Rationalizing Human Organization in an Uncertain World: Jacob Marschak, from Ukrainian Prisons to Behavioral Science Laboratories

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When economist Jacob Marschak, who was born in 1898, suddenly died in 1977, his former colleague at the Cowles Commission Lawrence Klein (1978, 326) pointed out that "he left a clear mark on the development of such well-known figures as Arrow, Chernoff, Anderson, Rubin, Patinkin, Debreu, Brunner, Radner, Modigliani, Houthakker, Christ, Hildreth, Hurwicz, Haavelmo, Reiter, and others. This list . . . is impressive, and indicative of the depth of his influence." Yet, other than a few exceptions such as the exposition of von Neumann and Morgenstern's axiomatization of choice under uncertainty and the outline of the Cowles Commission's program, Marschak's work has received little attention.[1]

This disregard may be explained by the multifaceted character of his life and career, which spanned over four countries and covered several fields and activities. A Menshevik minister of labor in a Ukrainian republic at the

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1. Other exceptions are Epstein 1987 on the Cowles directorship, Mirowski 2002 on Marschak's turn to information and organization theory from the 1950s onward, and Mehrling 2010 on Marschak's founding contribution to monetary theory. Hagemann 1997 and 2006 cover the whole range of Marschak's life but the focus is mainly on the German period. See also Radner 2008.

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age of nineteen, he fled the Bolshevik dictatorship to Germany in 1919.[2] Under the tutelage of mathematical economist Ladislaus von Bortkiewicz, Emil Lederer, and Adolph Lowe, he developed into an economist while remaining a socialist activist. He worked on issues as diverse as the Marxist transformation equation, the rise of fascism in Italy, and the emergence of a middle class in interwar Germany, as well as wage policy and the formation of capital. The mastery of mathematics and nascent econometric techniques displayed in his early work on demand theory (Marschak 1931) earned him a position at Oxford after he was forced to leave Germany in 1933.[3] There, he developed a theory of money demand under uncertainty and conducted empirical research on labor mobility. He again emigrated, this time to the United States, in 1939, and like many fellow German scientists, he settled at the New School for Social Research in New York. In 1943, he moved to Chicago to head the Cowles Commission and became a major player in the econometric revolution. After Tjalling Koopmans succeeded him as director in 1947, Marschak remained at Cowles, even when it moved to Yale in 1955. In these years, among other interests, he developed a stochastic decision theory that subsequently triggered an interest in information, communication, and organization theory and directed him toward interdisciplinary collaborations and experimentation. He eventually settled at the Western Management Science Institute of the University of California, Los Angeles, in 1960, where he spent the rest of his life refining his theory of teams.

Not only did Marschak embrace diverse schools of thought over time, but he was also used to working with both a neoclassical and a behavioral framework or with two different concepts of information at the same time. As Kenneth Arrow (1978, xii) pointed out,

> Scholars, like all other individuals, vary greatly in their tolerance for uncertainty and ambiguity. Some feel no comfort until they have a theoretical framework or at least a vision capable of explaining to their satisfaction the phenomena of interest in their field. The entertainment

2. The biographical material is taken from Hagemann 1997, the most exhaustive biographical article available on Marschak; Marschak's own memories of his youth in Russia gathered for the UCLA Oral History Project (Marschak 1971); and archival material (boxes 143, 144, and 148 in particular are devoted to Marschak's German work). Unless otherwise indicated, all archival material cited in the present article is taken from the Jacob Marschak Papers, which are in the Charles E. Young Research Library at UCLA.

3. It was in the wake of this second emigration that he changed the spelling of his first name from *Jakob* to *Jacob*.

> of alternative hypotheses is difficult for them. Others can contemplate with equanimity the possibility that our empirical knowledge and theoretical understanding are compatible with more than one view of the world, that only gradually will there be greater resolution.
>
> . . . The risk-tolerant scholar is more open to new ideas and, in particular, is liable to play a special role in synthesis, in the yoking together of ideas from disparate fields.
>
> Jacob Marschak certainly belongs on the risk-tolerant end of the spectrum.

These dramatic changes in theories and context make the assessment of Marschak's intellectual development difficult. His life may appear as somewhat rambling, and historians have recently warned against overdone consistency in the writing of biographies (see Hacohen 2007 and the others articles in Weintraub and Forget 2007). Our claim nevertheless is that there is an underlying continuity in Marschak's intellectual development, one that becomes apparent when his postwar ideas are studied against the background of his Ukrainian and German experiences.

Marschak's geographical and intellectual wanderings also determined the manner of his influence on the profession. His impact was not primarily on economics proper, for the result of his thirty-year effort to build a theory of organization, set forth in the *Economic Theory of Teams* (Marschak and Radner 1972), never caught on. Rather, fellow economists and friends Arrow (1978, xiv) and Koopmans (1978, ix) emphasized his "leadership ability," his "innovative drive in directing research on both sides of the Atlantic," and his role as "an initiator" and "a catalyst" through the new ideas and tools emerging from his rich personal experiences and his numerous research interests. Much of Marschak's energy was indeed devoted to the organization and management of research programs: he became the founding director of the Oxford Institute of Statistics (OIS) in 1935 and then organized in New York a seminar on econometrics and mathematical economics that proved to be the catalyst for the development of econometrics in the United States (Koopmans 1978, ix). He succeeded at assembling an able team of researchers at Cowles to develop the famous structural estimation method.[4] Finally, he headed the UCLA Western Management Science Institute in 1965–69 and established the

4. The formation of the OIS is recounted in Young and Lee 1993, chap. 5. On Marschak's role in shaping the structural estimation method at Cowles, see Christ 1952, 1994; Epstein 1987; and Hildreth 1988.

Interdisciplinary Colloquium on Mathematics in the Behavioral Sciences. Marschak thus held a special institutional position within the academic world, from where his scientific vision could influence his colleagues through the research guidelines he provided.

This article intends to capture Marschak's scientific vision in the 1940s and 1950s, at the apex of his influence on the profession. Our thesis is that while his understanding of the proper subject matter and methods of economics somewhat reflects the broader evolutions seen within the discipline, the roots of his vision lie in his private experience of the vicissitudes of the twentieth century and the resulting role he attributed to the scientist in contemporary troubled societies. Indeed, his definition of economics as the science of rational choice (section 1) and his emphasis on mathematization, experimentation, and interdisciplinarity as the proper methodology (section 2) closely relate to his definition of uncertainty as the main characteristic of the social environment (section 3) and to the claim that economists should be "social engineers" (section 4).

1. Social Organization Emerging from Rational Decisions

Marschak retrospectively described his initial understanding of economics as dealing with "the history of social forms," driven by his conviction that "large human organizations are here to stay and ought to be improved" ("A Dummy Application," 23 November 1953, box 99). The subject of his first published article already reflected such a concern. It was a response to "Economic Calculation in the Socialist Commonwealth," the famous paper in which Ludwig von Mises (1920) argued that there was no price formation in a socialist economy and thus no efficient allocation of resources, thereby launching the socialist calculation debate. Marschak (1923) replied that the centralization of economic authority in a socialist state was compatible with the decentralization of information necessary in a complex economy, and remarked that the numerous monopolies and cartels typical of contemporary economies hindered the efficiency of market organization. With his endorsement of the notion of "economic structures" at the Kiel Institute for the World Economy in 1928–30, his participation in the various controversies surrounding the inability of the German government to cure the economic depression, and his encounter with the intellectual atmosphere at Oxford (1935–39), Marschak gradually moved

toward a more "macroeconomic" definition of economics.[5] In "Peace Economics" (1940, 286), he argued that of the three fundamental economics principles he knew—developing resources, allocating them so as to "achieve the most complete possible satisfaction of the consumer's desires," and avoiding idle resources ("the requirement that booms and depressions be mitigated")—the last had usually been overlooked by economists.[6] Still, he insisted, a necessary prerequisite to the preservation of peace was the elaboration of an international business-cycle policy (Marschak to Johnson, 26 February 1940, box 155).[7] The same year, he nevertheless began a lecture with the idea that the "economist's attitude [is to seek] the *plausible* patterns of human behaviour . . . often rational and quantitative" ("Probabilities and the Economist," lecture given at Princeton, probably 1941, box 87). This indicates that on the verge of the war, Marschak's vision of the subject matter of economics was still not settled. It was evolving as he touched upon new subjects, as he entered new subfields. Already in 1941 we can see that he was turning to rational choice as a defining element of economics, but only after he became a member of Cowles did he unambiguously adopt it.[8]

It was when Thomas Carroll, dean of the business school of the University of North Carolina, conducted a survey on "economics and the behavioral sciences" on behalf of the Ford Foundation in 1952 that Marschak provided an articulated view of economic science. He participated in the survey and subsequently attended a conference organized by Ford officials at the University of Chicago in December. His interventions on this occasion clearly indicate where he stood in the transition from the concept

5. On Marschak's participation in the German wage controversy, see Hagemann 1999. On the Oxford intellectual atmosphere, see Young and Lee 1993. Marschak's work in Oxford was mainly about advanced empirical and econometric work (Makower, Marschak, and Robinson 1938) and attempts to wed the theory of the demand for money to early treatments of uncertainty (Makower and Marschak 1938).

6. This paper was an offspring of a New School graduate project "On the Organization of Peace" designed to figure out the economic and social conditions of Europe once totalitarianism had been defeated and what types of political institutions would provide an enduring peace on the European continent (folder "On the Organization of Peace," box 155).

7. Such a statement should be related to Marschak's belief that Hilter's election was largely a consequence of the German government's inability to cure unemployment and of its deflation policy (letter from Marschak, probably 1940, box 155).

8. Marschak conducted other projects during this period that may have also influenced his intellectual development. He pursued his research on the demand for money under uncertainty (see Marschak 1950b among others) and studied and taught the various theories of the business cycle (his macroeconomic lectures were edited and published in 1948 as *Income, Employment, and the Price Level*).

of "wealth" to the concept of "choice" that the definition of economics was undergoing (documented in Backhouse and Medema 2009):

> *Marschak*: Two fold definition of economics; (1) optimization (rational behaviour); (2) dealing with material goods rather than with other fields of decisions.
>
> *Boulding*: Yes. The two don't have anything to do with each other. It is the material goods that characterize economics. To state that the recent increase in American money wages was due to the increase of quantity of circulation has nothing to do with rational behaviour.
>
> *Marschak*: It has. This was stated already by David Hume who speculated on what will people do if everyone finds overnight that his cash balance has doubled. (Proceedings of the Chicago Ford Conference, 1 December 1952, box 99)[9]

Reflecting on the links between economics and the behavioral sciences meant providing clear boundaries between them and thus defining the subject matter of economics. Marschak's unusually long response to Carroll consisted of a four-page definition of economics as "the science of optimizing." Economics extends far beyond the realm of material goods, he reflected, and is rather characterized by its peculiar concern with "rational behaviour" (which he also called the "principle of consistent choices"): "The distinctive contribution of the economist consists in asking: how would the buyers, sellers, bankers, stockholders, workers, farmers behave if they consistently made choices that are the best from their own point of view?"[10] This principle was also the basis of the economic theory of organization Marschak was engrossed in from the 1950s onward: "My thinking habits as an economist . . . start with the assumption of a consistent,

9. According to Roger Backhouse and Steve Medema (2009), there were two transitions under way in the 1950s: a transition to the scarcity definition of economics along the lines of Robbins 1932 and the transition to the rational choice definition. In the early 1950s, they still coexisted with the wealth definition, so that it is very difficult to know whose definition best reflected the opinion of the audience at large.

10. Marschak to Carroll, 5 August 1952, box 99. This definition mirrored the redirection of the Cowles Commission's research program from structural estimation to rational decision making under uncertainty (see the Cowles reports beginning with no. 48, in particular Cowles Report 50–51 titled "Rational Decision Making and Economic Behaviour"). This picture of economic actors characteristic of Marschak and his Cowles colleagues—rational, in a situation of uncertainty, with choices to make—also illustrates the importance of the Cold War and of the military (the main source of funds in the postwar period) in shaping economic hypotheses and methods (see Klein 2007).

decision-guiding goal (utility), in the light of which the 'efficiency' of an organizational form is judged" (Marschak to Tyler, 1 February 1955, "What Do I Expect for the Fellowship Year 1955–56," box 176).

"Since both efficiency and rationality are normative concepts," economics is inherently and primarily a normative science, as Marschak insisted in every application or report he drafted, in straightforward opposition to the picture of economics Milton Friedman (1953) was promoting at the same time (see, for instance, "A Dummy Application," 1953, box 99).[11] He was of course aware that the rationality assumption does not accurately describe actual behavior, but considered that it was up to the other behavioral sciences to develop a theory that accurately describes actual behavior (to the extent that one is developed at all); economics, on the other hand, should confine itself to the rationality assumption.[12] Although normative, economics was nevertheless relevant to empirical explanation, description, and prediction, Marschak added. When efficiency is defined as "survival," for instance, the study of existing firms amounts to the examination of those who have been successful in maximizing their chances of survival in a given environment, that is, of the optimal survival behavior (Marschak to Tyler, 1 February 1955, box 176).

2. Mathematics, Empirical Testing, and Interdisciplinarity as the Proper Scientific Method

In his 1952 response to Carroll on economics and the behavioral sciences, Marschak stated clearly what he believed was the right scientific method of inquiry:

11. Marschak was, however, not concerned with welfare economics per se, that is, his goal was not to define a criterion toward which economic agents or economists themselves should strive, such as the maximization of a social welfare function. Whether the goal of an economic agent was the maximization of expected utility, of welfare, or of profit, or, in the case of firms, survival, Marschak considered such a goal as given. The task of the economist, he argued, was rather to find the best way to achieve such a goal given the environmental and technical constraints of a situation. This kind of research he labeled "prescriptive" rather than "normative" (see "ONR Proposal," 1960–61, box 126). The quotation at the beginning of the paragraph is from "A Dummy Application."

12. "I also agree that to identify 'economic' with 'rational' narrows down the field to an extent that realistic economics becomes almost impossible. . . . To construct a rational man acting under conditions of uncertainty, would mean to make the man not only a 'homo economicus' but also a 'homo statisticus'; he would have to be supposed to make rational decisions based on incomplete information, as it is being done by sampling statisticians," he wrote Karl Polanyi (letter dated 13 March 1947, box 94).

> I should like to add that much of the "semantic difficulties involved in communicating and understanding" . . . would be overcome if one would accept modern scientific methods as a common basis. Fruitless discussions on whether one terminology is better than another, and whether any prediction of behaviour is at all possible ("all men are different," "life is complicated," "history never repeats itself") cease automatically as soon as people proceed to work together in setting up a model (a hypothesis) and in designing an empirical test of it, by experiment or otherwise.
>
> Also in connection with semantic difficulties and the marriage of methods, the role of mathematics (including statistics or logic) has proved to be a very useful one, in providing a neutral and unambiguous language. (Marschak to Carroll, 5 August 1952, box 99)

Of the major steps he mentioned in the above quotation—modeling, empirical testing, and the use of mathematical language—the last one can be considered as the most enduring and unifying feature of Marschak's contributions to economics, ever since his 1931 work on the elasticity of demand had been praised for its high technical qualities.[13] The advantages of the mathematical language were manifold, he kept insisting: among them were the focus on the essential features of various empirical situations in order to draw generalizations (Marschak 1946, 114; 1947b, 270) and the possibility of dealing with uncontrolled historical data—unavoidable in the social sciences—and the statistical problems resulting from the stochastic character of economic relations (Marschak to Carroll, 5 August 1952, box 99). But most important, it enabled the economist to rid his assumptions of the "ambiguity" that might protect his conclusions against a confrontation with reality, as in the case of the theory of unemployment or the "JM Keynes vs JB Say" controversy (Marschak 1947b, 269; "Memorandum to the Rockefeller Foundation," 1950, box 154). It also safeguarded against the "subconscious smuggling-in of undefined terms and operations or of assertions that have not been proved" by detaching the "intuitive" considerations of the scientist from experience until the final conclusions are reached, as he enthusiastically noted in his review of von

13. In 1933, Schumpeter considered Marschak as "probably the most gifted scientific economist of the exact quantitative type now in Germany" (Hagemann 2006, 597). After the 1933 meeting of the Econometric Society, Henry Schultz noted in his diary a few "general impressions": "the quickness of apperception of J. Marschak. . . . he 'ate up' the lectures on linear transformations and quadratic forms. . . . he is a first class mind" (diary of Henry Schultz, box 88).

Neumann and Morgenstern's *Theory of Games*, his model of "good science" (Marschak 1946, 114–15).[14] It finally helped the fight against the "preconceived ideas affected by emotional preference, as in the case of the role of wage rigidity, monopolies, income distribution, and public spending," ideas that Marschak thought endangered the economist's freedom from value-laden analyses (Epstein 1987, 64–65).[15] By "neutral" and "unambiguous," Marschak thus not only meant un*political* but also un*emotional*. This set of quotations also highlights that he viewed mathematics not only as a research tool, but also as a *communication* device, one that had proved useful for an emigrant such as he who had had to confront and learn many new languages. In 1934, upon publication of a paper on the elasticity of demand intended as a mediation between Ragnar Frisch and Wassily Leontief, he was already confessing to Frank Taussig, the editor of the *Quarterly Journal of Economics*, that he felt unable to make himself "fully comprehensible" without using mathematical symbols.[16]

Marschak did not see the high degree of abstraction needed to apply mathematical methods as a threat to the concrete usefulness of economic science. On the contrary, he wrote to the mathematician David Blackwell that he was "utterly convinced that in our times mathematics can contrib-

14. This axiomatic method praised by Marschak was far from being accepted in the early 1950s, as illustrated by the heavy discussions between economists and the Ford official in charge of the behavioral science division, Bernard Berelson. During several 1952 meetings, Marschak joined mathematical psychologist Clyde Coombs, algebraist Robert Thrall, and other members of the Michigan seminar in defending work in applied mathematics against Berelson's suspicion that form was favored over content and the resulting work was sterile (Marschak to Koopmans, 10 August 1952, box 99). He similarly defended Gary Becker's *Human Capital* against George Katona's critique of the use of formalism and algebra in the book. He retorted that Becker had held mathematics to the minimum amount necessary for the explication of some ideas, where purely verbal expressions lead easily to confusion. "[Becker] had to use some elementary formulas of investment theory ('sum of discounted values of future earnings')," he pointed out. "Try to relate them to the reasoning inherent in the theory of economic equilibrium, wage theory, etc. ('no employer would pay a wage rate exceeding the marginal product')," he continued, "and you will soon see that your English becomes more and more involved and clumsy (hardly less involved than the proverbial lawyers' jargon) and less and less convincing" (Marschak to the selection committee, Woytinsky award, 23 June 1965, folder "Woytinsky," box 94).

15. Note that the list of subjects affected by emotional preferences reflects the debates he participated in as a politically engaged German economist. Marschak often warned against articles or books driven by "emotions" in his private correspondence (see, for instance, Marschak to Schwartz, 5 April 1943, box 101, folder "Management in Russia"), and upon several occasions he warned that "because of the emotional element which the public inevitably brings into this discussion, we all should state our propositions as clearly and coldly as possible" (Marschak to Michael Polanyi, 8 February 1945, box 94).

16. Marschak to Taussig, October 1934, box 154.

ute to practical problems of society as much as the 17th century mathematics then contributed to the knowledge of nature" (Marschak to Blackwell, 19 June 1946, box 97). "Usefulness is consistent with a high degree of abstraction," he explained to Rockefeller officials in 1950 in response to the criticisms leveled against the structural estimation method at the 1949 Conference on Business Cycles. He gave as a first example the "highly abstract theory of games" and underlined its application in quality control by firms and military strategies. An avid and regular reader of journals such as *Fortune* and *Time*, he meticulously gathered case studies in folders labeled "game theory" and "team theory" according to their relevance for his theoretical work: "non zero sum game," he would write in the margin of an article on the geographical location of the 1956 Democratic and Republican conventions.[17] Among the direct applications he saw for economic theory were also the optimal choice of weapons systems and optimal schemes for the nation's industry. He emphasized the practical importance of organization and information theory and of statistical economics for the military, as well as for large firms such as the Electricité de France (Marschak to Carroll, 5 August 1952, box 99). That Marschak's research programs, at the Cowles Commission as at UCLA, were mainly funded by military organizations certainly much influenced his opinion that mathematical economics has direct practical relevance.[18] In his 1950 memorandum to the Rockefeller Foundation, he remarked that for the projects sponsored by the military or business firms, "the solution . . . should be expressible in terms of man-hours and ton-miles, of specified geographi-

17. If Marschak found illustrations of economic theories in newspaper articles, it was also because some journalists explicitly used such a framework. In the late 1940s, *Fortune* journalist John McDonald, who was working on poker, was advised by John Kenneth Galbraith to read von Neumann and Morgenstern. He subsequently made a reputation by writing about company strategy, such as that of General Motors, through the lens of game theory (McDonald 1980, 106; I am grateful to Tiago Mata for this reference). Marschak would even occasionally send to colleagues a newspaper article he found puzzling, such as "How to Be Efficient with Fewer Violins," a 1955 article dealing with the reorganization of an orchestra that he distributed with a note that read, "Exactly where is the catch? If you have an opinion, please write to J Marschak" (box 140).

18. The Cowles Commission worked in close association with RAND, which was funded by the military, during the 1950s. Marschak and Koopmans tried to substitute "peace" for "military" funds by applying for Ford Foundation grants (Marschak was a convinced pacifist; see Craver and Leijonhufvud 1987), but failed to secure a constant flow of money (box 99, folder "Ford Foundation," folder "Cowles and Koopmans"). Marschak's UCLA studies in decision making and organization were funded by the Office of Naval Research (boxes 125 and 126).

cal locations and concrete industrial processes. Yet all this presupposes highly abstract work." Based on several studies including Marschak's work with Arrow and Theodore Harris's "Optimal Inventory Policy" (Arrow, Harris, and Marschak 1951) for the Office of Naval Research (ONR), Judy Klein (2007, 41–42) concluded that, among the characteristics of economic science shaped by the Cold War, an important one was the fast applicability of theories and the formulation of results in terms of concrete rules of actions.

Another reason why Marschak (1946, 115) viewed highly mathematical theory as necessarily relevant for practical purposes is that it would always eventually "be translated into the language of the concrete field . . . [and] thus [be] prepared for [an] empirical test," which he believed was the inescapable second stage of a proper scientific method. From the beginning of his career, Marschak had systematically pursued theoretical and empirical investigations at the same time, as shown by the structure of his 1931 elasticity study—"theoretical part/ statistical part/critique"—but what he meant by "testing" nevertheless evolved over the years. From his years in Germany to the structural estimation project at Cowles, Marschak believed that progress in the empirical stage would come from the improvement of the quality of data and data analysis techniques. The former included time series and data derived through sector analyses (such as his own work on the coal and cigarette industries in the 1920s and on the demand for meat and housing with George Garvy). The latter included the statistical techniques used to confront data with theoretical hypotheses. With the reorientation of the Cowles program toward decision making under uncertainty, however, Marschak began to contemplate controlled experiments as a way of testing his theories. At first, however, he was unwilling to collaborate with those performing such experiments, such as psychologists. In 1951, he commented to Koopmans that "appointments jointly with psychology might be considered, provided they do not force upon us more participation in empirical work than we are, at this time, willing to perform. (I should not, however, express too strongly our 'anti-empirical' bias)." "Communication with (and among) sociologists and psychologists is highly impeded by their poor 'language habits,'" he added in reference to their lack of mathematical knowledge (Marschak to Koopmans, 21 August 1951, box 99). In the same vein, he also explained to Bernard Berelson from the Ford Foundation that he had read standard books on behavioral psychology, by Clark Hull, James Dillard, and George Miller,

and that he found them "very clumsy, vague and tiresome" (Marschak to Koopmans, 10 August 1952, box 99).

His position toward other sciences, psychology in particular, was nevertheless about to change radically. During the early 1950s, he got in touch with other social scientists with a strong mathematical background such as UCLA numerical analyst Charles Tompkins and MIT psychologist Alex Bavelas, who in turn introduced him to MIT experimental mathematician Duncan Luce. His 1955–56 visit to the Center for Advanced Study in the Behavioral Sciences (CASBS), the interdisciplinary research center established by the Ford Foundation to encourage interdisciplinary work in the social sciences, completed his change of mind. He had come there with the hope of improving the theory of teams he was working on with the young mathematical statistician Roy Radner by being introduced to the knowledge of the communication process of neurophysicists and engineers, the theories of organization developed by those in business administration and political scientists, and the analysis of survival of biologists and anthropologists (Marschak to Tyler, 1 February 1955, box 176). In his own words, he left the center "cured of [his] previous parochialism," thanks to his encounter with scaling techniques, the psychometric probabilistic theory of human behavior, the logic of biological evolution, and the methods of psychological experiments. In subsequent years, Marschak conducted even more experiments of his stochastic decision theory, with the help of scientists such as the philosopher Donald Davidson, the mathematician H. D. Block (who specialized in brain models), and the statistician M. DeGroot (see Marschak and Davidson 1959; Marschak and Block 1960; and Marschak, Becker, and DeGroot 1963).

As shown by his recruitment by the Department of Management at UCLA, Marschak thus gradually turned into a "behavioural scientist" (Radner 1984), and economists began to wonder whether he had not actually left economics for other disciplines, such as psychology or information science (McGuire and Radner [1972] 1986, viii). Marschak's interdisciplinary bent, however, was not a new departure. In Russia, he had studied literature and mathematics and had attended successively a school of commerce and a technology institute in Kiev (Marschak 1971). Both the University of Heidelberg and the Kiel Institute exhibited a strong interdisciplinary tradition (Hagemann 2005, 7). The numerous quotations from philosophers, sociologists, writers, and others found in Marschak's professional archives also show how much his economic work was nurtured by

forays into other sciences.[19] But his advocacy of interdisciplinary work demonstrated by his move to UCLA was also closely tied to the characteristics of his scientific vision previously developed. His response to Carroll, his interventions at the Chicago conference headed by Carroll following his survey, his applications to the CASBS, and all his subsequent research projects, in particular those addressed to the ONR, all display a careful distinction between what he could bring to the projects as an economist focusing on rational behavior and the perspectives of psychologists, engineers, and others. He urged that a mathematician be systematically integrated into every research team so that hypotheses would be formulated in a language everyone could understand and discuss unambiguously.

Marschak's definition of the subject matter of economics and of the proper methodology was thus built from his scientific practice. But they are also closely related to his private experience as an émigré witnessing the outbreak of a world war.

3. Uncertainty and the Stochastic Character of Economics

For Marschak, economics was not merely about rational behavior. It was about rational behavior *under uncertainty*, and this emphasis on uncertainty as the main characteristic of the social environment can be seen as a product of his personal history. As Arrow (1978, xii) pointed out,

> It is perhaps then not entirely surprising that Marschak's sense of the uncertainties with which the world abounds should translate itself into a scholarly interest in decision making under uncertainty and the problems of communication and information. As befits an information theorist, Marschak's scientific behaviour depended not only on the shape of his utility function but also on observations on the external world.

19. In Heidelberg, Marschak had studied with Karl Jaspers in philosophy and Alfred Weber in sociology. His early articles display his mastery of Max Weber's philosophy of science (see Marschak 1923, first note). Also, his joint work with his former PhD adviser Emil Lederer dated 1926 and translated in 1937 as "The New Middle Class" would be considered a piece of sociology by today's standards. This background explains why, contrary to what his insistence on mathematics suggests, Marschak was willing to collaborate with social scientists as well as with those working in the hard sciences. "It is my impression . . . that there is . . . a growing interest in borderline problems (involving other social sciences, history, and law in addition to biology, mathematics, logic, and engineering)," he wrote Berelson after his stay at the CASBS.

By the time he arrived in New York in 1939, Marschak indeed had already experienced in a significant way the uncertainty undermining human life: he had suffered pogroms against Ukrainian Jews in his childhood, spent a few months in prison at age seventeen for his pacifist beliefs, escaped Bolsheviks and wandered in the Caucasus Mountains during the 1917 revolution, emigrated against his will three times in ten years, and witnessed the rise of Nazism, a severe economic depression, and the outbreak of a second world war. Accordingly, he had emphasized the consequences of uncertainty on the modeling of economic behavior as early as in his thesis on the Marxist transformation equation (Marschak 1924). And his 1938 forerunner work with Helen Makower explaining the demand for liquidity assets by uncertainty, while certainly influenced by Keynes, was also rooted in his personal experience of inflation as minister of labor in the short-lived republic of Caucasus in 1918 (Marschak 1971, 48–49).

Surely there is nothing original in the connection between Marschak's life and his focus on uncertainty. Wedding uncertainty to social behavior was something many European scientists were working on after Knight had published *Risk, Uncertainty, and Profit* in 1921. The impact of emigration on some economists' thinking has been documented (see Fontaine 2010 on John Harsanyi). More specifically, Robert Leonard (1995, 2006) has exhaustively described the ties between the interwar European intellectual atmosphere von Neumann and Morgenstern were living in, their emigration, and their formalization of behavior under uncertainty as games.[20] This literature, however, shows that a great diversity of personal and theoretical responses lay behind this common interest in uncertainty. Marschak, for instance, became obsessed with questions such as "Does history repeat itself?" or "Was Hitler inevitable?" which had a direct bearing on his work as an economist and an econometrician and caught him in a dilemma. On the one hand, he acknowledged that "[econometric functions] have a value as forecasting instruments only insofar—yes, in so far as history *does* repeat itself" (Marschak [1936] 1974, 170). Or, if not repetition, there had to be "invariant features" or "trends" for the econometrician to practice his science (undated manuscript, probably 1933–34, box 144). On the other hand, part of Hitler's propaganda was precisely his

20. While Marschak probably met von Neumann in mathematical courses at the University of Berlin in the early 1920s, there is no evidence that he became interested in von Neumann's treatment of uncertainty before he enthusiastically read and reviewed the *Theory of Games* in 1946.

claim to be "*zwangsläufig*" (inevitable) and to have determined "mankind's destiny for the next thousand years." Claiming that "Hitler was not inevitable in 1932–1933," as Marschak did in the draft of a 1941 New School lecture on uncertainty and the social sciences, implied a refusal, or at least a qualification, of his economic habit to look for trends. "Perhaps one of the worst curses we have inherited from the optimistic nineteenth century is the mystic belief in 'trends,' the pseudo-science of the inevitable. It is logically worthless," he wrote in a 1940 paper dealing with peace and the rise of Nazism (Marschak 1940, 280). The draft of his 1941 seminar catches his search for a third way in between "two opposite attitudes rejected (1) 'you cannot learn from history' (2) 'the wave of tomorrow is inevitable'" (10 August 1941, box 87). Marschak sensed that his preoccupations were shared by a great part of the profession. In his 1941 account of a conference dedicated to Frederick C. Mills's 1927 book *The Behavior of Prices*, he pointed out that the main issue addressed was that of "causal vs. stochastic" (442) or "mechanical relationships vs. concepts of probability" (443). Whether "any economic regularities . . . have ever been empirically observed as valid for a long period of time" (447) was the issue dividing the audience. Marschak's solution to "the scarcity of systematic relations, the presence of potent disturbances" (448), was already clear at the time: a "stochastical attitude" that "[gave] up the quest for systematic relations . . . but not the quest for the accumulated result of 'thousand forces'" (448), and that used probability distributions to represent economic relationships. Modeling the economic system with probabilistic distributions, with structural relationships described as a system of simultaneous behavioral equations abiding by the maximization principles, and estimating them with statistical methods outlined by Trygve Haavelmo among others soon became the hallmark of the Cowles Commission.

Marschak's ontological vision of the role of probabilities in economics thus challenged Claude Menard's ([1987] 1989) argument that the use of probabilities following Haavelmo 1944 was mainly instrumental because economists remained sharply influenced by classical mechanics (see for instance Mirowski's [2002] depiction of Koopmans).[21] He studied probabilities not only through his technical reading of Tintner, Wald, Haavelmo,

21. With respect to the influence of classical mechanics, Marschak (1946, 115) explicitly mentioned in his review of the *Theory of Games* that borrowing tools from physics had often proved illegitimate and sterile, praising the axiomatic choice of von Neumann and Morgenstern instead.

and others, but retained ideas from Laplace, Pascal, Bachelier, and even Voltaire, Proust, Henry James, and Churchill. He obsessively collected those sentences of theirs that linked probabilities with the human condition in a "probs" folder. He completed it with newspaper excerpts dealing with war, management, politics, horse racing, medical diagnoses, police inquiries, and everyday life, whose sentences containing the word *probability* he underlined and captioned "subjective probs," "inductive reasoning," and so forth (these folders are scattered among boxes 87, 89, 90, and 103). The draft of his 1941 New School lecture on uncertainty reveals that, for Marschak, the use of a probabilistic framework was warranted both by the consequence of uncertainty on agents' decisions and by its effects on the economists' efforts to identify stable causal relationships and to predict future evolutions. Marschak would tirelessly propagandize his stochastic representation of the economic world, first in the search for economic structural relations at Cowles (Marschak 1947b, 1950c, 1953), and then through the development of a stochastic decision theory by relaxing some hypotheses such as transitivity so that an agent's choice is less deterministic but still rational (see Radner 1984 for an exposition).

The pervasiveness of uncertainty in social life deeply shaped Marschak's perception of the way economists should model economic behaviors and structures and their econometric methods. More fundamentally, it also affected his vision of the role of the economist in society.

4. The Role of the Economist in Society: "Social Engineer" rather than "Prophet"

Marschak (1941, 448) concluded his aforementioned report of the debates surrounding Mills's book with a personal claim:

> This main difficulty—the scarcity of systematic relations, the presence of potent disturbances—must shape our aims. What can be the use of economic research? Because . . . the criterion of usefulness was ever present in the mind of the appraisers. Did this mean useful for predictions? Useful for inventions? I hope it meant the latter. I hope we can become "social engineers." . . . I don't believe we are much good as prophets.

Thus, ahead of time, he opposed the popular view spread by Friedman's 1953 article that economic research needs to be judged by its ability to

predict.[22] This does not mean that he believed prediction was impossible. He indeed hammered out in the 1947 Cowles report that the goal of the structural estimation method *is* prediction. But his idiosyncratic definition of prediction indicates that this goal was subordinated to a higher one: "To predict is, in general, to estimate for given conditions and for a given probability level, a probable range of the results of a given policy. This range is wide if the observations are few or subject to large errors, or if structural relations are subject to large random disturbances" (Marschak 1947a, 81). The first item in the first section of the report was very explicit in this regard: "Knowledge is called useful if it helps to choose the *best policy*" (81).

Marschak's lifelong desire to improve welfare reflected a genuine humanitarianism (see the obituaries listed in the introduction), one displayed in the energy he devoted to helping the various organizations supporting displaced Jews in England during the 1930s or the victims of the Russian totalitarian regime after the war (see boxes 142 and 145 in the Marschak Papers). His plan to improve human welfare was to make individual, organizational, and governmental behavior more "rational," and he accordingly titled the schedule he outlined for his Cowles directorship "Statistical Foundations of Rational Economic Policy" (Epstein 1987, 61). In his mind, an economic behavior was rational if it met the rules of statistical induction and expected utility maximization, whether individual or social.[23] A 1946 letter to statistician Abraham Wald perfectly summarized the close relationships he saw between the technical, policy, and ethical goals of economic science: "Good statistical foundations are needed to make economics a science; scientific economics is needed to get good economic policy; and the potential leverage of economic policy for the

22. He repeatedly did so. "As far as applied thinking is concerned, my own thinking works in the direction of changing or affecting things, not of forecasting them," he characteristically wrote Karl Polanyi in 1943 (letter dated 7 July 1943, folder "Polanyi," box 94). At first he did not target Friedman's proponents but rather some advocates of planning, as he explained in his very favorable review of Friedrich Hayek's *Road to Serfdom*: "Those who love planning because they love the inevitable will, perhaps, after reading Hayek either revise their faith or their taste. Perhaps they will start to think in terms of ends and means instead of in prophecies" ("Report on the Road to Serfdom," 1943, box 91).

23. Mirowski's (2002, 275) claim that Marschak and Koopmans's purpose was to preserve Walrasian general equilibrium and maximization by modeling economic agents as statistical information processors, that is, on the model of the econometrician, should therefore be qualified. Marschak's purpose in that respect was normative rather than descriptive.

welfare of men may be enormous—at present probably larger than that of, say, physics which seems to contribute as much or more evil than good" (Marschak to Wald, 4 January 1946, box 96).

This "rationalist" approach, as Marschak himself called it, was an enduring feature of his worldview, but his understanding of how it should be translated in his research in practice underwent significant changes over the years.[24] In the interwar period, Marschak's approach to policy essentially developed from his practical experience of policy making rather than from his scientific vision, and, as a result, it was heavily tied to the Marxist and socialist intellectual environment of Russia and Germany. Marschak had already encountered policy issues at age nineteen when, as a Caucasian labor minister, he was in charge of reallocating the workforce between plants in the middle of the 1918 civil war (Marschak 1971, 47–49). He subsequently participated in the German *Sozializierungskommission* designed to supervise military demobilization and the return to a peace economy after World War I as assistant to Emil Lederer.[25] Under the influence of the German trade unionist economist and close friend W. S. Woytinsky, Marschak also early in his career advocated credit-financed public works.[26] His emigration to Oxford in 1933, however, created a sharp break from the mix of scientific analysis and political commitment he had hitherto performed, since it resulted in "an increasing abstinence from political activities and a withdrawal from his role as an advisor in economic policy."[27] "I still think it is important that we strive always to keep value judgments separate from our work. We might not be able fully to achieve it," he added, "but *Wertfreiheit* remains an ideal," he later told his UCLA

24. Letter to Bertrand de Jouvenel, 5 July 1958, box 92.

25. With the exception of Joseph Schumpeter, the commission was exclusively comprised of socialist economists, who favored planning. The material found in the Jacob Marschak Papers is difficult to interpret. Box 158 contains a huge file dealing with the commission's activities, including letters from and to Karl Wilbrandt, its director, and many drafts, such as "Skeleton Reflection on the Communalisation of Business Sectors," "The Army Economy in the Context of the National Economy," and "Reflexion over the Organizational Transformation in the Management of War to Allow a Uniform Utilisation of Money." These reports are, however, unsigned, so it is impossible to identify Marschak's possible contribution.

26. On Woytinsky's influence on German economic and political thinking, see Garvy 1975.

27. See the interview of Marschak's mentor Lowe by Hagemann in 1987, quoted in Hagemann 1997, 241. In Germany Marschak worked for two years as a journalist for the liberal *Frankfurter Zeitung* and produced sectorial empirical work for German trade unions. He was a member of the Socialist Association for Economic and Social Research (box 144), an adviser to the parliamentary group of the Social Democrats in the Reichstag (box 109), and was an active member of the economic wing of the International Brotherhood for Peace and Freedom (box 143).

colleague Axel Leijonhufvud (Craver and Leijonhufvud 1987, 181).[28] Just like the use of mathematical language mentioned in previous sections, such a rule of conduct was intended to free the debates over wages, monopolies, income distribution, and more largely macroeconomic policy from the "emotional preconceptions" he had encountered on the German scene. Notions of "planning" nevertheless continued to infuse his scientific practice: the Continental tradition Marschak had brought with him to the United States in 1939 was perfectly in line with the needs for statistics and rational organization created by the New Deal, the war effort, and the associated rise of bureaucratic systems (see Stapleford 2009). Marschak's growing concern with stabilization issues was also in accordance with the postwar demand for macroeconomic planning (described in Balisciano 1998). As explained by Roy Epstein (1987, chaps. 2–3), he optimistically embraced the econometric foundations laid by Jan Tinbergen, Trygve Haavelmo, Henry B. Mann, and Abraham Wald and embedded them in a wider intellectual framework pervaded by his planning concerns.[29] Not only was the very notion of "structure" reminiscent of the German Marxist and socialist milieu in which he was immersed in the 1920s, in particular at the Kiel Institute, but the procedure entailed that the set of structural equations estimated was to be combined with a maximized social welfare function, so that the policy maker would know which variables of the equations he could control to attain a social optimum.[30] The specification-identification-estimation-testing procedure was thus designed with the very purpose of facilitating comprehensive government intervention, which explains the requirements that the structural models be exhaustive and that the exogenous variables be clearly identified.[31] Marschak, however, did not envision this Cowles framework as reflective of any political agenda. If he supported planning, he thought, it was because of

28. He kept his word with remarkable rigor, not only refraining from any public political statement until his death, but also eschewing political discussions in his private correspondence and regularly faulting one manuscript or another for being too "emotional."

29. This state of affairs reflects the influence of Koopmans and Klein as much as that of Marschak. The collective social engineering utopia is emphasized in Epstein 1987, introduction, 60–85.

30. Beckmann 2000 explains how Adolph Lowe's vision of business cycles was initially tied to Rosa Luxemburg's, and explains how the Kiel Institute's research already embodied the idea of the social market economy, an idea that would spread throughout Europe and the United States.

31. Such a procedure can be compared with the econometrics Milton Friedman developed at the same period, comprised of single-equation models, an ambiguous definition of the exogeneity of money (see Hammond 1996), and his ultimate distrust of state intervention.

the numerous scientific proofs of its efficiency that had been developed in the past decades. Although his participation in the socialist calculation debate was restricted to his response to von Mises, he nevertheless closely followed its development. In a reference letter for Abba Lerner in 1946, he argued that "a revolution has occurred in economics in the last decade. . . . the revolution consisted . . . in our revising . . . [among other things] the ultimate criteria of social welfare and the techniques of attaining it: [the] so-called theory of . . . planning." This enhancement of the "theory of planning" he attributed to the work of Lerner and Oskar Lange, with whom he had collaborated (see Lange 1944; Lerner 1944; and Marschak to Ed Shils, 11 April 1946, box 93).[32]

By the end of the 1940s, however, planning had become less fashionable (Balisciano 1998, 171–75), and the Cowles models were increasingly challenged (Epstein 1987, chap. 4). As head of Cowles, Marschak received critical letters from Joseph Schumpeter on the use of aggregate difference equations and Irving Fisher on money behavior and on the treatment of expectations in structural equations, and the various talk of Cowles researchers was met with skepticism. He was thus painfully aware of the lack of economic knowledge on the structure they proposed to estimate, and having maintained an interest in theoretical economics through his work on money and uncertainty and his 1946 review of von Neumann and Morgenstern's theory of utility and his subsequent axiomatization of choice under uncertainty (Marschak 1950a), he could fully participate in the theoretical redirection of the Cowles program that Koopmans, his successor as Cowles research director, initiated at the end of the 1940s. As seen in previous sections, such an evolution entailed a gradual move toward a "rational behavior" definition of economics, with the consequence that Marschak came to envision planning as rationalizing economic agency (individual, governmental, industrial, or commercial) by routinely using a set of technologies on a case-by-case basis. From planner, Marschak became an "engineer," a metaphor that had spread among economists from the 1950s on (Morgan 2001). For instance, he character-

32. Also, he did not feel that he held a partisan view of social organization because he did not systematically favor planning over free markets. In a 1945 written dispute with Karl Polanyi for instance, he argued that "there is no disagreement that a social optimum . . . will be reached if both the consumers and the hired factors of production were left free to maximize their satisfaction." In line with his earlier reply to von Mises, he noted that since neither perfect competition nor perfect foresight were fulfilled in practice, letting individual managers maximize their profit freely would not bring an optimum (Marschak to Polanyi, 2 August 1945, box 94).

istically wrote to a Princeton colleague that he hoped "to hammer into the economists' minds the notion . . . that 'rational behaviour' is something that can be learned by practitioners, and that in many cases (as in the case of superfluous inventories) this learning by practitioners is in the public interest" (Marschak to T. M. Whitin, undated [probably 1950s], box 156).

Even during this late period, however, the picture of the economy underlying such an evolution nevertheless remained stable throughout Marschak's career; until his death he consistently believed—as a scientific truth—that "if one could disregard organizational costs . . . a 'centralized' system, that is one in which every action is based on complete information, would be optimal," as he later explained in 1961. The advantages of decentralization derived from costs of observation, communication, and decision making in a given environment. Choosing the optimal organization in each practical case thus amounted to performing a scientific calculus, he concluded ("ONR Proposal," 1961, box 126). Nor was the normative character of economics a danger to the scientist's value neutrality, Marschak claimed. Defining the goal or decision criterion as maximizing expected utility or the chances of survival did not convey any value judgment in his mind. The decision criteria Marschak had to work on were actually given by those who financed his studies, such as the ONR or big firms, so he felt immune from value judgments.

5. Conclusion

The coincidence between the running threads of Marschak's intellectual development and the postwar developments of economic science—the policy orientation, the mathematization, and the probabilistic revolution, as well as the redefinition of the subject matter of economics as "rational choice theory" and the recent interdisciplinary turn (Backhouse 2008)—explains why Marschak could so easily be seen as representing the direction in which economics was going. Marschak's willingness to remain value-neutral notwithstanding, the socialist inspiration of his structural estimation program and of his work in information and organization theory has been emphasized in the rare narratives dedicated to him (see, for instance, Epstein 1987, 59–61; and Mirowski 2002, 232–49). A comparison of Marschak's writings with those of Chicago colleague and architect of neoliberalism Milton Friedman shows how diametrically opposed their historical and social perspectives were. While Friedman (1962) explained how the functioning of free markets characteristic of the nineteenth

century had been gradually hindered by the sprawl of the state, Marschak (1940, 284–85) started at the other end of the spectrum. Raised in a country that was embracing communism, he rather envisioned a completely centralized and totalitarian economy, only to warn that the reader try "not to be too fascinated by the totalitarian slogan of 'planning'" because socialist economists have recently "found that a free market for consumer goods, and even for labor, is probably the safest guarantee for the best allocation of national resources." Marschak's scientific practice was not merely the result of technical and conceptual progress or professional encounters, but originated in a deep reflection on the dynamics of human history, the nature of modern society, and the role of the scientist in it. His scientific vision was eventually deeply informed by his own history and his private beliefs, ethical, political, and otherwise—in a word, by his worldview.

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