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Leonid Hurwicz (1917-2008): A Tribute

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On 24 June, 2008, Leonid Hurwicz, Regents' Professor of Economics, University of Minnesota, passed away in Minneapolis at the age of ninety one. When The Bank of Sweden Nobel Memorial Prize in Economics was awarded to him in October 2007, he was the oldest person to receive the prize in economics, possibly the oldest recipient in any subject in the history of the prize. Unable to attend the ceremony in Stockholm, Leo received the prize from the Swedish ambassador to the USA at a special convocation held on the campus of the University of Minnesota. He was accompanied by Evelyn, his spouse of six decades, and other members of his family.

It remains a mystery why the Nobel Committee was so late in honouring him, because without question Leo Hurwicz was one of the towering figures of modern economic theory. I distinctly remember the disappointment and sense of injustice that assailed us every year during my years (1979-1983) of graduate study there. 'We demand the prize for Leo' once covered the blackboard of the coffee lounge in bold capitals! The great man must have seen it, but his reaction is not recorded. Perhaps he had gotten used to the collective disappointment. Interestingly, Kenneth Arrow, with whom he

had collaborated extensively in the 1950s on problems of mathematical programming, became the youngest person in economics to receive the prize in 1972. Leo was the graduate advisor to Daniel McFadden who won the prize in 2000. In this connection one is reminded of Subramaniam Chandrasekhar, the Indian-born physicist, who also was remembered rather late by the Committee. There is a story that after winning the prize himself one of his former graduate students commented on the mystery of the master being overlooked year after year. Chandra is said to have responded, 'I have long ceased to bother about what a group of people do in Stockholm at a particular time of the year. I place my faith in posterity which does not remember all Nobel laureates.' Not all institutions shared the Committee's tardiness, though. Leo Hurwicz was the recipient of six honorary doctorates: Northwestern University(1980), University of Chicago (1993), Autonomous University of Barcelona (1989), Keio University (1993), Warsaw School of Economics (1994) and University of Bielefeld (2004). Numerous universities and institutes in the USA and elsewhere have been privileged to have him as visiting professor. These include Bangalore University (1965), Tokyo University, People's University (now Renmin University of China) and the University of Indonesia. Prof Hurwicz was known for his ready willingness to accept invitations from even remote places because he had an eager interest in mankind in all its variety and diversity.

First I will give a brief account of his extraordinary life, then give my personal reminiscences and conclude with an appreciation of his signal contributions. I shall, for obvious reasons, restrict myself to a brief overview of the major contributions.

Life

Leonid Hurwicz was born in Moscow to a Jewish family a few months

before the October Revolution. The family was Polish but had been displaced by the First World War. Soon after Leo's birth they moved back to Warsaw, but became uprooted when Germany invaded Poland. Leo moved to Switzerland and Portugal and finally emigrated to the USA in 1940. His first exposure to economics had happened when, encouraged by his father, he was studying for the degree of LL.M from the University of Warsaw. After that he studied at the LSE with Kaldor and Hayek. In 1939 he moved to the Institute of International Studies in Geneva and attended the seminar of Ludwig von Mises. After moving to the USA he continued his studies at Harvard University and the University of Chicago. In 1941 he worked at MIT as research assistant to Paul Samuelson. In 'Robert Solow: an Affectionate Portrait' Samuelson wrote, 'Hardy summed up his scholarly worth with the assertion, 'I collaborated with Littlewood.' When I meet up with St. Peter in Heaven it will be my boast, 'I collaborated with Bob Solow.' Surely Samuelson would not mind if we take the liberty of expanding the last sentence by adding, 'and once had Leo Hurwicz as my research assistant.'

During the Second World War Leo taught electronics to the US Army Signal Corps at the Illinois Institute of Technology. During 1942-44 he was on the faculty of the Institute of Meteorology at the University of Chicago and taught Statistics in the department of economics. He became associated with the Cowles Commission for Research in Economics, where his advisors were J. Marschak and T.C. Koopmans. After a stint at Iowa State College as associate professor in economics, he joined the Cowles Commission full time in October, 1950, and led research on the theory of resource allocation.

Recruited by the University of Minnesota in 1951, he became the Regents' Professor in 1969. Even after retirement from full time teaching in 1988 he continued vigorously as professor emeritus and offered graduate courses in welfare economics and mathematical economics as late as the fall of 2006.

Two volumes of essays were presented to him on his sixty fifth birthday and there was a Hurwicz Conference at Minnesota in April, 2007. What an extraordinarily eventful and intellectually exciting and fulfilling life! The Nobel prize came just in the nick of time to put the crown of glory on it and barely managed to save itself from disgrace.

Personal Memories

The year is 1979, the season fall, and the venue graduate chairperson Herbert Mohring's house in Minneapolis. 'Dammit, school's beginning' - party is in progress on a lovely, rather warm afternoon. Several professors were already there, but we, the newcomers, were waiting for the great man to arrive because for us Minnesota was synonymous with Leo Hurwicz at that time. Sudhakar Rao Aiyagari, a third year senior, assured us that Leo never missed a students' party. Within a few minutes he arrived, spotted the group of two Indians and two Bangladeshis and immediately put us at ease by announcing loudly, 'If you gentlemen over there think that Minnesota will stay as warm as this, you are badly mistaken. Be prepared for the worst soon!' (I am not sure if these were the exact words, but this was the message.). We soon discovered that the great man just loves to talk and interact with people. In fact, such was the flow of his words (in delicious continental accent) that one was forced to be a listener most of the time. When Tapen Sinha from Indian Statistical Institute, Calcutta, introduced himself to him, he quipped with a twinkle in his eyes, 'Sinha is lion and so is Leo. We are kindred spirits!' He also asked if any of us was a brahmin. The constant twinkle in the eyes and the slightly mischievous laugh will always stay with anybody who spent even fifteen minutes with him. We were joined by a group of students from Spain and he proceeded to tell them of his experiences in Barcelona last year. He spoke so rapidly that, I remember, they were finding it difficult to follow.

We were gratified to discover later on that he had a particular fondness for India and Indians. I met him many times in the bookstore and also in the basement cafeteria where he once sat down at our table with a cup of coffee. On one occasion he suddenly said, ‘You know, Poland and India have one thing in common, we produce brilliant individuals but cannot do much collectively.’ There was also a short lecture in the usual style on North and South Indian food preferences. This was based on his stays in Bangalore and Delhi. We listened with interest. (That’s what you mostly did when Leo talked.) At one screening of Ray’s films on campus we found him standing near the main entrance of the auditorium with his wife. He told us that he and Evelyn never missed a chance to see the Apu trilogy. I recall one student from Bolivia in the Business School telling me that once Leo accosted him at the bus stop and subjected him to a barrage of questions about current South American politics. He also expressed a strong desire to visit the continent. An almost insatiable curiosity about other nations, their histories and cultures was a fascinating trait of Leo Hurwicz. Needless to say, this is not very common among the stalwarts of mathematical economics. In North American politics Leo was an active democrat all his life. He helped design the ‘walking subcaucus’ method of allocating delegates among competing groups, a method that is still in use. So deep was his commitment that he even attended the Precinct Caucus in February, 2008, at the age of ninety!

Leo taught us two compulsory micro courses. Some of us took more advanced courses from him subsequently. Unlike most senior professors, he actually preferred to teach first year courses. Since there were several students from different science subjects who had no previous training in economics, this called for very special skill on the part of the instructor. We looked back with amazement at Leo’s performance in taking us smoothly from the properties of indifference curves and simple demand -supply graphs all the way to the fundamental theorems of welfare economics and the problems posed by in-

creasing returns, indivisibilities and incomplete information. (Prof. Richter was invited to give us a taste of revealed preference one day and we were knocked hard by the jump in the technical difficulty of the lecture. For us the greatness of Leo was underscored once more.) Eiji Tajika was his assistant for the courses. Mr Tajika sat at the back of the class with a scarf around his neck and a very serious, almost grim, face. Often Prof. Hurwicz would make little jokes and actually wave at Tajika, encouraging him to laugh. After the midterm, Leo announced, 'When you get back your blue books you'll find that your answers have been doublechecked. Mr Tajika's corrections will be in red ink, mine in green.' In no other course it was like this.

Here I cannot resist recounting an incident in my second year. In some connection Leo mentioned the novel 'Erewhon' ('Nowhere' spelt backward, not exactly) but could not remember the author. From the second row I supplied the name, Samuel Butler, to which he said 'I don't think so.' I said, ' Will you give me an A if I am right?' He replied, 'Of course not! But I'll check.' Couple of days later in the corridor he said, ' Sikdar, my secretary has checked and you are right!' I just happened to know about the book, but what is truly amazing is a Polish mathematical economist referring to a little known work by a not very well known British author!

Contributions

Leo Hurwicz's contributions to economic analysis are both deep and wide ranging. When his friends, colleagues and former students decided to honour him on his sixty fifth birthday two Festschrift volumes were needed to touch all the relevant areas. For convenience of exposition Leo's contributions can be grouped under three broad heads:

- (1) Lagrange-Kuhn-Tucker constrained maximization theory
- (2) Demand theory and stability of competitive equilibrium

(3) Mechanism design and incentives

Of the three, I shall keep my focus narrowed to the third chiefly because that is where his work has been the most influential in opening up an entirely new frontier of research. The major works in (1) and (2) have been enshrined in two volumes: Arrow and Hurwicz (1958) and Arrow, Hurwicz and Uzawa (1977). In demand theory his most famous work is a joint paper with Uzawa on integrability of demand functions. This represents a culmination of work in the area by such stalwarts as Antonelli, Pareto, Slutsky and Samuelson. This is included in Chipman, Hurwicz, Richter and Sonnenschein (1971).

Hurwicz's pioneering work in mechanism design finally gave economists a formal framework to put in perspective an important debate that had been going on since the beginning of the twentieth century. This debate concerned the feasibility of socialism as an alternative to self-interest driven capitalism. Mises' (1935) skepticism as to even the theoretical feasibility of rational allocation under a command system elicited Lange's (1938) response that there was in principle no reason why managers under socialism could not be coordinated to achieve efficiency by appropriate prices set by a central planner. In a highly influential paper Hayek (1945) argued that, instead of being a problem of how to allocate 'given' resources among competing ends, the fundamental economic problem of a society is to secure the best use of information about resources and preferences that remain widely dispersed among the population. To achieve his target the central planner will have to gather all this information somehow and use it as input in his decision making. Here Hayek introduced the fundamental idea of economic systems as mechanisms for transmitting and processing information and believed that socialism as one such system will be outperformed by capitalism. But his arguments, though cogent, were informal. The debate on the whole remained inconclusive due to the inadequacy of the existing framework of economic analysis.

Fundamentally new techniques were needed to allow analytical comparison of alternative institutions. This was the gap bridged by Hurwicz (1960). The deep questions could finally be addressed within one common formal structure.

In the formal model presented in the 1960 paper the economic organization is treated as a variable, in a context where the underlying data such as technology, endowments and preferences are given and define the environment. A ‘mechanism’ specifies rules according to which, given the information available to him, a participant sends ‘messages’ to others. The content and nature of the messages will vary from mechanism to mechanism. They may, for example, be proposals for trade, price bids or plans of input use for the entire system. In the competitive process they are the proposed prices and commodity bundles. The mechanism has also an ‘outcome rule’ that maps message configurations into outcomes. Comparisons of different types of mechanisms are to be made in terms of (a) the optimality properties of the outcomes that they lead to in various environments and (b) the costs of operating them, mainly the informational costs. It is known that the competitive process is Pareto satisfactory in classical environments (no externalities, increasing returns or indivisibilities). But it can be asked if there could be processes that are ‘informationally better’ than the competitive process in the same environment. In terms of some precise criteria of dimensionality of messages, Hurwicz showed that the answer is in the negative. The insights of Mises and Hayek were thus finally vindicated to the theorist’s satisfaction.

Another fundamental issue that was missing from the old debate is the problem of incentives, intimately connected with the problem of decentralized information. A rational individual could not be expected to honestly reveal private information about preferences or endowments or other characteristics that may be used against his private interests. If a mechanism with desirable

properties is found, the question arises whether it will be in the best interests of the participants to follow its rules. It is possible that a participant may gain by ‘cheating’ (misrepresentation of his true characteristics) without openly violating the rules. Economists were first alerted to this possibility by Samuelson (1954) in the context of the allocation problem for public goods. Mechanism design theory showed that the problem is much more pervasive.

Hurwicz turned to game theory for the study of the incentive properties of mechanisms. He introduced the concept of ‘incentive compatibility’ of a mechanism in terms of the Nash equilibria of a noncooperative game and applied it to important allocation mechanisms to establish some fundamental ‘impossibility results’. We discuss one here.

In his public goods paper Samuelson argued that no feasible mechanism can guarantee efficiency in the allocation of public goods because asking somebody to pay for public goods according to his benefits is not going to work because he has an incentive to misrepresent his preference (true benefit). Hurwicz (1972) showed that the same incentive problems arise in the allocation of private goods too. In a standard Edgeworth Box economy the question is whether an agent can think up for himself a false (but convex and monotone) preference map which would be more advantageous for him than the true one, assuming that he will follow the rules of price taking according to the false map while the other trader does not cheat. The answer is in the affirmative and hence perfect competition is not incentive compatible.

But might there not exist some other sets of rules avoiding this problem? The impossibility result says that the trouble will persist in any process yielding Pareto efficient outcomes and giving the agents the option of refraining from trade if they so desire. Thus the difficulty is due not to lack of inventiveness, but to a fundamental conflict among various desirable attributes

of mechanisms such as Pareto optimality, incentive compatibility and informational decentralization. In general, the notion of incentive compatibility has proved to be one of great scope and organizing power, at par with the notion of efficiency, and incentive constraints have become as much a part of economic models as the traditional resource constraints.

Mechanism design quickly became one of the major areas of active research and numerous contributors over the years have extended Hurwicz's fundamental results in many different directions. Leo himself continued to be a vigorous presence in the field.

We conclude with the words of Groves, Radner and Reiter (1987), the editors of the first Hurwicz Festschrift, 'The effect of his work has been to help make economic theory a more effective instrument for the study of what Frank Knight long ago asserted was the proper subject matter of economics, namely, the study of how a society organizes (and we may say, should organize) its economic activity, a study in which the characterization of optimal allocations is only a component element.'

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