable to the functioning of economic systems (Arrow 1974c). Yet while Arrow emphasized that social norms generate behavioral patterns distinct from market

logic, he integrated them into a unified, functionalist theory of institutions—one governed by the criterion of Pareto efficiency.

By the mid-1970s, the idea that asymmetries in the distribution of information could pose fundamental obstacles to the functioning of the price mechanism had become widely accepted. Moreover, concepts of uncertainty and information were increasingly used to build models that explained the logic behind a broad range of social institutions. Economists applied these tools to analyze phenomena such as discrimination, educational signaling, credit rationing, and occupational hierarchies—areas previously considered outside the traditional scope of market analysis (Stiglitz 1975; Arrow 1972; Spence 1973; G. Akerlof 1976).

By the late 1970s, mechanism design had taken on a new form, grounded not in general equilibrium theory or adjustment processes, but in game-theoretic models of strategic interaction. The focus shifted from structural analysis and stability to questions of implementability and incentives (Reiter 1977). Implementation theory developed by Dasgupta, Hammond, Maskin, and Myerson—redefined the normative agenda: not which outcomes are desirable, but which can be achieved under informational constraints (Maskin 1983; Dasgupta et al. 1979). In this emerging paradigm, mechanisms became formal game forms, and decentralization no longer referred to dispersed information in a process, as Hurwicz conceived it, but to agents' incentives to truthfully report their private information to a central planner. The revelation principle—proven in its most general form by Myerson—marked the culmination of this shift, offering a unified framework that connected incentive compatibility to Bayesian game theory and reimaged the planner as a designer of games rather than a coordinator of processes (Myerson 1979; 1983).

Yet the emerging framework of mechanism design as a theory of implementation marked a departure from the kind of general frameworks Arrow and Hurwicz had originally envisioned. It no longer aimed to uncover the underlying structural logic of economic institutions or to offer conceptual clarity in the spirit of general equilibrium theory. Instead, its central theorems became increasingly technical, abstract, and self-referential. The grand project of using mathematics to illuminate foundational economic questions gradually gave way to increasingly specialized models.

Alongside these shifts, the normative and ideological stakes of earlier decades—the tension between markets and planning, capitalism and socialism—faded from view. The ambition to “make order out of chaos” was replaced by a problem-oriented perspective focused on the design of markets and specific policy mechanisms.

Summary – mathematization and the social realm

Arrow and Hurwicz both held the perspective that information economics was the most important development in post war economic thinking. At the same time, both of them also presented some disappointment from the direction it took, in particular from the abandonment of the general equilibrium framework.

For Arrow, the transition towards partial equilibrium analysis of informational market failure, was unable to ask the big question of economics, which only general equilibrium theory was capable of truly answering (Arrow 1987, 202). For Hurwicz, the new focus on strategic manipulation did not replace his earlier ambition to build a grand theory of institutions grounded in optimal control (Hurwicz 1978). In general, both Hurwicz and Arrow remained ambivalent about game theory’s growing dominance. While they acknowledged its strengths and respected

the achievements of others in the field, they were ultimately dissatisfied with its inability to produce a genuinely general theory of the economic system (Hurwicz 2003; Arrow 1987, 216).⁸

In the broader contest over the future of mathematical economics, it was von Neumann's vision—centered on strategic reasoning, equilibrium concepts, and model-specific applications—that ultimately prevailed over the Bourbaki-inspired structuralist approach that Arrow and Hurwicz had championed.⁹ By the 1980s, game theory—especially in its repeated and evolutionary forms—had become the dominant tool for modeling strategic interaction and rational behavior across economics and the social sciences. This intellectual shift helped consolidate the new institutional economics as a leading research agenda, offering a framework for analyzing rules, incentives, *and norms* as equilibrium outcomes within formal economic models.

This paper has argued that general equilibrium theory—far from neglecting institutions—was central to the broader post-war challenge of mathematizing the social realm. As part of the ambition to rationally manage the economy and society, funded heavily by organizations like the Ford Foundation, mathematical economists sought to extend formal analysis beyond markets narrowly conceived. From early on, some theorists saw general equilibrium as a framework

⁸ Arrow had another, interesting, criticism of game theory. In his view, it required “great demands on rationality, well beyond those that neoclassical theory imposes.” (Arrow 1987, 241). In the neoclassical model, he argued, agents respond to prices—so part of their rationality is effectively delegated to the rationality of the price system itself (Arrow 1986). Game theory, by contrast, lacks such a directive mechanism, making its assumptions about individual rationality significantly more demanding.

⁹ While Mirowski (2002) describes this divide in terms of a clash between instrumental and structuralist visions of mathematization—with von Neumann representing a post-Gödelian, applied orientation and Bourbaki a more aestheticized formalism—my emphasis lies elsewhere. What distinguished Arrow and Hurwicz's structuralist approach was not merely a stylistic preference, but a deeper commitment to developing a unified mathematical framework that could clarify core economic concepts across domains. In contrast, the von Neumann-inspired turn in game theory led to a more fragmented, context-specific modeling strategy, focused on tractable representations of strategic interaction rather than a general conceptual architecture for analyzing institutions.

capable of addressing questions of socio-economic organization, albeit through abstraction rather than empirical investigation. This approach did not aim to describe institutions in their historical specificity, but to reconstruct their roles within a unified analytical language.

This is not to suggest that the approach was necessarily successful or appropriate for every domain. Rather, it is to highlight the conceptual challenge posed by extending mathematical reasoning to areas that lacked the quantitative structure of markets—prices, quantities, and clearly defined agents. In this regard, it is worth remembering that game theory, now often treated as the “unifying language of the behavioral sciences” (Gintis 2014), was initially seen as relevant primarily to traditional economic problems such as oligopolistic competition (Giocoli 2001). Its centrality to economic theory emerged gradually, alongside shifting methodological priorities.

Moreover, the expansion of economic analysis beyond the market was not always a matter of applying the same logic to new domains. In Arrow’s work, for instance, it often involved grappling with domains—such as health, trust, or political representation—that resisted market logic and required new conceptual tools. This complicates the familiar story of economic imperialism. Economists did not merely “conquer” new territories; they often drew on insights from other disciplines, adapted their models, and responded to empirical and policy challenges they had not previously faced. That said, the rise of mechanism design and information economics did mark the consolidation of a functionalist, efficiency-oriented framework as the dominant normative language for analyzing institutions—even in fields traditionally governed by other values.

Finally, while Hurwicz's influence on the development of mechanism design is widely acknowledged, Arrow's institutional legacy is perhaps more diffuse but no less significant. His work shaped the contractual approaches of Oliver Williamson, the analysis of norms and trust in Partha Dasgupta's writings, and even Akerlof and Yellen's accounts of unemployment as a norm-based phenomenon. In both cases, their work marked a turning point in the conceptualization of institutions in economic theory—not as external constraints but as endogenous components of a formal system.

There is still much to be said, as others have noted, about how economics developed as a social science—and about how its evolving methods and ambitions shaped its relationship with neighboring disciplines. This paper has aimed to contribute one piece to that larger story

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