# Stanford



# Paul Milgrom

Shirley R. and Leonard W. Ely, Jr. Professor in the School of Humanities and Sciences, Professor of Economics, Senior Fellow at SIEPR and Professor, by courtesy, of Economics at the GSB and of Management Science and Engineering

### Bio

#### BIO

Paul Milgrom is the Shirley and Leonard Ely professor of Humanities and Sciences in the Department of Economics at Stanford University and professor, by courtesy, in the Stanford Graduate School of Business and in the Department of Management Sciences and Engineering. Born in Detroit, Michigan on April 20, 1948, he is a member of both the National Academy of Sciences and the American Academy of Arts and Sciences and a winner of the 2008 Nemmers Prize in Economics, the 2012 BBVA Frontiers of Knowledge award, the 2017 CME-MSRI prize for Innovative Quantitative Applications, and the 2018 Carty Award for the Advancement of Science.

Milgrom is known for his work on innovative resource allocation methods, particularly in radio spectrum. He is coinventor of the simultaneous multiple round auction and the combinatorial clock auction. He also led the design team for the FCC's 2017 incentive auction, which reallocated spectrum from television broadcast to mobile broadband.

According to his BBVA Award citation: "Paul Milgrom has made seminal contributions to an unusually wide range of fields of economics including auctions, market design, contracts and incentives, industrial economics, economics of organizations, finance, and game theory." As counted by Google Scholar, Milgrom's books and articles have received more than 80,000 citations.

Finally, Milgrom has been a successful adviser of graduate students, winning the 2017 H&S Dean's award for Excellence in Graduate Education.

#### ACADEMIC APPOINTMENTS

- Professor, Economics
- Senior Fellow, Stanford Institute for Economic Policy Research (SIEPR)
- Professor (By courtesy), Economics
- Professor (By courtesy), Management Science and Engineering

#### ADMINISTRATIVE APPOINTMENTS

- Professor (by courtesy), Management Sciences and Engineering, Stanford University, (2018- present)
- Shirley R. and Leonard W. Ely, Jr. Professor of Humanities and Sciences, Stanford University, (1993- present)
- Professor of Economics, Stanford University, (1987- present)
- Professor (by courtesy), Graduate School of Business, Stanford University, (1987- present)
- Senior Fellow, SIEPR, Stanford University, (2007- present)

- Director, Stanford Institute for Theoretical Economics, Stanford University, (1989-1991)
- Williams Brothers Professor of Management Studies and Professor of Economics, Yale University, (1985-1987)
- Professor of Economics and Management, Yale University, (1983-1985)
- Visiting Professor, Yale University, (1982-1983)
- Kellogg Graduate School of Management Department of Managerial Economics and Decision Sciences, Northwestern University, (1979-1983)
- Professor, Northwestern University, (1982-1983)
- Associate Professor, Northwestern University, (1981-1982)
- Assistant Professor, Northwestern University, (1979-1981)
- Honorary doctorate, Stockholm School of Economics, (2001- present)
- Taussig Visiting Research Professor, Harvard University, (2000-2000)
- Fellow (2nd time), Center for Advanced Study in the Behavioral Sciences, (1998-1998)
- Senior Research Fellow, Institute for Policy Reform, (1993-1993)
- Fellow, American Academy of Arts and Sciences, (1992-1992)
- International Guest Scholar, Kyoto University, (1992-1992)
- Fellow, Center for Advanced Study in the Behavioral Sciences, (1991-1991)
- Ford Visiting Professor of Economics, University of California-Berkeley, (1986-1986)
- Fellow, Institute for Advanced Studies, Hebrew University of Jerusalem, (1985- present)
- Fellow, Econometric Society, (1984-1984)
- Fellow, Morse College (of Yale University), (1984-1984)
- Visiting Research Associate, Stanford University, (1981-1981)
- Fellow, Society of Actuaries, (1974-1974)
- Williams Brothers Chair in Management Studies, Yale University, (1986-1986)
- Fellowship to study "Economic Theories of Organization", John Simon Guggenheim Fellowship, (1986-1986)

#### HONORS AND AWARDS

- Hononary Doctorate, Charles University (2024)
- Sveriges Riksbank Prize in Memory of Alfred Nobel, Nobel Foundation (2020)
- John J Carty Award for the Advancement of Science, National Academy of Sciences (2018)
- CME-MSRI Prize for Innovative Quantitative Methods in Economics & Finance, Chicago Mercantile Exchange & Mathematical Sciences Research Institute (2017)
- Dean's Award for Excellence in Graduate Education, Stanford College of Humanities & Sciences (2017)
- Foundations of Knowledge Award, BBVA Foundation (2012)
- Phase IB Award for "Incorporating Bidder Budget Constraints in Multi-item Auctions", National Science Foundation Small Business Innovation Research (2010)
- Phase I Award for "Incorporating Bidder Budget Constraints in Multi-Item", National Science Foundation Small Business Innovation Research (2010)
- Erwin Plein Nemmers Prize, Northwestern University (2008)
- Landau economics teaching prize, Stanford University (2003)
- Best Paper of the Year, Transactions of the Society of Actuaries (1987)
- Faculty Research Award, Yale University (1983)
- Honorary Master of Arts degree, Yale University (1983)
- Leonard J. Savage Thesis Award, International Society for Bayesian Analysis (1980)
- Triennial Paper Prize, Society of Actuaries (1976)

#### BOARDS, ADVISORY COMMITTEES, PROFESSIONAL ORGANIZATIONS

- Chairman of Economics Section, National Academy of Sciences (2019 2022)
- President, Western Economic Association International (WEAl) (2007 2007)
- Elected member, National Academy of Sciences (2006 2006)
- Elected member, Executive Committee of the Econometric Society (2005 2005)
- Elected Vice President, Western Economic Association (2005 2005)
- Council Member, Econometric Society (2004 2004)
- Elected member, Game Theory Society (2003 2003)
- IBM Research Chair, Northwestern University (1981 1981)
- Member, Editorial Board of European Journal of Pure and Applied Mathematics (2012)
- Member, Editorial Board of AEJ-Microeconomics (2009)
- President, Western Economic Association International (WEAl) (2007 2008)
- Member, National Academy of Sciences (2006 2007)
- President-Elect, Western Economic Association International (WEAl) (2006 2007)
- Vice President, Western Economic Association International (WEA1) (2005 2006)
- Member, Executive Committee of the Econometric Society (2005 2008)
- Member, Council, Econometric Society (2004)
- Member, Council, Game Theory Society (2003)
- Chief economist, Perfect Commerce (2000 2002)
- Editorial Consultant, MIT Press (1997 2002)
- Member, Editorial Board, Journal of Comparative Economics (1997 1999)
- Founder, Market Design Inc. (1996)
- Director, Market Design Inc. (1996)
- Chairman, Market Design Inc. (1996 2002)
- Member, Nemmers Prize Selection Committee, Northwestern University (1996 1996)
- Member, Advisory Board, Microeconomics Abstracts (1996)
- Member, Advisory Board, Economics Research Network (1995)
- Member, Program Committee, 1995 World Congress of the Econometric Society (1994 1995)
- Senior Research Fellow, Institute for Policy Reform (1993 1995)
- Associate Editor, American Economic Review (1993 2000)
- Fellow, American Academy of Arts and Sciences (1992)
- Co-Editor, American Economic Review (1990 1993)
- Associate Editor, Games and Economic Behavior (1990)
- Associate Editor, Journal of Financial Intermediation (1989 1992)
- Associate Editor, Econometrica (1987 1990)
- Associate Editor, Rand Journal of Economics (1985 1989)
- Associate Editor, Journal of Economic Theory (1983 1987)
- Chair, Program Committee, Econometric Society Winter Meetings (1984 1984)
- Fellow, Econometric Society (1984)

- Member, American Economic Association (1980)
- Member, Economic Association (2005 2005)

#### **PROFESSIONAL EDUCATION**

- Ph.D, Stanford University, Business (1978)
- M.S., Stanford University, Statistics (1978)
- A.B., University of Michigan , Mathematics (1970)

#### PATENTS

- Paul Milgrom, Stephan Cunningham, Marissa Beck. "United States Patent 11,574,358 Impression Allocation System and Method Using an Auction that Considers Losing Bids", OpenX Technologies, Inc, Feb 7, 2023
- Paul Milgrom, Steve Goldband. "United States Patent 8,788,364 System for Configuration and Implementation of an Assignment Auction or Exchange", Auctionomics, Inc, Jul 22, 2014
- Lawrence Ausubel, Peter Cramton, Paul Milgrom. "United States Patent 8,744,924 System and Method for Efficient Clearing of Spectrum Encumbrances", Efficient Auctions, LLC, Jun 3, 2014
- Marc Porat, Kevin Surace, Paul Milgrom. "United States Patent 8,738,463 Method, System and Business Model for a Buyer's Auction with Near-Perfect Information Using the Internet", Perfect Commerce, LLC, May 27, 2014
- Paul Milgrom, David Salant. "United States Patent 8,577,746 System and Method for a Multi-Product Clock Auction", Auction Technologies, LLC, Nov 5, 2013
- Lawrence Ausubel, Paul Milgrom. "United States Patent 8,566,211 System and Method for a Dynamic Auction with Package Bidding", Efficient Auctions, LLC, Oct 22, 2013
- Marc Porat, Kevin Surace, Paul Milgrom. "United States Patent 8,341,033 Method, System and Business Model for a Buyer's Auction with Near-Perfect Information Using the Internet", Perfect Commerce, Dec 25, 2012
- Lawrence Ausubel, Peter Cramton, Paul Milgrom. "United States Patent 8,335,738 System and Method for a Hybrid Clock and Proxy Auction", Efficient Auctions, LLC, Dec 18, 2012
- Paul Milgrom, Steven Goldband. "United States Patent 8,271,345 System and Method for Incorporating Bidder Budgets in Multi-Item Auctions", Auctionomics, Inc, Sep 18, 2012
- Lawrence Ausubel, Peter Cramton, Paul Milgrom. "United States Patent 8,224,743 System and Method for a Hybrid Clock and Proxy Auction", Efficient Auctions, LLC, Jul 17, 2012

#### LINKS

• Milgrom Website: http://www.milgrom.net/

# Teaching

#### COURSES

#### 2023-24

- Market Design: ECON 136 (Spr)
- Microeconomic Theory Seminar: ECON 391 (Aut, Win, Spr)
- Microeconomics II: ECON 203 (Win)

#### 2022-23

- Market Design: ECON 136 (Spr)
- Microeconomic Theory Seminar: ECON 391 (Aut, Win, Spr)
- Microeconomics II: ECON 203 (Win)

#### 2021-22

- Market Design: ECON 136 (Win)
- Microeconomic Theory Seminar: ECON 391 (Aut, Win, Spr)
- Microeconomics II: ECON 203 (Win)

• Simplicity and Complexity in Economic Theory: CS 360, ECON 284 (Spr)

#### 2020-21

- Market Design: ECON 136 (Win, Spr)
- Microeconomic Theory Seminar: ECON 391 (Aut, Win, Spr)
- Microeconomics I: ECON 202 (Aut)
- Microeconomics II: ECON 203 (Win)
- Simplicity and Complexity in Economic Theory: CS 360, ECON 284 (Spr)

#### STANFORD ADVISEES

#### Doctoral Dissertation Advisor (AC)

Kevin Li, Lea Nagel, Roberto Saitto, Mitchell Watt

#### Doctoral Dissertation Co-Advisor (AC)

Billy Ferguson

## **Publications**

#### PUBLICATIONS

- Incentive Auction Design Alternatives: A Simulation Study MANAGEMENT SCIENCE Newman, N., Leyton-Brown, K., Milgrom, P., Segal, I. 2024
- Algorithmic Mechanism Design With Investment ECONOMETRICA Akbarpour, M., Kominers, S., Li, K., Li, S., Milgrom, P. 2023; 91 (6): 1969-2003
- Taming the Communication and Computation Complexity of Combinatorial Auctions: The FUEL Bid Language MANAGEMENT SCIENCE Bichler, M., Milgrom, P., Schwarz, G. 2022
- When Should Control Be Shared? MANAGEMENT SCIENCE Milgrom, E., Milgrom, P., Singh, R. 2022
- Extended proper equilibrium JOURNAL OF ECONOMIC THEORY Milgrom, P., Mollner, J. 2021; 194
- Auction Research Evolving: Theorems and Market Designs AMERICAN ECONOMIC REVIEW Milgrom, P. 2021; 111 (5): 1383-1405
- Clock Auctions and Radio Spectrum Reallocation JOURNAL OF POLITICAL ECONOMY Milgrom, P., Segal, I.
  2020; 128 (1): 1–31
- Auction Market Design: Recent Innovations ANNUAL REVIEW OF ECONOMICS, VOL 11, 2019 Milgrom, P., Aghion, P., Rey, H. 2019; 11: 383–405
- Equilibrium Selection in Auctions and High Stakes Games *ECONOMETRICA* Milgrom, P., Mollner, J. 2018; 86 (1): 219–61

- Economics and computer science of a radio spectrum reallocation. Proceedings of the National Academy of Sciences of the United States of America Leyton-Brown, K., Milgrom, P., Segal, I. 2017; 114 (28): 7202-7209
- Adverse Selection and Auction Design for Internet Display Advertising AMERICAN ECONOMIC REVIEW Arnosti, N., Beck, M., Milgrom, P. 2016; 106 (10): 2852-2866
- Ascending prices and package bidding: Further experimental analysis *GAMES AND ECONOMIC BEHAVIOR* Kagel, J. H., Lien, Y., Milgrom, P. 2014; 85: 210-231
- Designing Random Allocation Mechanisms: Theory and Applications AMERICAN ECONOMIC REVIEW Budish, E., Che, Y., Kojima, F., Milgrom, P. 2013; 103 (2): 585-623
- CRITICAL ISSUES IN THE PRACTICE OF MARKET DESIGN ECONOMIC INQUIRY Milgrom, P. 2011; 49 (2): 311-320
- Simplified mechanisms with an application to sponsored-search auctions GAMES AND ECONOMIC BEHAVIOR Milgrom, P. 2010; 70 (1): 62-70
- Ascending Prices and Package Bidding: A Theoretical and Experimental Analysis AMERICAN ECONOMIC JOURNAL-MICROECONOMICS Kagel, J. H., Lien, Y., Milgrom, P. 2010; 2 (3): 160-185
- Online Advertising: Heterogeneity and Conflation in Market Design 122nd Annual Meeting of the American-Economics-Association Levin, J., Milgrom, P. AMER ECONOMIC ASSOC.2010: 603–7
- Assignment Messages and Exchanges AMERICAN ECONOMIC JOURNAL-MICROECONOMICS Milgrom, P.

2009; 1 (2): 95-113

• Substitute goods, auctions, and equilibrium JOURNAL OF ECONOMIC THEORY

Milgrom, P., Strulovici, B. 2009; 144 (1): 212-247

• The Limited Influence of Unemployment on the Wage Bargain AMERICAN ECONOMIC REVIEW Hall, R. E., Milgrom, P. R.

2008; 98 (4): 1653-1674

• Economics - The promise of prediction markets SCIENCE

Arrow, K. J., Forsythe, R., Gorham, M., Hahn, R., Hanson, R., Ledyard, J. O., Levmore, S., Litan, R., Milgrom, P., Nelson, F. D., Neumann, G. R., Ottaviani, M., Schelling, et al

2008; 320 (5878): 877-878

• What the seller won't tell you: Persuasion and disclosure in markets JOURNAL OF ECONOMIC PERSPECTIVES

Milgrom, P. 2008; 22 (2): 115-131

- Core-selecting package auctions INTERNATIONAL JOURNAL OF GAME THEORY Day, R., Milgrom, P. 2008; 36 (3-4): 393-407
- Package auctions and exchanges ECONOMETRICA Milgrom, P.

2007; 75 (4): 935-965

- Matching with contracts AMERICAN ECONOMIC REVIEW Hatfield, J. W., Milgrom, P. R. 2005; 95 (4): 913-935
- Envelope theorems for arbitrary choice sets *ECONOMETRICA* Milgrom, P., Segal, I. 2002; 70 (2): 583-601
- Advances in routing technologies and Internet peering agreements 113th Annual Meeting of the American-Economics-Association Besen, S., Milgrom, P., Mitchell, B., SRINAGESH, P. AMER ECONOMIC ASSOC.2001: 292–96
- Putting auction theory to work: The simultaneous ascending auction *JOURNAL OF POLITICAL ECONOMY* Milgrom, P. 2000; 108 (2): 245-272
- Combination bidding in spectrum auctions 26th Annual Telecommunications Policy Research Conference (TPRC) Milgrom, P.
  LAWRENCE ERLBAUM ASSOC PUBL.1999: 19–26
- Game theory and the spectrum auctions 12th Annual Congress of the European-Economic-Association Milgrom, P. ELSEVIER SCIENCE BV.1998: 771–78
- Coalition-proofness and correlation with arbitrary communication possibilities *GAMES AND ECONOMIC BEHAVIOR* Milgrom, P., Roberts, J. 1996; 17 (1): 113-128
- The LeChatelier principle AMERICAN ECONOMIC REVIEW Milgrom, P., Roberts, J. 1996; 86 (1): 173-179
- COMPLEMENTARITIES AND FIT STRATEGY, STRUCTURE, AND ORGANIZATIONAL-CHANGE IN MANUFACTURING JOURNAL OF ACCOUNTING & ECONOMICS

Milgrom, P., Roberts, J. 1995; 19 (2-3): 179-208

• Continuous adjustment and fundamental change in business strategy and organization International Workshop on Trends in Business Organization - Do Participation and Cooperation Increase Competitiveness Milgrom, P., Roberts, J.

J C B MOHR (PAUL SIEBECK).1995: 231–258

- THE FIRM AS AN INCENTIVE SYSTEM AMERICAN ECONOMIC REVIEW Holmstrom, B., Milgrom, P. 1994; 84 (4): 972-991
- COORDINATION, COMMITMENT, AND ENFORCEMENT THE CASE OF THE MERCHANT GUILD JOURNAL OF POLITICAL ECONOMY Greif, A., Milgrom, P., Weingast, B. R.

1994; 102 (4): 745-776COMPARING EQUILIBRIA AMERICAN ECONOMIC REVIEW

Milgrom, P., Roberts, J. 1994; 84 (3): 441-459

• COMPARING OPTIMA - DO SIMPLIFYING ASSUMPTIONS AFFECT CONCLUSIONS JOURNAL OF POLITICAL ECONOMY

Milgrom, P. 1994; 102 (3): 607-615

• MONOTONE COMPARATIVE STATICS ECONOMETRICA

Milgrom, P., Shannon, C.

1994; 62 (1): 157-180

• ORGANIZATIONAL PROSPECTS, INFLUENCE COSTS, AND OWNERSHIP CHANGES JOURNAL OF ECONOMICS & MANAGEMENT STRATEGY Meyer, M., Milgrom, P., Roberts, J.

1992; 1 (1): 9-35

• INFORMATION AND TIMING IN REPEATED PARTNERSHIPS ECONOMETRICA

Abreu, D., Milgrom, P., Pearce, D. 1991; 59 (6): 1713-1733

• A THEORY OF HIERARCHIES BASED ON LIMITED MANAGERIAL ATTENTION JOURNAL OF THE JAPANESE AND INTERNATIONAL ECONOMIES

Geanakoplos, J., Milgrom, P. 1991; 5 (3): 205-225

• COMPLEMENTARITIES, MOMENTUM, AND THE EVOLUTION OF MODERN MANUFACTURING 103RD ANNUAL MEETING OF THE AMERICAN ECONOMIC ASSOC

Milgrom, P., Qian, Y. Y., Roberts, J. AMER ECON ASSN.1991: 84–88

• ADAPTIVE AND SOPHISTICATED LEARNING IN NORMAL-FORM GAMES GAMES AND ECONOMIC BEHAVIOR

Milgrom, P., Roberts, J. 1991; 3 (1): 82-100

• MULTITASK PRINCIPAL AGENT ANALYSES - INCENTIVE CONTRACTS, ASSET OWNERSHIP, AND JOB DESIGN JOURNAL OF LAW ECONOMICS & ORGANIZATION

Holmstrom, B., Milgrom, P. 1991; 7: 24-52

• RATIONALIZABILITY, LEARNING, AND EQUILIBRIUM IN GAMES WITH STRATEGIC COMPLEMENTARITIES ECONOMETRICA

Milgrom, P., Roberts, J. 1990; 58 (6): 1255-1277

• SHORT-TERM CONTRACTS AND LONG-TERM AGENCY RELATIONSHIPS JOURNAL OF ECONOMIC THEORY

Fudenberg, D., Holmstrom, B., Milgrom, P. 1990; 51 (1): 1-31

• THE ECONOMICS OF MODERN MANUFACTURING - TECHNOLOGY, STRATEGY, AND ORGANIZATION AMERICAN ECONOMIC REVIEW Milgrom, P., Roberts, J.

1990; 80 (3): 511-528

• THE EFFICIENCY OF EQUITY IN ORGANIZATIONAL DECISION-PROCESSES 102 ANNUAL MEETING OF THE AMERICAN ECONOMIC ASSOC Milgrom, P., Roberts, J.

AMER ECONOMIC ASSOC.1990: 154-59

• **REGULATING TRADE AMONG AGENTS** SYMP ON THE NEW INSTITUTIONAL ECONOMICS : DIFFERENT APPROACHES TO THE ECONOMICS OF INSTITUTIONS

Holmstrom, B., Milgrom, P. J C B MOHR.1990: 85–105

• AUCTIONS AND BIDDING - A PRIMER JOURNAL OF ECONOMIC PERSPECTIVES

Milgrom, P. 1989; 3 (3): 3-22

• ECONOMIC-THEORIES OF THE FIRM - PAST, PRESENT, AND FUTURE CANADIAN JOURNAL OF ECONOMICS-REVUE CANADIENNE D ECONOMIQUE

Milgrom, P., Roberts, J. 1988; 21 (3): 444-458

• EMPLOYMENT CONTRACTS, INFLUENCE ACTIVITIES, AND EFFICIENT ORGANIZATION DESIGN JOURNAL OF POLITICAL ECONOMY MILGROM, P. R. 1988; 96 (1): 42-60

- AN ECONOMIC-APPROACH TO INFLUENCE ACTIVITIES IN ORGANIZATIONS AMERICAN JOURNAL OF SOCIOLOGY Milgrom, P., Roberts, J. 1988; 94: S154-S179
- COMMUNICATION AND INVENTORY AS SUBSTITUTES IN ORGANIZING PRODUCTION SCANDINAVIAN JOURNAL OF ECONOMICS Milgrom, P., Roberts, J. 1988; 90 (3): 275-289
- JOB DISCRIMINATION, MARKET FORCES, AND THE INVISIBILITY HYPOTHESIS QUARTERLY JOURNAL OF ECONOMICS

Milgrom, P., Oster, S. 1987; 102 (3): 453-476

- INFORMATIONAL ASYMMETRIES, STRATEGIC BEHAVIOR, AND INDUSTRIAL-ORGANIZATION AMERICAN ECONOMIC REVIEW Milgrom, P., Roberts, J. 1987; 77 (2): 184-193
- AGGREGATION AND LINEARITY IN THE PROVISION OF INTERTEMPORAL INCENTIVES ECONOMETRICA

Holmstrom, B., Milgrom, P. 1987; 55 (2): 303-328

• PRICE AND ADVERTISING SIGNALS OF PRODUCT QUALITY JOURNAL OF POLITICAL ECONOMY

Milgrom, P., Roberts, J. 1986; 94 (4): 796-821

• RELYING ON THE INFORMATION OF INTERESTED PARTIES RAND JOURNAL OF ECONOMICS Milgrom, P., Roberts, J.

1986; 17 (1): 18-32

• LIMIT PRICING AND ENTRY UNDER INCOMPLETE INFORMATION - AN EQUILIBRIUM-ANALYSIS ECONOMETRICA Milgrom, P., Roberts, J.

1982; 50 (2): 443-459

- RATIONAL COOPERATION IN THE FINITELY REPEATED PRISONERS-DILEMMA JOURNAL OF ECONOMIC THEORY KREPS, D. M., Milgrom, P., Roberts, J., Wilson, R. 1982; 27 (2): 245-252
- PREDATION, REPUTATION, AND ENTRY DETERRENCE JOURNAL OF ECONOMIC THEORY

Milgrom, P., Roberts, J. 1982; 27 (2): 280-312

• CONVERGENCE THEOREM FOR COMPETITIVE BIDDING WITH DIFFERENTIAL INFORMATION ECONOMETRICA MILGROM, P. R.

1979; 47 (3): 679-688