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U JEDNOJ GODINI TRI NOBELOVE ZVEZDE IZ EKONOMIJE - I DEO

Džon Čarls Haršanji Nobelova nagrada za 1994.

Rezime

Nobelovu nagradu iz ekonomije za 1994. godinu „za pionirsku analizu ravnoteže u teoriji nekooperativnih igara“ dobili su Džon Čarls Haršanji, Rajnhard Zelten i Džon F. Neš.

Haršanji je najznačajniji doprinos je u sagledavanju problematike informacija. Odnosno, stepen informisanosti igrača od ključnog je značaja za tok i rezultat igre, ali i za primenu teorije igara u analizama konkretnih problema. Na igre sa nepotpunim informacijama nije bilo moguće primeniti standardnu proceduru rešavanja. Haršanji je ponudio originalno rešenje predloživši prevođenje igara sa nepotpunim informacijama u igre sa nesavršenim informacijama. Analiza ovog nobelovca imala je veliki uticaj na razvoj i usavršavanje ekonomike informacija, a razvijanjem koncepta rešavanja igara sa nepotpunim informacijama podstaknuta je široka primena teorije igara na mnoge probleme ekonomske nauke.

Ključne reči: Džon Čarls Haršanji, Rajnhard Zelten, Džon F. Neš, Nobelova nagrada, teorija nekooperativnih igara, nepotpune informacije, nesavršene informacije, standardi, procedure, Mađarska, Austrija, Australija, SAD, Berkli univerzitet

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John Charles Harsanyi Nobel Prize for 1994

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Summary

1994 Nobel Prize in Economics “for their pioneering analysis of equilibrium in the theory of non-cooperative games” was awarded to John Charles Harsanyi, Reinhard Selten and John F. Nash. Harsanyi’s most important contribution was in the field of economics of information. He showed how the amount of information possessed by agents bears the key significance to the course and result of the game, but also to the implementation of game theory in the analysis of concrete problems. It was impossible to apply the standard solving procedure to the incomplete information games. Harsanyi offered an original solution by proposing the conversion of a game with incomplete information into one with complete yet imperfect information. The analysis of this Nobel Prize winner largely contributed to the development and advancement of the economics of information, whereas his concept of solving games with incomplete information triggered the widespread application of game theory to many other problems in the economic science.

Key words: John Charles Harsanyi, Reinhard Selten, John F. Nash, Nobel Prize, theory of non-cooperative games, incomplete information, imperfect information, standards, procedures, Hungary, Austria, Australia, USA, Berkley University

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IN ONE YEAR THREE NOBEL STARS IN ECONOMICS - PART ONE

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Nobelovu nagradu iz ekonomije za 1994. godinu „za pionirsku analizu ravnoteže u teoriji nekooperativnih igara“ dobili su Džon Čarls Haršanji, Rajnhard Zelten i Džon F. Neš. Ono što je zajedničko za ovu trojicu nobelovaca jesu oblast rada iz ekonomije i teška životna iskušenja kroz koja su prošli i uspešno ih prebrodili.

Džon Čarls Haršanji

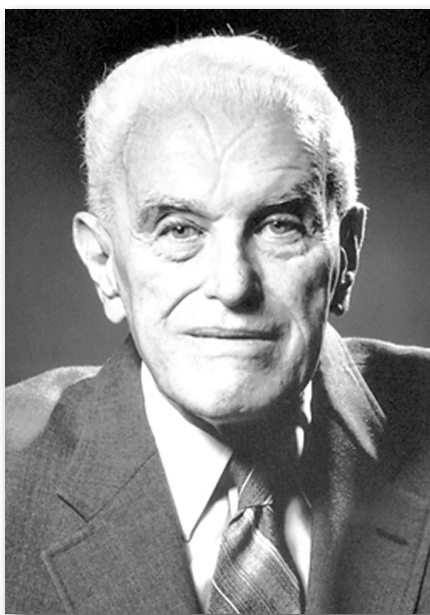
Biografija

Džon Haršanji kao sin jedinac Čarlsa Haršanjija i Alise Gombos, rođen je u Budimpešti 29. maja 1920. godine. Do Drugog svetskog rata apoteka u vlasništvu ove jevrejske porodice koja je prihvatila katoličanstvo pružala je siguran i udoban život. Haršanji je završio veoma cenjenu Luterijansku gimnaziju u Budimpešti i potom 1937. godine upisao studije farmacije u Francuskoj. Po izbijanju rata napušta Francusku i nastavlja studije u Budimpešti koje takođe prekida ulaskom Nemaca u Mađarsku. Zbog svog jevrejskog porekla uhapšen je i odveden u radni logor blizu Budimpešte. Krajem rata, kada su Rusi bili blizu Budimpešte, Nemci su organizovali preseljenje logora u Austriju. Tom prilikom Haršanji uspeva da se spase bekstvom sa železničke stanice i krijući se u podrumu jednog jezuitskog samostana.

Po završetku rata 1946. godine ponovo se upisao na univerzitet u Budimpešti radi studija filozofije, psihologije i sociologije. Doktorirao je 1947. i godinu dana radio kao asistent na Univerzitetu. Tu je i upoznao studentkinju En Klouber koja će kasnije postati njegova žena. Haršanji 1948. podnosi ostavku zbog svojih političkih stavova i neslaganja sa zvaničnom ideologijom. Zajedno sa En 1950. godine ilegalno prelazi mađarsku granicu uz pomoć iskusnog vodiča koji ih je proveo preko teško preglednih močvarnih terena do Austrije. Nakon kraćeg zadržavanja u ovoj zemlji odlaze

30. decembra iste godine za Sidnej, Australiju. Uskoro, 2. januara 1951. godine, venčava se sa En koja je, po Haršanjijevim rečima, bila za njega celog života neiscrpna podrška.

Prve tri godine, zbog nedovoljnog poznavanja engleskog jezika i nepriznavanja mađarskih diploma, Haršanji je radio u fabrikama razne poslove, a En je bila krojačica. Pohađao je, takođe, večernje kurseve na Univerzitetu u Sidneju. Već tada svoje interesovanje usmerio je na ekonomiju. Magistarsku diplomu iz ekonomije dobio je 1953. a naredne godine postao je predavač na univerzitetu Kvinslend u Brizbejnu. Rokfelerovu stipendiju dobio je 1956. godine, što



mu je omogućilo da zajedno sa En provede 2 godine na Stenford univerzitetu, SAD. Tu je odbranio doktorat iz ekonomije 1959. a En je postala magistar iz psihologije. Savetnik i mentor njegove doktorske disertacije bio je čuveni Kenet Erou, dobitnik Nobelove nagrade za ekonomske nauke. On ga je tada više zainteresovao za matematiku i statistiku, što će Haršanjiju, po sopstvenom priznanju, biti veoma korisno za kasniji rad u teoriji igara.

Po povratku u Australiju dobio je atraktivan posao istraživača na Australijskom nacionalnom univerzitetu u Kamberi. Međutim, veoma brzo se osetio izolovanim od savremenih istraživanja u ekonomiji, posebno kada je u pitanju teorija igara, jer je ona bila skoro nepoznata u

Haršanji je autor mnogobrojnih članaka, studija i knjiga. Od knjiga izdvajamo: *Racionalno ponašanje i uspostavljanje ravnoteže u igrama i društvenim situacijama* (1977), kao i dve zbirke njegovih objavljenih radova: *Eseji o etici, socijalnom ponašanju i naučnim objašnjenjima* (1976) i *Radovi u oblasti teorije igara* (1982). Od kasnijih radova spomenućemo dva: „Napredak u razumevanju racionalnog ponašanja“, objavljen 1990. godine i „Teoretski modeli igara i odlučivanja u etici“, iz 1995. godine.

In 1994 the Nobel Prize in Economics was awarded to John Charles Harsanyi, Reinhard Selten and John F. Nash, “for their pioneering analysis of equilibrium in the theory of non-cooperative games”. What these three Nobel Prize winners have in common is the field of economics they studied, as well as the hardships that they had undergone and successfully overcome during their lifetime.

John Charles Harsanyi

Biography

As the only son of Charles Harsanyi and Alice Gombos, John Harsanyi was born in Budapest on May 29, 1920. Up until the Second World War, the pharmacy owned by this Jewish family which had converted to Catholicism provided them a safe and comfortable living. Harsanyi graduated from a highly esteemed Lutheran Gymnasium in Budapest, after which, in 1937, he began his studies of pharmacy in France. After the outbreak of the war, he left France and continued his studies in Budapest, also to be interrupted by the German invasion of Hungary. Due to his Jewish origin, he was arrested and sent to a labour camp near Budapest. Towards the end of the war, while the Russians were nearing Budapest, the Germans organized the transfer of his labour camp unit to Austria. On this occasion, Harsanyi managed to escape from the railway station and remain in hiding in the cellar of a Jesuit monastery.

After the war ended, in 1946 he re-enrolled at the University of Budapest in order to study philosophy, psychology and sociology. He gained his Ph.D. in 1947 and spent one

Harsanyi authored numerous articles, studies and books. We hereby underline his book: *Rational Behavior and Bargaining Equilibrium in Games and Social Situations* (1977), along with the two collections of his journal articles: *Essays on Ethics, Social Behavior, and Scientific Explanation* (1976) and *Papers in Game Theory* (1982). Of his later papers, we will mention the following two: “Advances in Understanding Rational Behaviour”, published in 1990, and “Game and Decision Theoretic Models in Ethics”, published in 1995.

year working as a teaching assistant at the University. This is where he met Anne Klauber, a psychology student, later to become his wife. In 1948 Harsanyi resigned due to his political views and disagreement with the official ideology. Together with Anne in 1950 he illegally crossed the Hungarian border with the help of an experienced guide who led them over a marshy terrain to Austria. Following a brief stay in this country, on December 30 that same year they left for Sydney, Australia. Soon, on January 2, 1951 Harsanyi married Anne who had, according to his own words, been an unfailing source of support and understanding his entire lifetime.

During the first three years, due to their poor knowledge of English and the fact that their Hungarian university degrees were not recognized, Harsanyi had to do various factory work, whereas Anne worked as a seamstress. However, in the evening he took economics courses at the University of Sydney. It was already at that time that his interests drifted towards economy. He gained his M.A. degree in economics in 1953, and the following year he became a lecturer at the University of Queensland in Brisbane. In 1956 he was awarded a Rockefeller Fellowship, enabling him and Anne to spend two years at Stanford University, USA. It was there that he got his Ph.D. in economics in 1959, whereas Anne got an M.A. in psychology. His advisor and dissertation supervisor was the famous Kenneth Arrow, winner of the Nobel Prize in Economics. He raised Harsanyi’s interest in mathematics and statistics, which will, according to his own words, prove to be very useful in his later work in game theory.

Upon their return to Australia, he got a very attractive research position at the Australian National University in Canberra. However, he soon felt isolated from the contemporary economic research, especially when it came to game theory, which was virtually unknown in Australia. He turned to Ken Arrow for help. With his and Jim Tobin’s help, in 1961 he was appointed Professor of Economics at the University of Detroit, USA. After three years, he became first Visiting Professor and then Professor at the University of California in Berkeley, where he worked until his retirement



Australiji. Za pomoć se obratio svom mentoru Erou. Uz njegovu i pomoć Džima Tobina imenovan je 1961. godine za profesora ekonomije Univerziteta u Detroitu, SAD. Nakon tri godine postaje gostujući profesor, a potom i profesor na Berkliju na kome je radio sve do penzionisanja 1990. godine. U braku sa En dobio je sina Toma. Haršanji je preminuo 9. avgusta 2000. godine. Njegovi saradnici, prijatelji i svi ostali koji su ga poznavali opisivali su ga kao ljubaznog, toplog, nežnog i duhovitog čoveka.

Naučni rad

Akademski uspon Džona Haršanjija počinje njegovim dolaskom u SAD. U ovoj zemlji bio je aktivan u brojnim značajnim institucijama: član Nacionalne akademije nauka i umetnosti, istaknuti naučni saradnik u Američkom udruženju ekonomista, saradnik Centra za napredne studije, počasni doktor nauka Univerziteta Nortvestern i dr. Autor je mnogobrojnih članaka, studija i knjiga.

Naučnim istraživanjima počeo je da se bavi razmatranjem teorije igara. Njegov najznačajniji doprinos je u sagledavanju problematike informacija. Odnosno, stepen informisanosti igrača od ključnog je značaja za tok i rezultat igre, ali i za primenu teorije igara u analizama konkretnih problema. Na igre sa nepotpunim informacijama nije bilo moguće primeniti standardnu proceduru rešavanja. Haršanji je ponudio originalno rešenje predloživši prevođenje igara sa nepotpunim informacijama u igre sa nesavršenim informacijama. To se postiže uvođenjem trećeg igrača (odnosno „prirode“)

Igra se odvija na sledeći način: Lutrija (priroda) odlučuje koji će od tipova igrača sa obe strane stvarno da učestvuje u pregovorima. Na taj način se početna statička igra sa nepotpunim informacijama preformuliše u dinamičku igru sa nasavršenim informacijama. Kada su lutrijom određeni konkretni pregovarački tipovi tada igra formalno počinje. U tom trenutku svaki od pregovarača zna kojem tipu pripada, ali ne zna koji je tip njegov protivnik. On zna verovatnoće sa kojima se pojavljuju

tipovi protivnika. Haršanji je pretpostavka je bila da je ova matrica jedinstvena, da svi učesnici u igri imaju istu procenu o ponašanju prirode. Na taj način se igra transformiše iz jednog oblika u drugi.

Strategija u ovakvoj igri mora da uključi svaki mogući tip svakog igrača u plan njegovih akcija. Kako su tipovi drugih igrača nepoznati svakom pojedinačnom igraču, svaki igrač mora da formira najbolji odgovor na očekivanu strategiju svakog protivnika. Igrač mora da traži neku prosečnu reakciju svih tipova protivnika i na osnovu toga bira vlastitu strategiju. Ovako uspostavljena ravnoteža je Bajes-Nešova ravnoteža.

Shodno ovoj analizi, Haršanji je ponudio i drugačiju interpretaciju mešovitih strategija. One predstavljaju posledicu neznanja igrača o tome šta će da učini njegov protivnik. Kao posebna klasa dinamičkih igara sa nepotpunim informacijama razvijene su igre signalinga koje su zasnovane na klasičnom odnosu „lidersledbenik“ i preuzete su iz teorije duopola. Njima se rešava problem informacione asimetrije. Ako imamo igru sa više igrača u kojoj je jedan bolje informisan i ostali to znaju, njegov položaj može biti otežan. Ovakva situacija može se okončati nepovoljno za sve učesnike.

Haršanji je analiza je imala veliki uticaj na razvoj i usavršavanje ekonomike informacija, a razvijanjem koncepta rešavanja igara sa nepotpunim informacijama podstaknuta je široka primena teorije igara na mnoge probleme ekonomske nauke.

U naredna dva broja o ostalim dobitnicima Nobelove nagrade za 1994. godinu.

in 1990. Shortly after arriving in Berkeley, he and Anne had their only child, Tom. Harsanyi died on August 9, 2000. His associates, friends and everybody else who had known him, described him as a kind, affectionate, gentle and witty man.

Scientific work

The rise of John Harsanyi in the academic circles started upon his arrival to the USA. There he was rather active in the numerous important institutions: he was a Fellow of the American Academy of Arts and Sciences, a Distinguished Fellow of the American Economic Association, a Fellow of the Center for Advanced Study, an honorary Doctor of Science at Northwestern University, etc. He authored numerous articles, studies and books.

Harsanyi started his scientific research by investigating game theory. His most important contribution was in the field of economics of information. He showed how the amount of information possessed by agents bears the key significance to the course and result of the game, but also to the implementation of game theory in the analysis of concrete problems. It was impossible to apply the standard solving procedure to the incomplete information games. Harsanyi offered an original solution by proposing the conversion of a game with incomplete information into one with complete yet imperfect information. This is to be achieved by introducing the third agent (i.e. "nature").

The game develops in the following way: the chance (nature) decides which types of agents on both sides will actually take part in the negotiations. Thereby the initial static game with incomplete information becomes

converted into a dynamic game with imperfect information. Once the chance determines the concrete negotiation types, the game officially begins. At that moment, each of the negotiators knows which type they belong to, but they do not know the type of their opponent. They are familiar with the probabilities of occurrence of certain types of opponents. Harsanyi's assumption was that this matrix is unique, and that all participants in the game have the same assessment of the nature's behaviour. Thus the game gets transformed from one type into another.

The strategy in this kind of game implies that every possible type of each agent must be included into their actions. Given that the types of other agents are unknown to each individual agent, each agent must form the best response to the expected strategy of each opponent. An agent must anticipate the average reaction of all types of opponents, based on which he chooses his own strategy. Thus established equilibrium is called Bayesian-Nash equilibrium.

According to this analysis, Harsanyi offered a different interpretation of mixed strategies. They come as a consequence of the agent's ignorance of what his opponent would do. As a separate class of dynamic games with incomplete information, the so-called signalling games were developed, based on the classic "leader-follower" relationship, taken from the theory of duopoly. They are used to solve the problem of information asymmetry. If there is a game with several agents in which one agent is better informed and the others are aware of that, his position might be more difficult. Such a situation may be finalized in an unfavourable way for all participants.

Harsanyi's analysis largely contributed to the development and advancement of the economics of information, whereas his concept of solving games with incomplete information triggered the widespread application of game theory to many other problems in the economic science.

In the following two issues read about the remaining two Nobel Prize winners for 1994.

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