CORE

CENTER FOR OPERATIONS RESEARCH & ECONOMETRICS

Report of the Research Director for the period July 1, 1996 to June 30, 1997

UCL
Université catholique de Louvain

Presentation

Founded in 1966, the *Center for Operations Research and Econometrics* (CORE) is an interdisciplinary research center of the Université catholique de Louvain. In accordance with CORE main objectives, the description of the activities in 1996-1997 can be divided in three main categories.

The first category is represented by the huge set of contributions realized, during the period covered by this report, in CORE complementary areas of research - economics and game theory, econometrics and operations research. This is attested by the 81 discussion papers produced (10 more than last year). A summary is given in the following pages for each discipline. Interactive research in these disciplines, all united by mathematical reasoning, has generated not only theoretical results, but also applied conclusions in the different fields of economics and management that have been the focus of CORE activities this year. In economic theory, there has been an important effort in developing dynamic models (overlapping generations and endogenous growth models), and their application to various intergenerational issues with special emphasis on justice and equity considerations, such as the environment or social insurance systems, and to macro-economic issues with special emphasis on unemployment. Some of these issues were also considered from a political economy point of view, introducing an inter-regional or an international competition dimension. In industrial organization the focus was on human capital formation and the functioning of the labor market. In econometrics, it was on production efficiency measurement. In operations research, different kinds of optimization methods and algorithms have been investigated. Specific applications were in network design and pricing.

A second essential category of activities consists in developing as much as possible inter-university and international scientific exchanges and collaborations. These are promoted, since the beginning of CORE, by the active participation of permanent CORE members belonging to other neighbouring universities, by the fellowships and visiting professorships that are attributed every year to long-term visitors, and by the number of short-term visitors, coming either to present their work at one of the four weekly research seminars, or to participate

in some CORE organized conference, or simply to work with some co-author. The list of all seminars for the year is given below. These activities are, in great part, supported by CORE involvement in many of the cooperative programs and research contracts that are financed either by the Belgium Federal State or French Community, the European Commission or the Industry. All contracts are listed in this report. To be stressed is the renewal of the Belgian federal support to CORE as the coordinator of an Inter-university Program (PAI) involving the three universities that were the founding members of CORE (Université catholique de Louvain, Katholieke Universiteit Leuven and Université libre de Bruxelles). This important support, granted for excellence, has been renewed for the coming five years (Phase IV). Also to be mentioned is the recent signature of a joint contract between France science foundation, the CNRS, and the Belgian FNRS, creating CORE as a Laboratoire Européen Associé (LEA), the first of its kind in Social Sciences.

The third kind of CORE activities corresponds to CORE fundamental responsibility in transferring to the young generation its newly acquired knowledge and in providing scientific training to young researchers in its areas of specialization. CORE devotes a large part of its resources to this mission. Some 35 advanced students have been completing their doctoral studies at CORE under the supervision of different CORE members and benefit from CORE facilities. Half of them are foreign students. Doctoral research accounts for a large part of this year research contributions. CORE doctoral students acquire a good position on various job markets. Important, in that respect, is the European Doctoral Program in Quantitative Economics which is a doctoral network involving several European universities : Bonn University, the Ecole des Hautes Etudes en Sciences Sociales (Paris), the London School of Economics, and an association with the University of Tel Aviv. It will now include a new participating institution : Pompeu Fabra University (Barcelona). This program helps many graduate students, who want to pursue an academic career, to find jobs in European universities.

All these activities, whatever the category, could not have been realized without the dedicated work of all CORE permanent staff, both academic and

administrative. They should be thanked for their efforts. In particular, I would like to express here the gratitude of CORE to two members who have recently left for other universities, Françoise FORGES to Cergy near Paris, Aldo RUSTICHINI to CentER in Tilburg. These departures of course affect dramatically CORE basic resources. They should remind us that 1996-1997, as well as the very next coming years, are to be crucial years in the determination of the future of CORE. In 1996-1997, CORE has already contributed to the University strategic plan (Projet 2002-2007). The results of this plan should be implemented very soon. But organizing the future of CORE cannot stop there. The strengthening of CORE essential objectives (quality and relevance of research, inter-university collaboration and scientific training of the young) in a new environment, will require the help, energy and imagination of all concerned, inside and outside.

1 Personnel

1.1 Management

Officers for the period covered by this report:

President:	Laurence A. WOLSEY
Research Director:	Claude d'ASPREMONT
Co-directors:	Luc BAUWENS
	Yves POCHET
Administrative Director:	Sheila WEYERS

1.2 Staff in 1996–1997

During the academic year 1996-1997, the permanent staff of CORE consisted of *Faculty Members* of the Université catholique de Louvain (UCL), the Katholieke Universiteit Leuven (KUL), the Université libre de Bruxelles (ULB), the Facultés universitaires Saint-Louis, Bruxelles (FUSL), the Université de Liège (ULG), the Facultés Notre-Dame de la Paix, Namur (FUNDP) and the Université de Lille III (France).

Anton BARTEN
Professor emeritus, Katholieke Universiteit Leuven and Université catholique de Louvain.
Ph.D. (economische wetenschappen), Nederlandse Economische School, Rotterdam, 1966.
Visiting professor, University of California, Berkeley, 1962–1963; University of Wisconsin, Madison, 1963; University of Pennsylvania, Philadelphia, 1964; University of Chicago, 1969–1970.
Econometrics and macroeconomic models.
Fellow of the Econometric Society; member of the International Statistical Institute; corresponding member of the Royal Netherlands Academy of Sciences; foreign member of the Royal Belgian Academy of Sciences.

Luc BAUWENS

Professor, Université catholique de Louvain.

Docteur en sciences économiques, Université catholique de Louvain, 1983.

World Bank, 1983–1984; senior researcher at Faculté universitaire catholique de Mons, 1984–1987; senior lecturer at Ecole des Hautes Etudes en Sciences Sociales, Marseille, 1987–1991.

Econometrics and statistical methods.

Leonard J. Savage Thesis Award, 1984; associate editor, *Computational Statistics.*

Laurence BROZE

Professor, Université de Lille III; director of GREMARS, Lille III, 1995– .

Docteur en sciences mathématiques, Université libre de Bruxelles, 1986.

Scholarship from IRSIA, 1982–1985; research fellow, Université libre de Bruxelles, 1985–1989; associate professor, Université de Lille III, 1989–1995.

Theoretical econometrics, financial econometrics.

Member of the editorial board, *Annales d'économie et de statistique* and *Recherches économiques de Louvain.*

Claude d'ASPREMONT

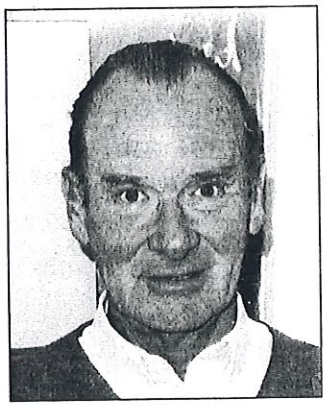
Professor, Université catholique de Louvain and Facultés universitaires Saint-Louis, Bruxelles; research director of the Center for Operations Research and Econometrics (CORE), 1995– .

Ph.D. (decision sciences), Graduate School of Business, Stanford University, 1973.

Visiting professor, Université d'Aix-Marseille III, 1984; Université Louis Pasteur, Strasbourg, 1988–, Ecole Polytechnique, Paris, 1995; visiting scholar, Graduate School of Business, Stanford, Summer 1987 and Spring 1995.

Mathematical economics, social choice theory, industrial organization.
Chairman of the economics department, Université catholique de Louvain, 1991–1994; fellow of the Econometric Society, Francqui Prize 1995; associate editor, *Games and Economic Behavior, Journal of Mathematical Economics* and *Social Choice and Welfare*; past associate editor, *European Economic Review* and *Journal of Economics/Zeitschrift für Nationalökonomie.*

Mathias DEWATRIPONT
Professor, Université libre de Bruxelles.
Ph.D. (economics), Harvard University, 1986.
Visiting assistant professor, Massachusetts Institute of Technology, 1988-1989.
Economic theory and applications.
Fellow of the Econometric Society.



Jacques DRÈZE
Professor emeritus, Université catholique de Louvain.
Ph.D. (economics), Columbia University, 1958.
Visiting professor, Carnegie Institute of Technology, 1957–1958; Northwestern University, 1962; University of Chicago, 1963–1968; holder of the Chaire Francqui, Université libre de Bruxelles, 1970–1971 and Katholieke Universiteit Leuven, 1982–1983; Andrew D. White professor at large, Cornell University, 1971–1977.
Economic theory and econometrics.

President of the Econometric Society, 1970; president of the European Economic Association, 1985–1986; president of the International Economic Association; fellow of the Econometric Society; Docteur Honoris causa of University of Essex, Paris I (Panthéon-Sorbonne), Université de Montréal, Université de Liège, Universitaire Faculteiten Sint-Ignatius te Antwerpen, Norges Handelshoyskole Bergen, Universita degli Studi di Bologna, Université de Genève, University of Chicago, Universität Basel, Université d'Aix-Marseille.

Françoise FORGES

Chercheur qualifié, Fonds national de la recherche scientifique (FNRS).

Docteur en sciences mathématiques, Université catholique de Louvain, 1984.

Assistant, Université catholique de Louvain, 1980–1981; aspirant FNRS, 1981–1985; post-doctoral fellow, Mathematical Sciences Research Institute, Berkeley, 1985–1986; chargé de recherches FNRS at CORE, 1985–1989.

Game theory.

Co-editor, *Economic Theory*; member of the editorial committee, *Recherches économiques de Louvain.*

Jean J. GABSZEWICZ

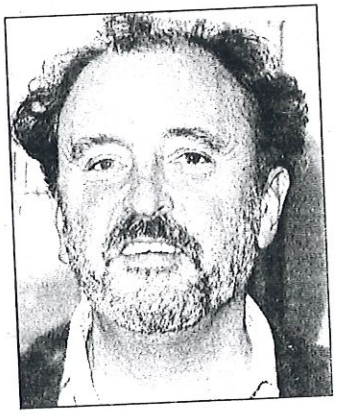
Professor, Université catholique de Louvain.

Docteur en droit, Université catholique de Louvain, 1961; Docteur en sciences économiques, Université catholique de Louvain, 1968.

Visiting professor, Polish Academy of Sciences, 1972; University of Tel-Aviv, 1973; Université de Paris IX (Dauphine), 1973; Université d'Aix-Marseille, 1973; Université de Paris XII, 1979; Université d'Aix-en-Provence, 1981; Université de Lyon, 1981; Université de Strasbourg, 1982; Université de Dijon, 1983;

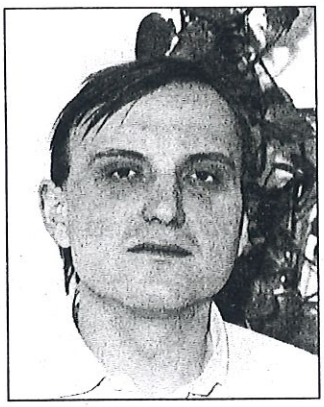
Institut universitaire Européen, Florence, 1984.
Economic theory.
Fellow of the Econometric Society; administrator of CEPREMAP (Paris); member of the Council of the European Economic Association (1986–1989); associate editor, *Journal of Economics* and *Ricerche Economiche*.

Louis GEVERS
Professor, Facultés universitaires Notre-Dame de la Paix, Namur.
Ph.D. (economics), Stanford University, 1970.
Dean of the Faculté des sciences économiques sociales et politiques, Facultés universitaires Notre-Dame de la Paix, Namur, 1979–1982.
Political and social economy.
Fellow of the Econometric Society; member of the board of directors of the Institut belge de finances publiques; associate editor, *Social Choice and Welfare*; past associate editor, *Journal of Public Economics* and *European Economic Review*.



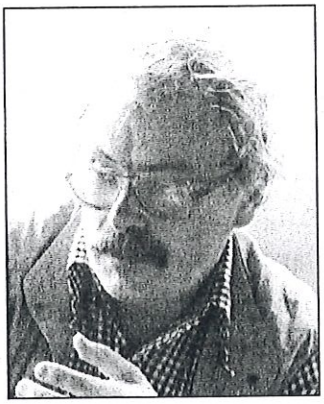
Victor GINSBURGH
Professor, Université libre de Bruxelles.
Docteur en sciences économiques, Université libre de Bruxelles, 1972.
Researcher, Yale University, 1975; visiting professor, Université catholique de Louvain, 1973, 1978 and 1985; University of Virginia, 1979; Université Paris I (Panthéon-Sorbonne), 1986–1987 and 1991–1992; Université Paris II (Panthéon-Assas), 1986– ; Université d'Aix-Marseille, 1986–1989; University of Chicago, 1996; holder of the Chaire Francqui, Université de Liège, 1992–1993.
Economic theory and cultural economics.

Associate editor, *Recherches économiques de Louvain*; past associate editor, *Annales d'économie et de statistique* and *European Economic Review*.



Aloïs KNEIP

Professor, Université catholique de Louvain; member of the Sonderforschungsbereich 303, department of economics, Bonn Universität.
Doctor of Science, Heidelberg Universität, 1988; habilitation in economics, Bonn Universität, 1994.
Econometrics and statistics.



Etienne LOUTE

Professor, Facultés universitaires Saint-Louis, Bruxelles.
Docteur en sciences appliquées, Université catholique de Louvain, 1976.
Visiting professor, Brookhaven National Laboratory, 1977; IIASA (Vienne), 1979; Ecole des Hautes Etudes Commerciales (Montréal), 1981; Université de Genève, 1992; Université de Savoie, 1992, 1994, 1996.
Mathematical programming: algorithmic and implementation issues; management and engineering applications of mathematical programming.
Dean of the Faculté des sciences économiques et politiques, Facultés universitaires Saint-Louis, Bruxelles, 1993–1996; member of SOGESCI (Société Belge pour l'Application des Méthodes Scientifiques de Gestion), INFORMS and Mathematical Programming Society.

Maurice MARCHAND

Professor, Université catholique de Louvain.

Docteur en sciences économiques, Université catholique de Louvain, 1971.

Visiting lecturer, Graduate School of Business, University of Chicago, 1968–1969; Faculté catholique de Mons, 1969–1971.

Public economics and health economics.

Member of the Executive Committee of the International Seminar in Public Economics (ISPE); associate editor, *Journal of Public Economics* and *International Tax and Public Finance.*

Jean-François MERTENS

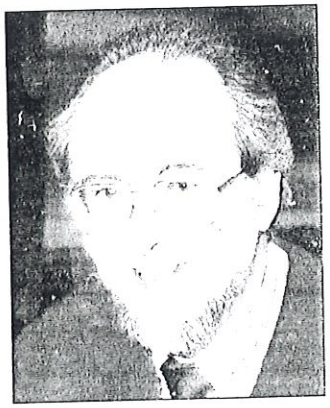
Professor, Université catholique de Louvain.

Docteur en sciences, Université catholique de Louvain, 1970.

Visiting professor, Universität Heidelberg, 1970; Hebrew University of Jerusalem, 1970; University of California, Berkeley, 1971; Universität Bielefeld, 1972; University of California, 1972–1975; Cornell University, 1978; Stanford University, 1979; Harvard Business School, 1981; Universität Bielefeld, 1983; University of California, Los Angeles, 1984; leading professor of economics and of applied mathematics, S.U.N.Y. at Stony Brook, 1989–1992.

Mathematical economics and game theory.

Fellow of the Econometric Society; past editor, *Journal of Mathematical Economics*; *International Journal of Game Theory* and *Economic Theory.*



Michel MOUCHART

Professor, Université catholique de Louvain.

Docteur en sciences économiques, Université catholique de Louvain, 1973.

International professor CIENES, Santiago, Chili, 1966–1967; visiting professor, University of Chili, 1967–1968 and 1994–1996; University College, London, 1976; Université de Strasbourg, 1981; Indian Statistical Institute, 1982; Université d'Aix-Marseille, 1982; Università di Bologna, 1984; Carnegie-Mellon University, 1985; Université des

Sciences Sociales de Toulouse, 1991–1993; Université de Paris I (Panthéon-Sorbonne), 1993–1994.
Statistics and econometrics.
Member of the International Statistical Institute, Bernouilli Society, Econometric Society, International Society of Bayesian Analysis, Société Belge de Statistique.

Yurii NESTEROV
Professor, Université catholique de Louvain.
Doctor in applied mathematics, Institute of Control Sciences, Moscow.
Research associate, Central Economic and Mathematical Institute of the Russian Academy of Science, Moscow, 1977– ; visiting professor, Université de Genève, 1992–1993.
Numerical analysis, static and dynamic transportation networks, equilibrium in economical models.

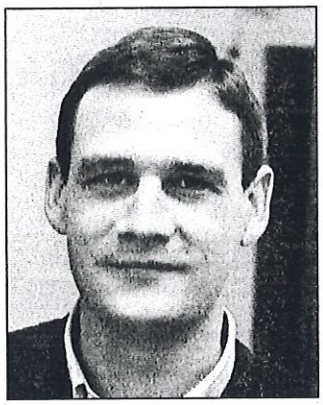
José PARIS
Professor, Université catholique de Louvain.
Docteur en sciences, Université catholique de Louvain, 1961.
Aspirant Fonds national de la recherche scientifique, 1958–1961.
Statistics and actuarial sciences.
Member of the International Statistical Institute and of the International Actuarial Association; editor, *ACTU-ERE*.

Dominique PEETERS

Chargé de cours, Université catholique de Louvain.
Docteur en sciences appliquées, Université catholique de Louvain, 1980.
Post-doctoral fellowship, McMaster University, Hamilton, Ontario, 1982; visiting professor, Université du Québec, Montréal, 1986; Université de Bourgogne, 1991; Université de Tsukuba, 1996–1997.
Location theory, economic geography, regional science, mathematical programming, operations research.

Pierre PESTIEAU

Professor, Université de Liège.
Ph.D. (economics), Yale University, 1971.
Assistant professor, Cornell University, 1971–1976; visiting professor, Université Paris X (Nanterre), 1991– .
Population economics and public economics.
Associate editor, *European Journal of Political Economy*, *Public Finance/Finances Publiques*, *Journal of Population Economics* and Economica; co-editor, *Journal of Public Economics* and *Empirica*.



Yves POCHET

Professor, Université catholique de Louvain; co-director of CORE, 1992– .
Docteur en sciences appliquées (recherche opérationnelle), Université catholique de Louvain, 1987.
Operations research: mathematical programming, polyhedral combinatorics, production planning and sequencing.
Administrator of the Belgian Operations Research Society (SOGESCI-BVWB), 1989– .

Heracles POLEMARCHAKIS
Professor, Université catholique de Louvain.
Ph.D. (economics), Harvard University, 1977.
Professor, Columbia University, 1978–1990.
Economic theory.
Co-editor, *Journal of Mathematical Economics.*

Jean-Marie ROLIN
Professor, Université catholique de Louvain.
Ph.D. (mathematics), University of California at San Diego, 1973.
Research associate, McGill University, 1973–1974; Facultés universitaires Notre-Dame de la Paix, Namur, 1975–1976; visiting lecturer, Facultés universitaires Saint-Louis, Bruxelles, 1983–1984 and 1984–1985.
Statistics and probability.

Aldo RUSTICHINI
Professor, Université catholique de Louvain.
Doctor in mathematics, University of Minnesota, 1987. Postdoctoral position at AT & T Bell Laboratories, 1987–1989; assistant professor, University of Wisconsin, 1987–1988; Northwestern University, 1989–1992; New York University, 1992–1993.
Economic dynamics and macroeconomics, general equilibrium theory, game theory, models of bounded rationality.
Associate editor, *Journal of Economic Theory* and *Journal of Mathematical Economics.*

Léopold SIMAR

Professor, Université catholique de Louvain and Facultés Universitaires Saint-Louis; Chairman, Institut de statistique, Université catholique de Louvain (1992–).

Docteur en sciences appliquées, Université catholique de Louvain, 1974.

Visiting professor, Cornell University, 1975.

Mathematical statistics and econometrics.

Yves SMEERS

Professor, Université catholique de Louvain.

Master of Science (industrial administration) and Ph.D. (operations research), Carnegie-Mellon University, 1972.

Computational economics in network based industries.

Honorary research fellow at the Centre for Petroleum and Mineral Law Policy at the University of Dundee; editor at large, *Interfaces*; European editor, *Energy Journal*; associate editor, *Energy Economics*; member of the editorial committee of RAIRO (operations research).

Frans SPINNEWYN

Professor, Katholieke Universiteit Leuven.

Ph.D. (economics), London School of Economics, 1975.

Chercheur qualifié, Nationaal Fonds voor Wetenschappelijk Onderzoek, 1977–1979; assistant, Katholieke Universiteit Leuven, 1979–1983; visiting professor, Cornell University, 1985.

Microeconomics.

B.A.C. prize, 1976.

Jacques THISSE

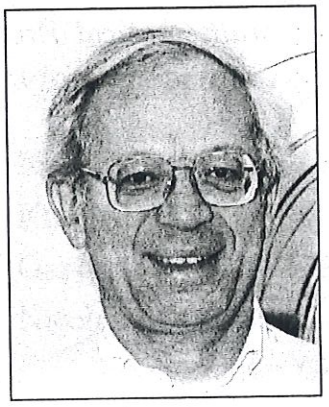
Professor, Université catholique de Louvain.

Docteur en sciences économiques, Université de Liège, 1975.

Visiting professor, McMaster University, 1981; University of Pennsylvania, 1985; INSEAD, 1987; Virginia Polytechnic Institute, 1990; Université de Paris I (Panthéon-Sorbonne), 1991–1996.

Industrial economics and economic geography.

Fellow of the Econometric Society; associate editor, *Annales d'économie et de statistique*, *Japanese Economic Review*, *Journal of Regional Science*, *Journal of Industrial Economics*, *Journal of Economics and Management Strategy* and *Regional Science and Urban Economics*.



Henry TULKENS

Professor, Université catholique de Louvain and Facultés universitaires Saint-Louis.

Dr. jur., KUL, 1960; Docteur en sciences économiques, Université catholique de Louvain, 1968.

Visiting professor, Université d'Aix-Marseille II, 1971; Université libre de Bruxelles, 1971–1972 and 1973–1974; Princeton University, 1973; Stanford University, 1973; Hebrew University of Jerusalem, 1976; Université Laval, 1977; Université de Paris XII, 1978; Stanford University, 1979; Princeton University, 1983; Université de Montréal, 1985; Beijer Institute of Ecological Economics, Stockholm, 1992, 1993; Fondazione ENI Enrico Mattei, Milan, 1993; Ecole Nationale de la Statistique et de l'Administration Economique, Paris, 1995.

Economic theory and public finance.

Dean, Faculté des sciences économiques, sociales et politiques, Facultés universitaires Saint-Louis, 1970–1974; president, Institut des sciences économiques, Université catholique de Louvain, 1978–1981; president, Institut belge de finances publiques; vice-president, International Institute of Public Finance;

chairman of the Commission de l'Environnement, Université catholique de Louvain; associate editor, *Journal of Productivity Analysis*, *International Tax and Public Finance*.

Laurence WOLSEY
Professor, Université catholique de Louvain.
Ph.D. (mathematics), Massachusetts Institute of Technology, 1969.
Visiting researcher, Manchester Business School, 1969–1971; London School of Economics, 1978–1979; Cornell University, 1983; visiting professor, Ecole polytechnique de Lausanne, 1986–1987.
Operational research and applied mathematics.
Administrator at SOGESCI; member of the Council of the Mathematical Programming Society, 1976–1979; past associate editor, *Operations Research Letters*; and co-editor, *Mathematical Programming*.

Administrative Staff

Martine BECKERS
Mady de DECKER
Fabienne DELBROUCK
Micheline DELIZE
Jeanine DE RIJCKE
Sabine FRASELLE
Catherine GERMAIN
Alain GILLIS
Marlène GLINSCHI
Anne HENRI
Fabienne HENRY
Geneviève LECLERCQ
Jean-Michel LECLERCQ
Guy LOUIS
Sylvie MAUROY
Sheila WEYERS

Researchers and Doctoral Students[1]

Gian-Luigi ALBANO
Gaëtan BELVAUX
Stefano BOSI
Chrissopighi BRAILA
Riccardo CALCAGNO
Emmanuel CANON

[1]The persons marked with a star hold a Ph.D.

Cécile CORDIER
Renaud CORNELIS
Sergio CURRARINI
Olivier DAXHELET
Olivier DE WOLF
Paola DONATI
Patricio ESPINOSA
Pierre GIOT
Lisa GRAZZINI
Frédéric JONARD
Nikolaos KIKIDIS
Thierry LEBOULENGE
Bernard LEJEUNE
Philippe LIEGEOIS
Mingxing LIN
Marko LOPARIC
Stefano LOVO
Francesco MAGRIS
Ginamarco OTTAVIANO
Oliver PADDISON
Costas PAPADOPOULOS
Anthony PAVLOPOULOS
Matteo SALTO
Alessandro TURRINI
Philippe VANDEN EECKAUT*
Tanguy VAN YPERSELE*
Claude WAMPACH
Jing-Yuan WEI*

Visiting Faculty Members and Research Fellows[2]

Knud ANDERSEN, Odense University.
Kurt ANSTREICHER**, University of Iowa.
Gaetano BLOISE, European University Institute, Firenze, Italy.
Nicolas BOCCARD, Ecole Nationale de la Statistique et de l'Administration Economique, Paris.
Jean-Michel COULOMB, Université de Paris X (Nanterre).
Illias DEDOPOULOS, Imperial College, London.
Bernard de MEYER, Faculté des Sciences, Université catholique de Louvain.
Florence GOFFETTE-NAGOT, Université de Bourgogne.
Jean-Michel GRANDMONT, CEPREMAP, Paris.
Isabel GRILO, Institut d'Administration et de Gestion, Université catholique de Louvain, and GREMARS, Université de Lille III.
Christian HAFNER**, Humbold-Universität zu Berlin.
Jens Leth HOUGAARD, The Royal Veterinarian and Agricultural University, Copenhagen.
Frédéric JOUNEAU, Université de Lille III.

[2]The persons marked with a double star held a CORE fellowship.

Paulo KLINGER MONTEIRO**, Instituto de Matematica Pura e Aplicada, Rio de Janeiro.

Vasiliki KOUBI, University of Georgia, Athens.

François LOUVEAUX, Facultés universitaires Notre-Dame de la Paix, Namur.

Massimo MORELLI, Harvard University.

José NINO-MORA**, Massachusetts Institute of Technology.

Jim RENEGAR, Cornell University.

Jonathan SHALEV**, Tel-Aviv University.

Domenico SINISCALCO, Universita di Torino, and Fondazione ENI Enrico Mattei.

Jean-Pierre VANDEUREN, Département de mathématique, Université catholique de Louvain.

Herman VAN DIJK, Erasmus Universiteit Rotterdam.

Kees Jan VAN GARDEREN, University of Southampton.

Steven WEI**, University of Toronto.

Short Term Visitors

In addition to the longer stays of the visiting faculty and research fellows, CORE benefitted from the visits of a number of scholars whose stays ranged from a few days to a few weeks. Among them,

Dirk ALBOTT, Paderborn University.

Tahar ABDESSALEM, Université de Tunis III.

Rabah AMIR, Wissenschaftszentrum Berlin.

Robin BOADWAY, Queen's University.

Giulio CODOGNATO, Universita degli Studi di Udine.

Miguel CONSTANTINO, Universidade de Lisboa.

Gérard CORNUEJOLS, Carnegie Mellon University.

Hervé CRES, Kobenhaven Universiteit.

Cid de SOUZA, Universidade Estadual de Campinas.

Amrita DHILLON, Cambridge University.

Adel DHIE, Université de Tunis III.

Rodolph DOS SANTOS FERREIRA, Université de Strasbourg.

Moshe DROR, Ecole Centrale de Paris and University of Arizona.

Ivar EKELAND, Université de Paris IX (Dauphine).

Hélène FERRER, Université de Caen.

Louis-André GÉRARD-VARET, GREQAM, Ecole des Hautes Etudes en Sciences Sociales, Marseille.

Sayantan GHOSAL, Queen Mary and Westfield College, London.

Kevin GLAZEBROOK, University of New Castle.

Sergiu HART, Hebrew University of Jerusalem.

Thomas HECKELEI, Bonn Universität.

Jean-Jacques HERINGS, Universiteit Tilburg.

Grant HILLIER, University of Southampton.

Moshe JUSTMAN, Ben-Gurion University, Israel.

Ali KHAN, John Hopkins University, Baltimore.

Maureen KILKENNY, Iowa State University.

Jon LEE, University of Kentucky.

Anat LERNER, Tel Aviv University.

Michel LUBRANO, Ecole des Hautes Etudes en Sciences Sociales, Marseille.

Marc MACHINA, University of California at San Diego.

Nicolas MARCEAU, Université du Québec à Montréal.

Nour MEDDAHI, GREMAQ, Université des Sciences Sociales, Toulouse.

Philippe MICHEL, GREQAM, Ecole des Hautes Etudes en Sciences Sociales, Marseille.

Enrico MINELLI, Universita di Brescia.

Michael NEWTON, University of Wisconsin-Madison.

Costas PANTELIDES, Imperial College of Science, Technology and Medicine, London.

Pedro PEDROSO, Tokyo University of Mercantile Marine.

Tito PIETRA, Universita degli Studi di Modena.

Ben POLAK, Yale University and London School of Economics.

Eric RENAULT, GREMAQ, Université des Sciences Sociales, Toulouse, et Institut Universitaire de France.

Juan RODRIGUEZ POO, Universidad de Cantabira, Santander.

Cinzia ROVESTI, Ufficio Problemi della Concorrenza, Autorita Garante della Concorrenza a del Mercato, Roma.

Amlan ROY, Queen Mary & Westfield College.

Dov SAMET, Tel Aviv University.

Marcia SCHAFGANS, London School of Economics.

Tomas SJÖSTRÖM, Harvard University.

Sébastien STEINMETZ, Ecole Polytechnique, Paris.
Benyamin SHITOVITZ, University of Haifa.
Mohamed SOUISSI, Ecole Mohammadia d'ingénieurs, Rabat.
François VANDERBECK, University of Cambridge.
Jean-Philippe VIAL, Université de Genève.
Marianne VIGNEAULT, University of Bishops.
Yaoguang WANG, Max-Planck-Institut für Informatik, Saarbrücken.
Robert WEISMANTEL, Konrad-Zuse-Zentrum für Informationstechnik Berlin.
Paul WILSON, University of Texas.
Jean-Michel ZAKOIAN, Centre de Recherche en Economie et Statistique, Paris.
Yves ZENOU, Université Panthéon-Assas.

1.3 Visitors for 1997–1998

The following visiting faculty members and research fellows will be in residence for all or part of the 1997–98 academic year.

Luca ANDERLINI, University of Cambridge.
Parkash CHANDER, Indian Statistical Institute.
Philippe CHEVALIER, Institut d'Administration et de Gestion, UCL.
Hélène FERRER, Université de Caen.
Masahisa FUJITA, Kyoto University.
Fabrizio GERMANO, Université de Lausanne.
Olivier GOSSNER, Université Paris-Dauphine.
Sougata PODDAR, University of Copenhagen.
Jonathan SHALEV, Tel-Aviv University.
Jean-Philippe VIAL, Université de Genève.

1.4 Sabbatical leaves

- Victor GINSBURGH spent part of his sabbatical year at the University of Chicago from September to December 1996.

- Dominique PEETERS spent his sabbatical year at the Institute of Policy and Planning Sciences at the University of Tsukuba in Japan.

- Yves POCHET also in sabbatic this year concentrated his work on an Esprit project.

- Heracles POLEMARCHAKIS visited various places throughout his sabbatical year, and most particularly the Cowles Foundation at Yale University from September to December 1996 and the Department of Economics of Universität Bonn from April to July 1997.

2 Research Activities

The first part of this section lists all contributions realized during the period covered by this report. Three major areas of research are distinguished: Operations Research, Economic Theory (including Decision and Game Theory) and Econometrics. The second subsection discusses ongoing research projects at CORE that are sponsored by outside agencies in the form of grants and contracts. The third subsection reviews European supports to young researchers (doctoral and post-doctoral).

2.1 CORE Discussion Papers

Over the period covered by this report a total of 81 discussion papers were written at CORE. Of these 81 papers (53 in Economic Theory, 17 in Operations Research and 11 in Econometrics), 51 were written by more than one author. All abstracts are listed in the appendix of this report.

2.1.1 Operations Research

Themes in Operations Research over the period were

1. pricing in electricity markets
2. interior point methods
3. discrete optimization
4. miscellany (queuing methods)

1. Pricing and Electricity Markets

In (9717) and (9726), Smeers and Wei investigate spatially oligopolistic models with opportunity cost pricing for transmission capacity reservations by looking at an unbundled electricity supply industry. In each of the papers two markets are investigated. Of these two markets one supplies electricity, the other transmission capacity reservations; the former is assumed to be an oligopoly, the latter a regulated natural monopoly. As both markets must be simultaneously in their own equilibrium, i.e. a Nash equilibrium in the first, a market-clearing one in the second, the strong interaction of the behaviour of the two markets requires a new concept of equilibrium. Using a simulation in (9717), a 3-bus example is presented in (9726) to show the main result of the model. In (9739) Smeers and Wei simulate the long run electricity market in a spatial

competition model with regulated transportation prices that has competition in both quantity and quality. The variational inequality approach, as in (9717), is used to compute the equilibria of the model.

2. Interior Point Methods

2.1. Theory

Anstreicher considers in (9740) a volumetric cutting plane method for convex programming, in particular for finding a point in a convex set and proves polynomality of the algorithm. In (9745) Anstreicher deals with ellipsoidal approximations of convex sets based on the volumetric barrier and uses a new characterisation of circumscribing ellipsoids centred at, or near, the volumetric centre of a polyhedral set and in (9746) he shows that the complexity to solve linear programming problems using standard linear algebra, can be reduced to $O([n3/lnn]L)$ operations, where n is the number of variables in a standard form problem with integer data of bit size L.

Several "infeasible-start" path-following and potential-reduction primal-dual interior-point methods for non-linear conic problems are presented by Nesterov, Todd and Ye in (9637). The three authors try to find a recession direction of the feasible set of a self-dual homogeneous primal-dual problem and prove that strict infeasibility (primal or dual) can be detected in $O\sqrt{\nu}\ln\frac{\nu}{\rho}$ iterations, where ρ is a primal or dual infeasibility measure and v the parameter of a selfconcordant barrier for the cone.

2.2. Application

In a joint paper with Fampa, Lee and Williams (9729), Anstreicher uses continuous non-linear relaxations to solve constrained maximum-entropy sampling problems. The authors show that the performance of their new non-linear relaxation on test problems is far superior to a previous implementation using an eigenvalue-based relaxation. Furthermore, parallel implementation of their algorithm successfully solves problem instances which were heretofore intractable.

2.3. Software

Finally, the APOS linear programming (LP) solver intended for solution of large-scale sparse LP problems is presented in (9730) by Andersen and Andersen. The solver is based on the homogeneous interior-point algorithm, employs advanced (parallelized) linear algebra, handles dense columns in the constraint

matrix efficiently and has a basis identification procedure as well as can be incorporated into XPRESS-MP. Computational results are reported.

3. Discrete Optimisation

3.1. Theory

In (9720), Marchand and Wolsey study the 0-1 knapsack problem with a single continuous variable. They derive valid inequalities that can be used as cuts for these sets as well as for more general mixed 0-1 constraint, where existing knapsack separation routines cannot be used, i.e. constraints containing mainly 0-1 variables and one or a small number of continuous variables. Lee provides a recipe in (9725) for constructing an orientation for matroids representable over both GF[3] and GF[5].

3.2. Heuristic Analysis and Algorithms

Wang considers in (9658) the single job sequence problem with release dates and aims at investigating efficient and effective approximation algorithms with a bicriteria performance guarantee. He presents a new $O(n \log n)$ algorithm with the sought after performance guarantee and also shows the randomised and derandomised bicriteria performance guarantee of an approximation version of an algorithm introduced by Goemans.

Pedroso Ramos Dos Santos is interested in Niche search and evolutionary optimisation and introduces in (9662) evolutionary algorithms and their biological background as well as presents a survey of the most important evolutionary schemes found in the literature. Niche search, an evolutionary search that he has designed and implemented, is a search on two layers. The numerical results obtained by the search which is not directed (i.e. individuals and niches evolve based on the selection of the fittest) are promising as the computational performance is considerably better than that of other algorithms analysed in the literature.

3.3. Analysis of Semi-Definite Relaxation

Nesterov looks at the quality of semidefinite relaxation for non-convex quadratic optimization. Whereas in (9730) only Boolean quadratic maximization is considered, (9744) looks at global optimization. Nesterov proves that in some cases the relaxation provides a fixed absolute (9730) and constant relative (9744) accuracy estimate for the exact solution.

3.4. Network Design

Brockmüller, Günlük and Wolsey (9647) study a capacitated network design problem arising in the design of private line networks in (9647). Under the objective to install capacity on the edges and route traffic in the resulting capacitated network, they present computational results with branch-and-bound and branch-and-cut so that a) all the demand between a pair of nodes is routed along a single path and b) the demand is either sent directly from source to sink, or via a number of hub nodes.

4. Miscellany

4.1. Queuing

Glazebrook and Nino-Mora address the problem of scheduling a multiclass queuing network on M parallel servers so as to minimise the time-average holding cost. They analyse a heuristic index rule based on Klimovís solution to the single-server model and present closed-form performance guarantees for this heuristic with respect to a) the optimal cost in the original parallel-servers network and b) the optimal cost in a "corresponding" single-server network attended by a server working M times faster.

2.1.2 Economic Theory

The papers in Economic Theory can, this year, be broadly split up into 3 different branches: decision and game theory, imperfect competition, industrial organization and the labour market, social organization and public economics.

1. Decision and Game Theory

Shalev looks at the problem of loss aversion. In (9706) he extends Nash's axioms to define a solution for bargaining problems that take loss aversion into account and using this solution concept he finds a unique solution that is predicted to be observed in steady state. Using a strategic non-cooperative approach as well as a dynamic approach he finds convergence to a steady state solution even under weak assumptions. In (9723) Shalev shows that an increase in loss aversion of one player can affect his and other player's payoffs in different directions. This is done by extending strategic form games so as to include loss aversion, by showing the existence of loss-aversion equilibrium for any extended game, comparing it to Nash equilibrium and looking at the comparative statics.

Vannetelbosch looks at N-equilibrium sequential bargaining in two papers. In (9641) he shows that if exiting the game with partial agreements is not allowed the non-equilibrium approach of the bargaining game is only solvable by a refinement of rationalisability for multi-stage games if the players are sufficiently impatient. In (9642) a negotiation model wherein a simultaneous voting game endogenizing the choice of the bargaining procedure is introduced, i.e. before the bargaining commences negotiation takes place as to what procedure (clockwise or anticlockwise) with exit will be adopted during the bargaining. Although the anticlockwise procedure leads to a less fair bargaining outcome, the more patient players are the more likely it is that it will be the outcome of the voting game. In (9702), a joint paper with Herings, Vannetelbosch refines rationalizablilty for normal-form games. As the three main refinements that have been proposed in the literature (these being cautious, perfect and proper rationalizability) suffer from several drawbacks, Vannetelbosch and Herings introduce the "trembling-hand" rationalizability concept: players' actions also have to be best responses against perturbed conjectures. The authors also propose the weakly perfect rationalizability refinement. The relationship between any two refinements is then given in examples.

Chen, Friedman and Thisse take a probabilistic choice approach to the boundedly rational Nash equilibrium. They propose an equilibrium concept in (9644) for n-person finite games based on boundedly rational decision making by players. They show existence of equilibrium and convergence to Nash equilibrium and identify conditions such that, for given rationality parameters, the path of choices over time when the players use fictitious play converges to equilibrium.

In (9635), De Meyer completes Mertens and Zamir's proof by justifying the appearance of the normal density as a consequence of a generalisation of the central limit theorem. Two further papers written by De Meyer look at Brownian games: (9715) extends the analysis of the dual bounds for Brownian games undertaken in (9714) by proving that the second player's optimal strategy is unique; he also looks at regularity issues.

Morelli provides a co-operative solution as well as a non-cooperative analysis to study coalition formation and payoff distribution in weighted majority games (9735). A new co-operative solution concept is proposed — the Anonymous Core — which keeps the spirit of Core-like competition but is non-empty and precisely characterised for every vector of weights. He also introduces a non-

cooperative coalitional bargaining game which resembles the rules of the game describing the formation of coalitional governments, obtains an algorithm for the computation of all the symmetrical Markov Subgame Perfect Equilibria of such a game and shows that the set of such equilibria has a one-to-one correspondence with the Anonymous Core for homogeneous weighted majority games.

Weyers presents results on communication and common knowledge without differentiating counterfactuals in a group with a learning mechanism which is less demanding than the one most commonly used in the existing literature. The paper (9656) also examines the case of pairwise communication in a group of n individuals and discusses the difficulty of using the presented learning mechanism for pairwise communication.

Khan and Sun argue in (9712) that Loeb measure spaces can be effectively and systematically used for the analysis of game-theoretic situations by constructing Loeb measure spaces on the basis of sequences and showing that they satisfy many useful properties, including regularity properties of correspondences involving distribution and integration. In (9738) they show that the main theorem in Al-Najjar's 1995 *Econometrica* paper is false and provide additional references for the residual implications that are valid.

2. Imperfect Competition, Industrial Organization and the Labour Market

Poddar investigates the issue of capacity and entry deterrence in two papers. A two period model with an incumbent firm and a potential entrant is considered in each of them. In (9708), demand uncertainty is assumed, in (9709) it is asymmetric information on demand. In (9708) the question asked is: How by choosing capacity at an earlier period of actual production of output and, more importantly, not knowing which state of demand is going to realise as well as knowing that there is a potential entrant, can the incumbent firm influence the outcome of the game by changing its initial condition ? The results are compared to the demand certainty case. As an extension, in (9709) the information regarding the demand is asymmetric: the incumbent possesses private information concerning the state of demand while the entrant only knows the probability distribution. Thus, the incumbent can convey information to the potential entrant regarding the state of demand if the cost structure of the former is common knowledge.

Jellal, Thisse and Zenou also model demand uncertainty in (9733). They show that with a finite number of firms competing for heterogeneous workers, unemployment may arise in equilibrium because of uncertainty on product-demand and job-mismatch if the variance of the demand shock is large and/or the cost of the mismatch is "sufficiently" high. Under free-entry, full employment always prevails, thus unemployment may persist as long as the incumbent firms choose their skill requirements to protect their supranormal profits.

Klinger Monteiro and Page (9711) demonstrate the existence of an optimal individually rational and incentive compatible selling mechanism for a multi-product monopolist facing a market populated by consumers with budget constraints. In (9742) Klinger Monteiro proves the existence of the optimal-pay auction when signals are correlated and in (9743) Klinger Monteiro and Páscoa discuss the issue whether the local uniqueness (relative to the L^∞ topology) may be a generic property of equilibria in incomplete markets economies with a continuum of states — an issue raised by Mas-Colell in 1991.

Over the time period, three papers looked at human capital: (9707), (9722) and (9724). In (9707), Turrini investigates the fact that although it is widely recognised that human capital formation through education should be strengthened in the presence of increasing wage differentials, the extent on which this is currently occurring is not satisfactory. To do so, he shows an example where technology and terms-of-trade shocks that enhance the wage differential aggravate the underinvestment in public education arising from majority voting, thus leading to an undesirable outcome - both in terms of efficiency and equity. In (9722) Hamilton, Thisse and Zenou take a look at skill acquisition and wage competition with heterogeneous workers and firms. They solve their model for symmetric free-entry Nash equilibria of the wage-offer game under two different information structures and consider different tax instruments to increase allocative efficiency and to finance investment in general human capital. Finally, Justman and Thisse show that the disparity between the centralised output-maximising allocation of resources to education and the decentralised equilibria arising when labour is inter-jurisdictionally mobile and public funding of higher education is sub-federal can be alleviated through inter-jurisdictional subsidies of local education expenditures based on net migration flows (9724).

Similar to (9722), in (9705) Wauthy and Zenou also focus on the joint role of workers' heterogeneity and imperfect competition in the endogenous formation of labour market equilibria. They show that imperfect competition leads to

higher unemployment and a misallocation of workers. Amir and Wooders show that a priori identical firms in a two-period duopoly characterised by a one-way spillover structure in process R&D will always engage in different levels of R&D. Thus, (9727) gives rise to endogenous innovator/imitator roles and also provides a general analysis of the social benefits of, and firms' incentive for, forming research joint ventures.

Strategic investment is studied by Perrez in a general equilibrium model where oligopolists take decisions sequentially (9634). As firms have a linear technology and invest less as competition intensifies, in a situation of unemployment output, employment and well being increase with competition.

Samartin models information induced and "pure-panic" runs in an environment of risk-averse agents in (9643). Then conditions are presented to assure that bank-runs as an equilibrium phenomenon are derived as well as a welfare analysis of two devices that have traditionally been used by banks in order to prevent runs.

Anderson, Palma and Thisse ask what happens when a public firm is privatised and has to compete against private ones. As in the short run privatisation is harmful (the disciplinary role of the firm is lost), yet beneficial in the long run (further entry), (9645) shows that a sufficient statistic for the social surplus to be higher in the long run is that the public firm makes a loss, which suggests that profitable firms should not necessarily be privatised.

Six papers look at pricing: (9650), (9659), (9666), (9732), (9734), (9736).

From a market game point of view, Mertens (9650) extends the double-auction mechanism to a mmulti-commodity set-up. In industrial organization, the adoption of flexible manufacturing techniques by firms is shown to lead to a tougher price regime in (9659). However, Norman and Thisse also show that this deters entry and facilitates segmented market structures and thus need not benefit consumers. Yet, the ability of flexible manufacturing to deter entry is suggested, this leading to excessive product variety. In (9666) non-linear pricing is analysed by Hamilton and Thisse in a model of duopoly competition where firms are imperfectly informed about consumer locations. Consumers purchase a variable amount of a product from one of two firms located at the end points of the market. As at the Nash equilibrium consumers buy the same quantities as they would from the same firm if it were a monopolist facing the same informational asymmetries, no efficiency gains result from competition. However, if consumers have the option to reveal their locations and have firms

deliver the goods, all consumers will choose to do so in equilibrium; they have no incentive to do so if they however face a monopoly seller.

As the pleasure of consuming a good may be affected by the consumption choice of other consumers, Grilo, Shy and Thisse propose in (9732) to graft the consumption externality model onto the spatial duopoly model in order to be able to clarify the market and welfare implications of such a consumption externality.

A two-stage game in a model calibrated to the Italian car market (it being one of the most protected in Europe) is presented by Turrini in (9652) to evaluate ex ante trade policy effects taking into account the role of change in quality. This is done by endogenizing quality and aims at studying the impact quantitative restrictions on trade have on the average quality of exports.

Ginsburgh is concerned in (9734) with the observation that in multiple-item auctions of identical objects prices tend to decline over time. By illustration of a wine auction, he is able to explain why it is obvious that the auctioneer will sell the lots in decreasing order of valuation to satisfy bids. Finally, Martini and Rovesti compare different social institutions which fight against industry cartels on prices in an economic setting with asymmetric information and show in (9736) that private suits can be more effective than interventions of an Antitrust Authority in many instances.

In (9665) Brueckner, Thisse and Zenou present an amenity-based theory of location by income: depending on the city centre's amenity advantage (weak or strong), the rich are likely to live in the suburbs (or centre). Their model therefore ties location by income to a city's idiosyncratic characteristics and predicts a multiplicity of location patterns across cities.

Albano and Lizzeri model information revelation as a strategic variable of intermediaries — institutions that provide information about quality to buyers who cannot observe the quality of a product. They show in (9737) that efficiency is increased by the intermediary, however less quality is produced in equilibrium than under complete information.

3. Social Organization and Public Economics

Important themes in this area over the period seem to be issues related to equity and redistribution. Boccard, Van Ypersele and Wunsch analyse in (9651) the interaction between comparative advantages, social protection and the political system and conclude that redistributive policies can be either "exported" or

"imported" between symmetrical countries — which would point to the need of co-ordinating social policies. However, competitions from other countries could force a reduction in the exclusion from the labour market when the political process reduces to an insider-outsider story.

Dhillon and Mertens (9655) give an improved axiomatisation of relative utilitarianism.

In (9704) and (9741), Fleurbaey and Michel examine social orderings applied to infinite intergenerational consumption paths. To understand the general structure of extensions of the Ramsey criterion, the authors show how filters and ultrafilters can be used to construct orderings which meet as many axioms as possible. In (9667) altruism, voluntary contributions and neutrality is considered by Jouvet, Michel and Pestieau, by developing a model where production creates pollution and allowing for altruistic as well as non-altruistic consumers which both contribute voluntarily to the quality of the environment. Redistribution is shown to be neutral and a type-differential subsidy on contributions as well as a capital tax is shown to be needed to reach the optimal level of pollution. The same theme is taken up in (9741): Jouvet, Michel and Vidal look at intergenerational altruism and the environment and show that steady-state consumption can be a decreasing function of the intergenerational degree of altruism.

Belan, Michel and Pestieau show that in a setting of endogenous growth with positive externality the move from an unfunded to a funded social security system can be Pareto-improving (9657). Thus they overcome the welfare loss usually associated with such a move — as the transition generation would have to pay twice: first, saving for its own retirement and second, contributing to the pensions of the then retired generation. Social insurance if also the theme of (9661): Cremer and Pestieau take a political economy approach to social insurance and labour mobility and illustrate how the choice of social insurance systems resembles a prisoners dilemma type game if payroll tax competition is assumed between countries adopting different systems of social insurance. Tax competition of a different kind is at the heart of (9703). Bucovetsky, Marchand and Pestieau consider a federal country composed of local jurisdictions with differing taste for public goods which is private information. By transferring differential grants to jurisdictions the central government aims at both reducing the misallocation of capital and getting closer to the optimal balance between private and public consumption in every jurisdiction. At the optimum both

(some) misallocation of capital and (some) violation of the Samuelson rule in every jurisdiction is shown to exist. (9653) is in a similar spirit. Cremer and Pestieau study the design of redistributive policies between and within the member countries of an economic union. In a two-country set-up with imperfect information, the optimal incentive-compatible tax-transfer policy of the central government is derived and shown to imply a trade-off between inter- and intranational redistribution. As a result both insufficient as well as excessive redistribution can arise.

In (9654), Michel and Pestieau address the issue of optimum population by introducing a critical level of utility that depends on individual's marginal income. Thus, the absolute repugnant solution (that amounts to giving to an infinite number an infinitesimal amount) and the marginal repugnant solution (in which equilibrium consumption decreases with income) is avoided.

Mongin and d'Aspremont discuss the various technical constructions and philosophical interpretations of utility theory with a view of establishing its relevance to social ethics in (9663).

Germain, Toint and Tulkens use a game theoretic approach in (9701) to model financial transfers to ensure cooperative international optimality in stock pollutant abatement. New is that they deal with the issue of voluntary implementation of the international optimum in a dynamic context as well as deal with the fact that pollutants accumulate. In (9718), Germain and Toint propose a dynamic game theoretical approach of international negotiations on transboundary pollution.

Currarini extends Kaneko's analysis (1977) (which introduced the concept of ratio equilibrium for public goods economies and proved that the set of ratio equilibria coincides with the core of a strong voting game) to economies in which agents are partitioned in jurisdictions, each producing a specific public good (9664).

Turning to contracts, Wunsch relies on numerical methods in (9640) to estimate menus of linear contracts, as proposed by Laffont and Tirole (1986), for the regulation of firms in a framework with moral hazard and adverse selection. A general equilibrium, overlapping generations model of the principal-agent problem is introduced by Ghatak, Morelli and Sjöström (9728). Bargaining power, occupational choice and the returns to each occupation are endogenous. In a "high wage" equilibrium, an imperfect credit market mitigates the moral hazard problem on the labour market however co-ordination problems arise as multiple

equilibria exist, necessitating even high-earners to refer to credit markets.

In a framework of a two-sided incomplete information game, Bortolotti analyses the plea bargaining procedure — the viability of a stage of bargaining between prosecutor and defendant in criminal suits (9649).

2.1.3 Econometrics

The main focus of CORE's econometricians this year dealt with aspects of efficiency and/or productivity. Park, Sickles and Simar (9638) complement the results of Hausman and Taylor (1981) and Cornwell, Schmidt and Sickles (1990) as well as generalise Park and Simar (1994) by examining the semiparametric efficient estimation of panel models in which the random effects and the regressors have certain patterns of correlation. Their new estimator is illustrated by analysing the productive efficiency in the airline industry.

Kneip, Park and Simar (9639) investigate the consistency and speed of convergence of estimated efficiency scores - DEA (data envelopment analysis) estimators which are based on a finite sample of observed production units and are measured by their distance to an estimated (and unknown) production frontier, which is assumed to be concave and monotone. Having to distinguish between an output and input-oriented case, the speed of convergence is shown to rely on the smoothness of the unknown frontier as well as on the number of inputs and outputs. The authors show that the speed relies on the smoothness of the unknown frontier as well as on the number of inputs and outputs.

As the frontier is unknown, Gijbels, Mammen, Park and Simar (9731) propose an improved bias corrected estimator to the DEA estimator as the latter is a downwards biased estimator of the production frontier. This corrected estimator involves consistent estimation of the density function as well as of the second derivative of the production frontier. The authors illustrate the estimator with a real data example and discuss the construction of asymptotic confidence intervals.

Broze and Jouneau (9721) are also interested in production. They perform an estimation of a production function on a real data set after studying a new type of latent model in which only the rank statistics of the dependent variable are observed, and show that the proposed estimators behave nicely even in relatively small samples. Also, similar to (9731), as an extension to their earlier work (Simar and Wilson, 1996), Simar and Wilson (9660) deal with confidence intervals. In particular, they develop a consistent bootstrap estimation

procedure for obtaining the confidence intervals for Malmquist indices of productivity and their decomposition and give empirical examples using data on Swedish pharmacies.

In (9636), Triantis and Vanden Eeckaut attempt to merge the two concepts of fuzzy production plans, as proposed by fuzzy set theory, and the traditional assumption of deterministic (or crisp) production plans to define a new classification scheme based on fuzzy dominance. They investigate the implications of this on technical efficiency performance assessment. In (9713) a new and more general method to obtain qualitative information about returns to scale for individual observations is defined by Kerstens and Vanden Eeckaut; furthermore, a new and more general method for estimating returns to scale on nonparametric deterministic reference technologies that is suitable for all reference technologies is presented.

Three papers are methodological but seem to be unrelated to each other. Van Garderen (9648) derives exact expressions for the statistical curvature and related geometric quantities in first-order autoregressive (AR) models and gives the exact covariance matrix for the sufficient statistic. Bauwens and Giot (9716) review the application of Gibbs sampling to a cointegrated vector autoregressive (VAR) model. Using Gibbs sampling techniques to estimate the cointegrating relations and their weights in the VAR system from a Bayesian perspective, they are able to gain insight into convergence issues. Finally, Härdle and Hafner (9747) extend the Garch option pricing model of Duan (1995) to more flexible volatility estimation and show that out-of-the-money options strongly depend on volatility features such as asymmetry. Interestingly, their simulated threshold Garch option prices are substantially closer to observed market prices than the Black-Scholes and simulated Garch prices.

The remaining paper is concerned by consumer demand. Indeed the purpose of Evstigneev, Hildenbrand and Jerison in (9646) is to examine the metonymy hypothesis in more detail — an assumption that aids to justify the conclusion that cross section consumer expenditure data can be used to make conclusions about consumer demand behaviour and that was stated by Härdle, Hildenbrand and Jerison.

2.2 Research Projects under Contracts

A. Equilibrium Theory for Economic Policy (Contract PAI n° P4/01)

The Federal Administration for Scientific, Technical and Cultural Affairs (SSTC/DWTC) has renewed the important research contract that was granted from 1990 to 1996, for a new period of five years (Phase IV). CORE is the "Attraction Pole" (Promotor: Claude d'ASPREMONT). The partners are IRES, the research center of the Economics Department at Université catholique de Louvain (Promotor for that part: Henri SNEESSENS), the CES, the research center of the Economics Department at the Katholieke Universiteit Leuven (Promotor for that part: Frans SPINNEWYN), and a group of researchers (from CEME, ECARE and DULBEA) at Université libre de Bruxelles (Promotor for that part: Victor GINSBURGH). The research and networking objectives, as well as the themes of research of this new program, are the following.

1. Research Objectives

Equilibrium theory is central to economic analysis. It is at the foundation of both the logical consistency of economic models and of their relevance to the understanding of socio-economic phenomena. The objective of the program is to advance further the integration of the two different approaches to equilibrium that have been developed in economics: the *general competitive approach*, stressing the role of prices and markets in coordinating the choices of many individuals with different characteristics, and the *strategic approach*, focusing upon the interactions between agents with divergent goals and upon the need for various institutional and contractual arrangements. Empirical investigations, and policy applications have made clear the need to integrate these two approaches. On the one hand, the institutional parcimoniousness of traditional general equilibrium theory should be overpassed. This is to integrate some elements of the intricate norms regulating the functioning of real markets, affected by time, uncertainty and the processing of information by agents having more or less market power. On the other hand, game-theoretic analyses of industrial organization and public regulation should be enriched by formal descriptions of prevailing contracts and institutions, taking into account more general interdependencies.

2. Partnership Objectives

The previous project has revealed strong complementarities between the different institutional partners. They are to be developed through various kinds of joint activities, collaborations and joint work:

- Young researchers hired on the contract to work in collaboration;
- Several international conferences, many regular workshops, seminars, informal meetings and discussions jointly organized;
- Multiple exchanges of visitors;
- Doctoral cooperation, including doctoral seminars and workshops, a program of advanced courses (creation of a Doctoral School), and the co-promotion of doctoral theses
- Grants provided to promote joint work between junior researchers of different teams.

3. Research Themes and Applications

First, general equilibrium models are to be extended in several directions: the formation of expectations, learning and bounded rationality, asymmetric information, and imperfect competition. The dynamics of such extensions are to be studied in overlapping generations (OLG) models. Second, the econometrics of dynamic models will be developed, with a particular emphasis on tools for the analysis of financial data. The use of simulation based inference methods will be explored. Non-parametric and semi-parametric methods will be applied to efficiency analysis, frontier models and duration analysis. Third, in optimization, the major goal is to develop algorithms adequate to deal with very large applied models. In non-linear optimization the development of interior point methods is to be pursued. Economic equilibrium models will be formulated as variational inequality problems and transformed into non-linear complementarity problems. Also, effort will be devoted to discrete optimization in order to deal with problems involving indivisibilities, such as telecommunications and network design, production planning and scheduling. Finally, a selected number of applied topics have been selected, where complementarities between the different teams is to be particularly fruitful:

- Agency problems in financial economics and the econometrics of financial markets;
- Unemployment and the regulation of the labour market;
- International agreements on environmental isssues;
- Regulatory mechanisms in health care;
- The functioning of particular auction markets;
- Oligopolistic competition and the regulation of network industries;
- Economic integration and federalism.

B. Projects on International Negotiations on Climate Change

Henry TULKENS, in collaboration with Claude d'ASPREMONT and Jean-Pascal VAN YPERSELE, a physicist and climatologist at the research unit ASTR at UCL, completed in October 1996 the research project financed by FDS (UCL) on two important issues of the post-Rio international negotiations on climate change, namely "joint implementation" and "adequacy of commitments". Marc GERMAIN was employed under this project. Intertemporal models of cooperations in transfrontier stocks pollutants control have been developed. A detailed report of the activities under this project is available from the promotor.

Since January 1997, the Services Fédéraux des Affaires Scientifiques, Techniques et Culturelles support a new project coordinated by Henry TULKENS. The research consists in establishing a research network between three academic research institutions in Belgium and one administration of the Belgian State: CORE – Université catholique de Louvain (Claude d'ASPREMONT), ASTR – Université catholique de Louvain (Jean-Pascal van YPERSELE), CES – Katholieke Universiteit Leuven (Stef PROOST) and the Bureau Fédéral du Plan (Nadine GOUZÉE). The network is devoted to the interdisciplinary study of decision making in matters relating to climate change. The common scientific language is the one of mathematical modeling: modeling of physical phenomena, modeling of economic relationships, and econometric modeling. Using the tools and methods of each of these disciplines (dynamical systems solved on discrete grids, dynamical optimisation and game theory, statistical estimation), the purpose is to formulate an economic-climatic model allowing one to define, characterize and compute greenhouse gases abatement policies at the world, European and Belgian levels. The results of the simulations are destined to serve as a reference for those who are in charge of participating, as representatives of this country, in world negotiations on the implementation of the Rio Framework Convention.

C. Research in Energy and Environment Modelling: Different Projects

CORE has developed a whole research program on energy modelling. This includes three projects financed by the European Commission, one project supported by GAZ de FRANCE and two others by ELECTRABEL.

In the framework of the PRIMES model developed by different teams for the European Commission, CORE undertook the construction of a model of decentralised electricity. PRIMES is a partial equilibrium model of the European energy system. It comprises different modules, one of them dealing with the electricity sector. The part of the project undertaken in CORE involves the development of this module to accommodate a representation of decentralised generation and storage. Decentralised electricity is a relatively new concept that can be described as follows. The development of transmission and distribution systems is becoming more and more difficult and costly. This leads to bottlenecks in the distribution of electricity in some locations and time periods. Small scale generation, storage and/or demand side capacities, located throughout the system, mainly at the distribution level can postpone or even eliminate these bottlenecks. The question addressed in the project is the development of a methodology for appraising investments in these small scale capacities. Modelling decentralised electricity system raises a whole lot of issues. These involve shear model size and integration of models of quite different nature. The adopted approach has been to construct a two level model. The higher level is a regionalised model of the central electricity system. It includes a set of different demand nodes and a representation of the network liking these nodes. Separate but similar models are considered for representing the local distribution systems at the different nodes of the model. These separate models encompass a representation of investments in decentralised plants. The interaction between the two levels of the model is of the optimisation/equilibrium type. Decisions are undertaken by the different regional systems in response to price signal transmitted by the centralised system. The optimisation framework corresponds to the old paradigm of a vertically integrated utility. The equilibrium framework is better adapted to the various paradigms of separation of function that develop with the liberalisation of the sector. During the period covered by this report, the structure of the model and an algorithmic framework have been constructed.

Two other projects financed by the European Commission have been concluded during the period covered by this report. A first study conducted with the Center for Legal Theory of the Faculty of Law involves the analysis of transit in the context of the Energy Charter Treaty. This treaty which is currently in the ratification process aims at liberalising investments in the former Soviet Union. One of its chapters deals with energy transit, a subject of considerable practical importance given the oil and gas reserves of these countries. Transit is also a particular form of access to networks hence the intellectual appeal of the subject. The analysis is of the institutional design type. It considers three different scenarios that differ by the development of institutions and/or legislation in the relevant countries. It then tries to assess the difficulties likely to be encountered in the development of transit. The first scenario does not suppose any particular institutional development; transit is only subject to the article of the ECT. The second scenario assumes a development of a competition law similar to EC law. Transit is then analysed with reference to the European case law. Finally the third scenario considers different forms of regulation similar to those discussed in the context of access to the network. The analysis revealed that although the ECT is a remarkable instrument, it remains rather soft in terms of its potential to induce transit.

Another project dealing with regulation and competition in network industries was also completed. The model focuses on telecommunication but most of the development can easily be transferred to other network industries. The work considers both network and final services, these latter being decomposed in captive (e.g. universal service) and competitive services. Different assumptions are made on the regulation of the network and captive services. Various assumptions are also made on the competitive part of the final service market. The project then proceeds to develop a set of (small) computable models for dealing with the broad range of situations encountered. From a mathematical programming point of view these models are of the complementarily, optimisation subject to complementarity constraints and nested complementarity type.

CORE also undertook a new project for GAZ de FRANCE. The work deals with gas networks and involves the development of various short and long run equilibrium models.

The Belgian utility ELECTRABEL continued its important support to different activities involving transport, risk management and imperfect competition in the electricity sector.

These different projects are headed by Yves SMEERS. Emmanuel CANON, Renaud CORNELIS, Olivier DAXHELET, Frédéric JONARD, and Jean-Michel LECLERCQ worked on these projects. Paul NIHOUL from the Center for Legal Theory was extensively involved in the ECT project.

Claude d'ASPREMONT, Jean J. GABSZEWICZ and Yves SMEERS coordinated a project on the economic analysis of new electricity systems. This project is supported by the Belgian utility ELECTRABEL. It is jointly conducted with the Laboratoire d'Econométrie of the Ecole Polytechnique in Paris and aims at organising joint workshops focusing on different aspects of the restructuring of the electricity industry. Two workshops were organised in the period under coverage. In addition Jean J. GABSZEWICZ from CORE and Claude HENRY from the Ecole Polytechnique gave seminars in ELECTRABEL in the context of this project.

D. Market Games and Imperfect Competition in General Equilibrium

The Fonds National de la Recherche Scientifique supported a research project headed by Jean GABSZEWICZ and Jean-François MERTENS. The purpose of this research contract consists in developing the study of strategic market games, in particular in their relationship with the study of imperfect competition in general equilibrium models. They examine the extent to which the results obtained in the strategic market games approach can be applied to the concept of Cournot-Walras equilibrium in the context of imperfect competition.

E. Econometric Inference Using Simulation Techniques

A Human Capital and Mobility project of the European Commission involving the Tinbergen Institut (Rotterdam), INSEE (Paris), GREQAM (Aix-Marseille), CORE (Louvain-la-Neuve), the Universidad Carlos III de Madrid, Nuffield College (Oxford) and the European University Institute (Firenze) is devoted to the study of econometric inference using simulation techniques. The project started on January 1, 1995 for a period of 36 months.

The coordinator of the project is Herman VAN DIJK (Tinbergen Institut). Luc BAUWENS is the representative for CORE.

The research was devoted to two themes: Bayesian inference on econometric models using the Gibbs sampler, and specification texts based on simulations for diffusion processes.

1. Bayesian inference using the Gibbs sampler. The research on this theme continues, with a focus on the design of convergence checks in the application of the Gibbs sampler. In applying the Gibbs sampler, one has to check whether the quantities estimated on the basis of a simulated sample (e.g., the posterior mean of a parameter) have been sufficiently well approximated for a given (Monte Carlo) sample size. One technique to establish convergence checks is to use techniques from time series analysis (e.g. spectral methods), since a sample drawn by the Gibbs sampler has properties of dependence analogous to time series. The method has been applied in the context of a cointegrated VAR. The results are given in CORE Discussion Paper 9716.

2. Diffusion processes are used for the specification of continuous time models, e.g. to estimate models for interest rates. Since data are observed in discrete time and the model is formulated in continuous time, estimation of the model is difficult. It relies on a simulation technique known as indirect inference. The purpose of the ongoing research, conducted by Laurence BROZE, Olivier SCAILLET and Jean-Michel ZAKOÏAN is to develop specification tests in this context. A paper is in preparation.

F. Dynamic Economies: Information, Fluctuations and Growth

Heracles POLEMARCHAKIS coordinated a Human Capital and Mobility network financed by the European Commission. It is a three year project which started in 1994 with the Department of Economics of the Athens University of Economics and Business, DELTA of the Ecole des Hautes Etudes en Sciences Sociales and the Ecole Normale Supérieure, and the Department of Economics of the Universities of Cambridge, Carlos III, Pompeu Fabra and Rome as partners. Work at CORE under this project focused on economies which extend over time, economies of overlapping generations in particular and the existence, determinacy and optimality of competitive equilibria and on the impact of monetary policy.

G. Model Enhanced Solution Methods for Integer Programming Software

The MEMIPS (ESPRIT) project involves five industrial partners: BASF, DASH, POWERGEN, TRACTEBEL, UNILEVER and one other research group from the

University of Buckingham. Cécile CORDIER has been working on the development of new branching strategies, while Gaëtan BELVAUX has been working on a production/distribution of one of the partners and the testing of new modelling objects. Yves POCHET has collaborated in model development with several partners, as well as in the conception of new modelling tools.

2.3 European Support for Young Researchers

A. The European Doctoral Program in Quantitative Economics

Another Human Capital and Mobility network is also headed by Heracles POLEMARCHAKIS. It is a three year project which started in 1995 with, as partners, the Department of Economics of the University of Bonn, the London School of Economics, DELTA of the Ecole des Hautes Etudes en Sciences Sociales and the Ecole Normale Supérieure and ENSAE as partners. The project provided fellowships for doctoral students and funded the mobility of students across the participating institutions.

B. Individual Fellowships

The following visitors, researchers or graduate students benefitted or will benefit from financial support of the European Commission under the Training and Mobility of Researchers Programme.

Research Fellows

Knud ANDERSEN has continued his work on interior point methods for convex programs with quadratic constraints, as well as the development of a new homogeneous algorithm for large sparse linear programs. Gaetano BLOISE worked on endogenous business cycles and market imperfections. Nicolas BOCCARD concentrated his work on mechanism design and application to the renegotiation of incomplete contratcs. Ilias DEDOPOULOS worked on integrating the supply of electricity from renewable technologies in decentralised electricity systems. Vasiliki KOUBI worked on the understanding of the development of military technology. Massimo MORELLI worked on coalition formation and distribution. José NINO-MORA has continued to develop the mathematical programming approach to stochastic scheduling problems for manufacturing systems. Jonathan SHALEV worked on loss aversion in repeated games. Kees Jan VAN GARDEREN worked on the implications and implementation of curved exponential models for estimation and inference in applied econometrics.

Doctoral Students

Stefano BOSI worked on interdependent preferences. Chrissopighi BRAILA worked on the theory of economic growth under uncertainty with particular emphasis on the role of the asset market. Sergio CURRARINI worked on domestic political stability and international cooperation in the production of a public good. Paola DONATI worked on the theory of monetary policy, with particular emphasis on the effects of interest rate policy on investment decisions and on the information revealed by prices. Lisa GRAZZINI focused her research on fiscal competition and optimal taxation under imperfect competition. Nikolaos KIKIDIS worked on (1) the investment decisions under uncertainty and an incomplete asset market; (2) the theory of incentive compatible allocations under asymmetric information and the theory of optimal contracts. Stefano LOVO worked on (1) the revelation of information in financial markets and (2) the specification of dynamic models. Costas PAPADOPOULOS focused his work on investment decisions under uncertainty and an incomplete asset market. Anthony PAVLOPOULOS completed his doctoral dissertation with essays on the theory of economic growth in multi-sector economies, the theory of aggregation, the theory of research and the design of experiments. Matteo SALTO continued his research on the determination of exchange rates. Alessandro TURRINI worked on the reciprocal effects of product quality on skilled work, and vice versa.

3 Publications

In this section we give the list of all published papers, first those in the CORE Reprint series, then all others, and the list of discussion papers or mimeos that are not in the CORE Discussion Paper series. Also included are the books edited by CORE members, editorial activities and the list of doctoral dissertations. CORE discussion papers already described in Section 2 are listed (with abstracts) in the appendix.

3.1 Published Papers (CORE Reprints)

The following Reprints were issued during the period covered by this report.

1212 Jack MINTZ and Henry TULKENS. Optimality properties of alternative systems of taxation of foreign capital income. *Journal of Public Economics*, 60 (3), 373–399, 1996.

1213 Jean-Pierre FLORENS, Denis FOUGÈRE and Michel MOUCHART. Duration models. In L. Mátyás and P. Sevestre (eds.), *The Econometrics of Panel Data. A Handbook of the Theory with Applications.* Second edition. Dordrecht, Kluwer Academic Publishers, 491–536, 1996.

1214 Jacqueline BOUCHER and Yves SMEERS. Optimal development planning of gas reserves. *Energy Economics*, 18, 25–47, 1996.

1215 Willem K. KLEIN HANEVELD, Leen STOUGIE and Maarten H. van der VLERK. An algorithm for the construction of convex hulls in simple integer recourse programming. *Annals of Operations Research*, 64, 67–81, 1996.

1216 Rodolphe DOS SANTOS FERREIRA and Jacques-François THISSE. Horizontal and vertical differentiation: The Launhardt model. *International Journal of Industrial Organization*, 14, 485–506, 1996.

1217 Marc GERMAIN, Philippe TOINT et Henry TULKENS. Calcul économique itératif et stratégique pour les négociations internationales sur les pluies acides entre la Finlande, la Russie et l'Estonie. *Annales d'économie et de statistique*, 43, 191–127, 1996.

1218 Helmuth CREMER, Maurice MARCHAND and Pierre PESTIEAU. Interregional redistribution through tax surcharge. *International Tax and Public Finance*, 3, 157–173, 1996.

1219 Robin BOADWAY, Nicolas MARCEAU and Maurice MARCHAND. Investment in education and the time inconsistency of redistributive tax policy. *Economica*, 63, 171–189, 1996.

1220 Robin BOADWAY, Nicolas MARCEAU and Maurice MARCHAND. Time-consistent subsidies to unlucky firms. *European Journal of Political Economy*, 11, 619–634, 1995.

1221 Bernard BENSAID and Robert J. GARY-BOBO. An exact formula for the Lion's share: A model of preplay negotiation. *Games and Economic Behavior*, 14, 44–89, 1996.

1222 Olivier CHANEL, Louis-André GÉRARD-VARET and Victor GINSBURGH. The relevance of hedonic price indices. The case of paintings. *Journal of Cultural Economics*, 20, 1–24, 1996.

1223 Albert DI VITTORIO et Victor GINSBURGH. Des enchères comme révélateurs du classement des vins. Les grands crus du Haut-Médoc. *Journal de la société de statistique de Paris*, 173 (2), 19–49, 1996.

1224 Alois KNEIP and Léopold SIMAR. A general framework for frontier estimation with panel data. *The Journal of Productivity Analysis*, 7, 187–212, 1996.

1225 Robin BOADWAY, Nicolas MARCEAU and Maurice MARCHAND. Issues in decentralizing the provision of education. *International Tax and Public Finance*, 3, 311–327, 1996.

1226 Léopold SIMAR. Aspects of statistical analysis in DEA-type frontier models. *The Journal of Productivity Analysis*, 7, 177–185, 1996.

1227 Rabah AMIR. Continuous stochastic games of capital accumulation with convex transitions. *Games and Economic Behavior*, 15, 111–131, 1996.

1228 Rabah AMIR. Cournot oligopoly and the theory of supermodular games. *Games and Economic Behavior*, 15, 132–148, 1996.

1229 Maurice MARCHAND, Philippe MICHEL and Pierre PESTIEAU. Intergenerational transfers in an endogenous growth model with fertility changes. *European Journal of Political Economy*, 12, 33–48, 1996.

1230 Jean J. GABSZEWICZ and Tanguy VAN YPERSELE. Social protection and political competition. *Journal of Public Economics*, 61, 193–208, 1996.

1231 Mario NAVA, Fred SCHROYEN and Maurice MARCHAND. Optimal fiscal and public expenditure policy in a two-class economy. *Journal of Public Economics*, 61, 119–137, 1996.

1232 Luc BAUWENS, Wolfgang POLASEK and Herman K. van DIJK. Editors' introduction. First riverboat conference on Bayesian econometrics and statistics. *Journal of Econometrics*, 75, 1–5, 1996.

1233 Vincent J. VANNETELBOSCH. Testing between alternative wage-employment bargaining models using Belgian aggregate data. *Labour Economics*, 3, 43–64, 1996.

1234 Philippe DESCHAMPS. Monte Carlo methodology for LM and LR autocorrelation tests in multivariate regression. *Annales d'économie et de statistique*, 43, 149–169, 1996.

1235 Helmuth CREMER and Pierre PESTIEAU. Redistributive taxation and social insurance. *International Tax and Public Finance*, 3, 281–295, 1996.

1236 Carlos E. FERREIRA, Alexander MARTIN, Cid C. de SOUZA, Robert WEISMANTEL and Laurence A. WOLSEY. Formulations and valid inequalities for the node capacitated graph partitioning problem. *Mathematical Programming*, 74, 247–266, 1996.

1237 Helmuth CREMER and Pierre PESTIEAU. Distributive implications of European integration. *European Economic Review*, 40, 747–757, 1996.

1238 Marc GERMAIN, Philippe TOINT and Henry TULKENS. International negotiations on acid rains in Northern Europe: A discrete time iterative process. In A. Xepapadeas (ed.), *Economic Policy for the Environment and Natural Resources*. Cheltenham, Edward Elgar, 217–236, 1996.

1239 Helmuth CREMER and Pierre PESTIEAU. Bequests as a heir "discipline device". *Journal of Population Economics*, 9, 405–414, 1996.

1240 Corinna CZUJACK, Renato FLÔRES Jr. and Victor GINSBURGH. On long-run price comovements between paintings and prints. In V. Ginsburgh and P.-M. Menger (eds.), *Economics of the Arts. Selected Essays.* Amsterdam, North-Holland, 85–112, 1996.

1241 Jacques-François THISSE. Science régionale et économie géographique: matériaux pour un rapprochement. *Revue d'économie régionale et urbaine*, 4, 673–694, 1996.

1242 François VANDERBECK and Laurence A. WOLSEY. An exact algorithm for IP column generation. *Operations Research Letters*, 19, 151–159, 1996.

1243 Indrajit RAY. Efficiency in correlated equilibrium. *Mathematical Social Sciences*, 32, 157–178, 1996.

1244 Jacques-François THISSE. Location theory: Introduction. In J.-F. Thisse, K.J. Button and P. Nijkamp (eds.), *Location Theory.* Cheltenham, Edward Elgar, xvii-xxxii, 1996.

1245 Gary KOOP, Jacek OSIEWALSKI and Mark F.J. STEEL. Bayesian efficiency analysis through individual effects: Hospital cost frontiers. *Journal of Econometrics*, 76, 77–105, 1997.

1246 Gary KOOP, Eduardo LEY, Jacek OSIEWALSKI and Mark F.J. STEEL. Bayesian analysis of long memory and persistence using ARFIMA models. *Journal of Econometrics*, 76, 149–169, 1997.

1247 James K. HO and Etienne LOUTE. On the degree of decomposition in linear programming. *Informatica*, 7 (3), 227–348, 1996.

1248 Hsiao-Chi CHEN, James W. FRIEDMAN and Jacques-François THISSE. Boundedly rational Nash equilibrium: A probabilistic choice approach. *Games and Economic Behavior*, 18, 32–54, 1997.

1249 Daniel DE WOLF and Yves SMEERS. Optimal dimensioning of pipe networks with application to gas transmission networks. *Operations Research*, 44 (4), 596–608, 1996.

1250 Masahisa FUJITA and Jacques-François THISSE. Economics of agglomeration. *Journal of the Japanese and International Economies*, 10, 339–378, 1996.

1251 Pierre HANSEN, Dominique PEETERS and Jacques-François THISSE. Facility location under zone pricing. *Journal of Regional Science*, 37 (1), 1–22, 1997.

1252 Marco MARINI. Property rights and market: Employee privatization as a cooperative bargaining process. *Economic Systems*, 20 (4), 273–303, 1996.

1253 Timothy VAN ZANDT. Continuous approximations in the study of hierarchies. *RAND Journal of Economics*, 26 (4), 575–591, 1995.

1254 Timothy VAN ZANDT. Hidden information acquisition and static choice. *Theory and Decision*, 40, 235–247, 1996.

1255 Louis-André GÉRARD-VARET and Jacques-François THISSE. Local public finance and economic geography. *Annales d'économie et de statistique*, 45, 19–35, 1997.

1256 Masahisa FUJITA et Jacques-François THISSE. Economie géographique, problèmes anciens et nouvelles perspectives. *Annales d'économie et de statistique*, 45, 37–87, 1997.

1257 Daniel DE WOLF and Yves SMEERS. A stochastic version of a Stackelberg-Nash-Cournot equilibrium model. *Management Science*, 43 (2), 190–197, 1997.

1258 Francisco DE SOUSA RAMOS. Pigovian taxes, tradable permits and a dynamic process for an economy with pollution. In J.W. Owsiński, J. Stefański, A. Straszak (eds.). *Proceedings of the IFORS SPC-2 Conference on "Transition to Advanced Market Economies"*. Warsaw, Association of Polish Operational Research Societies, 445–455, 1992.

1259 Claude d'ASPREMONT, Rodolphe DOS SANTOS FERREIRA and Louis-André GÉRARD-VARET. General equilibrium concepts under imperfect competitions: A Cournotian approach. *Journal of Economic Theory*, 73 (1), 199–230, 1997.

1260 Sayantan GHOSAL and Heracles M. POLEMARCHAKIS. Nash-Walras equilibria. *Research in Economics*, 51, 31–40, 1997.

1261 Frédéric GANNON and Yves ZENOU. Segregation and labor discrimination in cities. *Annales d'économie et de statistique*, 45, 233–249, 1997.

1262 Jean J. GABSZEWICZ and Tanguy VAN YPERSELE. The voting mechanism and market allocation: A note. *European Journal of Political Economy*, 12, 723–727, 1996.

1263 Jacques-François THISSE. De l'indétermination des régions et de quelques inconvénients qui en résultent. *L'espace géographique*, 26(2), 135–148, 1997.

1264 Jayasri DUTTA and Stephen MORRIS. The revelation of information and self-fulfilling beliefs. *Journal of Economic Theory*, 73 (1), 231–244, 1997.

1265 Jean J. GABSZEWICZ and Philippe MICHEL. Oligopoly equilibrium in exchange economies. In B. Curtis Eaton and Richard G. Harris (eds.), *Trade, Technology and Economics. Essays in honour of Richard G. Lipsey.* Cheltenham, Edward Elgar, 217–240, 1997.

1266 Jonathan H. HAMILTON and Jacques-François THISSE. Nonlinear pricing in spatial oligopoly. *Economic Design*, 2, 379–397, 1997.

3.2 Published Papers (not in the Reprint series)

Knud D. ANDERSEN. A modified schor complement method for handling dense columns in interior-point methods for linear programming. *Association for Computing Machinery Transactions on Mathematical Software*, 22 (3), 348–356, 1996.

Kurt M. ANSTREICHER and M. FAMPA. A long-step path following algorithm for semidefinite programming problems. To appear in *Fields Institute Communications.*

Aloisio Pessoa de ARAUJO, Paulo KLINGER MONTEIRO and Mario Rui PASCOA. Incomplete markets, continuum of states and default. To appear in *Economic Theory.*

Pierre ARS et José PARIS. Expression des stratégies de couverture dans une optique de "Risk Management". *ACTU-ERE*, 1–26, 1996.

Jess BENHABIB and Aldo RUSTICHINI. Social conflict and growth. *Journal of Economic Growth*, 1, 125–142, 1996.

Jess BENHABIB and Aldo RUSTICHINI. Best sustanaible taxes in a two factors model. To appear in *Journal of Economic Theory.*

Laurence BROZE and Christian GOURIÉROUX. Covariance estimators and adjuted pseudo maximum likelihood method. To appear in *Journal of Econometrics.*

Laurence BROZE, Olivier SCAILLET and Jean-Michel ZAKOÏAN. Quasi indirect inference of diffusion processes. To appear in *Econometric Theory.*

Claude d'ASPREMONT et Louis-André GÉRARD-VARET. La théorie du choix utilitariste impersonnel de J.C. Harsanyi a-t-elle une portée pragmatique ? Dans P. Livet (ed.), *L'éthique à la croisée des savoirs.* Paris, Librairie philosophique J. Vrin, 1996.

Claude d'ASPREMONT et Louis-André GÉRARD-VARET. Decentralizing collective decision: The moral hazard problem. To appear in D. Wildasin (ed.), *Fiscal Aspects of Evolving Federations.* Cambridge, Cambridge University Press.

Eddie DEKEL, Bart LIPMAN and Aldo RUSTICHINI. Standard state-space models preclude unawareness. To appear in *Econometrica.*

Eddie DEKEL, Bart LIPMAN and Aldo RUSTICHINI. Recent developments in the theory of unforeseen contingencies. To appear in *European Economic Review.*

Bernard DELHAUSSE, Sergio PERELMAN and Pierre PESTIEAU. Retirement and growing old: Which model of protection ? In E. Reynaud, L. apRoberts, B. Davies and G. Hugues (eds.), *International Perspective on Supplementary Pensions. Actors and Issues.* London, Quorum Books, 137–150, 1996.

Aart de ZEEUW, Marc GERMAIN et Henry TULKENS. Stabilité stratégique et pollution-stock transnationale: le cas linéaire. Discussion Paper 9701, IRES, Université catholique de Louvain, Louvain-la-Neuve, 1997. To appear in *Revue économique.*

Jacques DRÈZE. Employment in Europe. Chapter 2 in J. Gual (ed.), *The Social Challenge of Job Creation.* Cheltenham, Elgar, 29–54, 1996.

Jacques DRÈZE. Piccolo è bello anche per le banche. Può durare ? *Cooperazione di Credito*, 152/3, 183–198, 1996.

Jacques DRÈZE. Research and development in public economics: William Vickrey's incentive guest for efficiency. *Scandinavian Journal of Economics*, 99(2), 179–198, 1997.

Jean J. GABSZEWICZ and Tito CORDELLA. Comparative advantage under oligopoly. To appear in *Journal of International Economics.*

Jean J. GABSZEWICZ and Tito CORDELLA. Nice primal equilibria in strategic market games. To appear in *Games and Economic Behaviour.*

Jean J. GABSZEWICZ et Tanguy VAN YPERSELE. Concurrence politique, protection sociale et libre échange. *Comptes-Rendus du 12ème Congrès des Economistes Belges de Langue Française.* Charleroi, CIFOP, 1997.

Henri-Jean GATHON et Pierre PESTIEAU. Etat providence et efficacité économique. *Revue française d'économie*, 11, 29–44, 1996.

Henri-Jean GATHON et Pierre PESTIEAU. Le déficit de performance des entreprises publiques. Une question de propriété ou de concurrence ? *Revue économique*, 47, 1225–1238, 1996.

Emmanuel GUERRE and Frédéric JOUNEAU. Geometric versus arithmetic randoms wolk. To appear in *Statistical Planning and Inference.*

Christian HAFNER. Estimating high frequency foreign exchange rate volatility with nonparametric ARCH models. To appear in *Journal of Statistical Planning and Inference.*

M. HÖLLER and Jacques-François THISSE. The economics of standardization. Special issue of the *European Journal of Political Economy*, 12 (2), 1996.

Paulo KLINGER MONTEIRO and G. MEHTA. Infinite dimensional utility representation theorems. *Economics Letters*, 53 (2), 169–173, 1996.

Paulo KLINGER MONTEIRO and Flavio MENEZES. Simultaneous pooled auctions. To appear in *Journal of Real State and Finance.*

Alois KNEIP and J. ENGEL. A remedy for Kernel estimation under random design. *Statistics*, 28, 201–225, 1996.

Maurice MARCHAND et Pierre PESTIEAU. L'Etat ou le marché dans l'assurance maladie. *Revue française d'économie*, 11, 3–20, 1996.

Philippe MARTIN and Gianmarco OTTAVIANO. La géographie de l'Europe multi-vitesses. *Economie internationale*, 45–65, 1996.

Salvatore MODICA, Aldo RUSTICHINI and Jean-Marc TALLON. Bankruptcy and unawareness in a general equilibrium model. To appear in *Economic Theory.*

Massimo MORELLI and Pier Luigi SACCO. Game theoretic definitions of fairness and the contractualistic foundations of justice. To appear in *Ricerche Economiche.*

Arkadii NEMIROVSKY and Yurii NESTEROV. Multiparameter surfaces of analytic centers and long-step path-following interior point methods. To appear in *Mathematics of Operations Research.*

Yurii NESTEROV. Interior-point methods: An old and new approach to nonlinear programming. To appear in *Mathematical Programming*

Yurii NESTEROV. Last trends in nonlinear optimization. To appear in the *Proceedings of European Control Conference, Brussels, 1997.*

Yurii NESTEROV. Long-step strategies in interior point primal-dual methods. *Mathematical Programming*, 76 (1), 47–94, 1997.

Yurii NESTEROV and Michael J. TODD. Self-scaled cones and interior-point methods in nonlinear programming. *Mathematics of Operations Research*, 22 (1), 1–42, 1997.

Yurii NESTEROV and Michael J. TODD. Primal-dual interior-point methods for self-scaled cones. To appear in *SIAM Journal of Optimization.*

Gianmarco OTTAVIANO. The location effects of isolation. *Swiss Journal of Statistics and Economics*, 132 (3), 427–440, 1996.

Sergio PERELMAN and Pierre PESTIEAU. Bequest motives and the level and composition of wealth in Belgium. A survey-based analysis. *Cahiers économiques de Bruxelles*, 149, 31–53, 1996.

Pierre PESTIEAU. La fiscalité de l'épargne et de l'assurance-vie. *Risques*, 1996, and *Bulletin de Documentation*, Ministère des Finances de Belgique, Bruxelles, 56, 259–277, 1996.

Pierre PESTIEAU. Politique sociale, redistribution et intégration économique. *Actualité économique*, 72, 1996.

Pierre PESTIEAU et Philippe VAN PARIJS. Repenser (radicalement ?) la solidarité avec les plus âgés. *Revue nouvelle*, 5/6, 49–59, 1997.

Pietro REICHLIN and Aldo RUSTICHINI. Diverging patterns in a two country model with labor migration. To appear in *Journal of Economic Dynamics and Control.*

Christian RITTER and Léopold SIMAR. Pitfalls of normal-gamma stochastic frontier models. *Journal of Productivity Analysis*, 8, 167–182, 1997.

Aldo RUSTICHINI. Dynamic programming solution of incentive constrained problems. To appear in *Journal of Economic Theory.*

Aldo RUSTICHINI and A. VILLAMIL. Intertemporal pricing in markets with differential information. *Economic Theory*, 8, 211–227, 1996.

Thomas SIMAR et José PARIS. Le nombre de sinistres nécessaires pour en estimer valablement le coût moyen dans le cas lognormal. *Mitteilungen der Schweizerische Aktuarvereinigung*, 1, 49–61, 1997.

Yves SMEERS. Evaluation des investissements électriques: vers une évolution des méthodes. A paraître dans la *Revue de l'énergie.*

Henry TULKENS. Cooperation vs. free riding in international environmental affairs. Two approaches. To appear in N. Hanley and H. Folmer (eds.), *Game Theory and the Environment.* London, Elgar.

Kees Jan van GARDEREN. An alternative comparison of classical tests: Assessing the effects of curvature. To appear in M. Salmon and P. Marriot (eds.), *The Application of Differential Geometry to Econometrics: Theory and Applications.*

Kees Jan van GARDEREN. Curved exponential models in econometrics. To appear in *Econometric Theory.*

Kees Jan van GARDEREN. Exact geometry of first order autoregressive models. To appear in *Journal of Time Series Analysis.*

Vincent VANNETELBOSCH. Wage bargaining with incomplete information in an unionized Cournot oligopoly. *European Journal of Political Economy*, 13, 353–374, 1997.

3.3 Other papers

Dirk ALBOTH, Anat LERNER and Jonathan SHALEV. Auctioning public goods to groups of agents. Mimeo, 1997.

Erling D. ANDERSEN and Knud D. ANDERSEN. APOS user's manual for QCOPT ver 1.00. A code for solving QCQP's on self-scaled cone from fast. Technical Report, 1997.

Richard BALDWIN and Gianmarco OTTAVIANO. Multiproduct multinationals and reciprocal FDI dumping. Mimeo, Graduate Institute of International Studies, Geneva, 1997.

Salvador BARBERA, Michael MASCHLER and Jonathan SHALEV. Electoral evolution: The quota-1 case. Mimeo, 1997.

Pascal BELAN and Pierre PESTIEAU. Privatizing social security: A critical assessment. Mimeo, 1997.

Antoine BILLOT and Jacques-François THISSE. A discrete choice model when context matters. Document de travail n^o 97-05, Centre d'Enseignement et de Recherche en Analyse Socio-Economique (CERAS), Paris.

Robin BOADWAY and Maurice MARCHAND. Redistribution with unobservable bequests. A case for taxing capital income. Mimeo, 1997.

Robin BOADWAY, Maurice MARCHAND and Motohiro SATO. Subsidies versus public provision of private goods as instruments for redistribution. Mimeo, 1997.

Robin BOADWAY, Maurice MARCHAND and Marianne VIGNEAULT. The consequences of overlapping tax bases for redistribution and public spending in a federation. Mimeo, 1997.

Stefano BOSI. Divisible conspicuous good. Document de travail n^o 96-10, Delta, Paris, 1996.

Stefano BOSI and Francesco MAGRIS. Interdependent preferences. Mimeo, 1997.

Stefano BOSI and Francesco MAGRIS. Liquidy constraint and persistence of endogenous fluctuations. Mimeo, 1997.

André BOUCKAERT and Michel MOUCHART. Latent events in clinical trials: A model with sure outcomes of random events. Discussion Paper 9607, Institut de Statistique, Université catholique de Louvain, 1996.

Riccardo CALCAGNO and Stefano LOVO. Bid-ask competition with asymmetric information between market makers. Mimeo, 1997.

Emmanuel CANON, Olivier DAXHELET, Frédéric JONARD and Yves SMEERS. Pricing rules in primes. Mimeo, 1996.

Jacques CRÉMER, Claude d'ASPREMONT and Louis-André GÉRARD-VARET. Unique implementation in auctions and in public good problems. Document de travail n^o 97A15, GREQAM, 1997.

Olivier DAXHELET and Yves SMEERS. Assessing competition and regulation in telecommunication through computable models. Report for the Directorate General for Telecommunication (DGXII) of the European Commission, 1997.

Paola DONATI. Monetary policy under asymmetric information. Mimeo, 1997.

Patricio ESPINOSA. Niveaux optimaux et niveaux approximatifs de stock pour un produit à durée de vie de 2 périodes. Mimeo, 1996.

Patricio ESPINOSA. Niveaux optimaux et niveaux approximatifs de stock avec information sur la demande de la période 2. Mimeo, 1996.

Patricio ESPINOSA. Modèle avec politique de rétention pour un produit à durée de vie de 3 périodes. Mimeo, 1997.

Patricio ESPINOSA. Valeur de l'information et performance des niveaux optimaux de stock pour un produit à durée de vie de 2 périodes (tests de simulation). Mimeo, 1997.

Patricio ESPINOSA. Performance des niveaux approximatifs de stock avec politique de rétention pour un produit à durée de vie de 3 périodes (test de simulation). Mimeo, 1997

Patricio ESPINOSA. Simulation de politiques de rétention pour un produit à durée de vie de 4 périodes. Mimeo, 1997.

Jean-Pierre FLORENS, Jean-François RICHARD and Jean-Marie ROLIN. Bayesian encompassing specification tests of a parametric model against a non-parametric alternative. Discussion Paper 9608, Institut de Statistique, Université catholique de Louvain, 1996.

Jean J. GABSZEWICZ and Alessandro TURRINI. Workers, skills, product quality and industry equilibrium. Mimeo, 1997.

Irène GIJBELS, Peter HALL and Alois KNEIP. Interval and band estimation for curves with jumps. Discussion Paper 9609, Institut de Statistique, Université catholique de Louvain, 1996.

Victor GINSBURGH and M. KEYZER. Sufficient conditions for existence of equilibrium when asset markets are incomplete. Mimeo, 1997.

Victor GINSBURGH and F. MAIRESSE. Defining a museum, suggestions for an alternative approach. Mimeo, 1996.

Kevin GLAZEBROOK and José NINO-MORA. A linear programming approach to stability, optimization and performance analysis for Markovian multiclass queueing networks. Mimeo, 1997.

Florence GOFFETTE-NAGOT. Urban spread beyond the city edge. Submitted for publication in J.-M. Huriot and J.-F. Thisse (eds.), *Economics of Cities.* Cambridge, Cambridge University Press.

Lisa GRAZZINI and Tanguy VAN YPERSELE. Tax harmonisation: Does unanimity rule play a role ? Mimeo, 1997.

J. Vernon HENDERSON and Jacques-François THISSE. On strategic community development. Discussion Paper n° 1550, Centre for Economic Policy Research, London.

Werner HILDENBRAND and Aloïs KNEIP. Modelling aggregate consumption expenditure and income distribution effects. Discussion Paper 9606, Institut de Statistique, Université catholique de Louvain, 1996.

Andreas IRMEN and Jacques-François THISSE. Competition in multi-characteristics spaces: Hotelling was almost right. Discussion Paper n° 1446, Centre for Economic Policy Research, London.

Frédéric JONARD and Yves SMEERS. Electricity market equilibrium under different nodal price schemes. Energy Modelling Forum, Stanford, 1997.

Paulo KLINGER MONTEIRO. Auctions of identical goods. Mimeo, 1997.

Kevin C. LEE, M. Hashem PESARAN and Kees Jan van GARDEREN. Prediction criteria and aggregation nonlinear models. Mimeo, 1997.

Salvador LOPEZ, Maurice MARCHAND and Pierre PESTIEAU. Source-based and residence-based, capital income taxation in open economies. Mimeo, 1996.

Philippe MARTIN and Gianmarco OTTAVIANO. Growing locations: Industry location in a model of endogenous growth. CEPR Discussion Paper 1523, London, 1996.

Philippe MARTIN and Gianmarco OTTAVIANO. Growth and agglomeration. CEPR Discussion Paper 1529, London, 1996.

Massimo MORELLI and Philippe PENELLE. Economic integration as a partition function game. Working paper 962, University of Chicago, 1996.

Michel MOUCHART, Jean-Marie ROLIN and Eliana SCHEIHING. Bayesian identification of semi-parametric response models. Discussion Paper 9713, Institut de Statistique, Université catholique de Louvain, 1997.

Paul NIHOUL and Yves SMEERS. Energy transit principles in the context of the energy charter treaty. Final report, contract 4.1041/E/95-03, The Synergy Programme, Commission of the European Communities, Brussels, 1997.

José NINO-MORA. Optimal threshold control of a pull production queue: Achievable performance, resource pricing and the $c\Delta\mu$ rule. Mimeo, 1997.

José NINO-MORA. Optimal basestock control of a production/inventory queue: Achievable performance, resource pricing and the $\Delta\lambda/\delta b$ rule. Mimeo, 1997.

José NINO-MORA. A polynomail-size LP formulation for the multi-armed bandit problem. Mimeo, 1997.

José NINO-MORA. Dynamic control of queueing networks: A mathematical programming approach. Mimeo, 1997.

José NINO-MORA. Breaking the curse of dimensionality: On Markov decision process, linear programming relaxations and the fair price of information. Mimeo, 1997.

Konstantinos PAPADOPOULOS. Impossibility of risk-sharing in an economywith asymmetric information: An example. Mimeo, 1997.

Konstantinos PAPADOPOULOS. Production decisions in incomplete markets: The Shapley value. Mimeo, 1997.

Byeong U. PARK, Léopold SIMAR and Christian WEINER. FDH efficiency scores from a stochastic point of view. Discussion Paper 9715, Institut de Statistique, Université catholique de Louvain.

Jean-Marie ROLIN. Nonparametric Bayesian survival analysis. Discussion Paper 9704, Institut de Statistique, Université catholique de Louvain.

Matteo SALTO. Indeterminacy in monetary open economies. Mimeo, 1997.

J.J. SEMPERE-MONERRIS and Vincent VANNETELBOSCH. Bargaining with externalities: Licensing of an innovation. Discussion Paper 9707, IRES, Université catholique de Louvain, 1997.

Chandra SHAH and Kees Jan VAN GARDEREN. The interpretation of dummy variables in semilogarithmic equations in the presence of estimation uncertainty. Mimeo, 1997.

Léopold SIMAR and Paul W. WILSON. Some problems with the Ferrier/Hirschberg bootstrap idea. Discussion Paper 9712, Institut de Statistique, Université catholique de Louvain, 1997.

Jacques-François THISSE et Bernard WALLISER. L'économie géographique: un parent pauvre ? Document de travail n° 97-06, Centre d'Enseignement et de Recherche en Analyse Socio-Economique (CERAS), Paris.

Pierre TYCHON and Vincent VANNETELBOSCH. Debt valuation and marketability risk. Mimeo, 1997.

Kees Jan vanGARDEREN. Exact geometry of explosive autoregressive models. Submitted for publication.

Kees Jan van GARDEREN. Empirical consequences of variance inflation. Mimeo, 1997.

Kees Jan van GARDEREN. Exact Bartlett corrections in the AR(1) model. Mimeo, 1997.

Vincent VANNETELBOSCH. On rationalizability in two-person alternating-offer bargaining. Discussion Paper 9623, IRES, Université catholique de Louvain, Louvain-la-Neuve, 1996.

Vincent VANNETELBOSCH. Profit-sharing: Does it reduce bargaining inefficiencies. Discussion Paper 9709, IRES, Université catholique de Louvain, 1997.

Claude WAMPACH. Stationary competitive equilibria in a model of overlapping generations with three period lives. Mimeo, 1997.

Jing-Yuan WEI. Do we need a power change when the number of power marketers are large enough. Mimeo, 1997.

Jing-Yuan WEI. Fully acceptable allocation set. A new xciomatic approach for general equilibrium analysis. Mimeo, 1997.

3.4 Books

The following books by members of the CORE staff were published during the period covered by this report.

Victor GINSBURGH and Pierre-Michel MENGER (eds.). *Economics of the Arts. Selected Essays.* Amsterdam, Elsevier, 1996.

Jacques-François THISSE (ed.). *Location Theory.* Classics in Regional Science. Gloucester, Edward Elgar, 1996.

3.5 Editorial Activities

Kurt ANSTREICHER,	associate editor *SIAM Journal on Optimization*
Luc BAUWENS,	associate editor *Computational Statistics* guest editor *Journal of Econometrics (Annals) Vol. 75,* "Bayes, Bernouillis and Basel"
Laurence BROZE,	associate editor *Annales d'économie et de statistique* *Recherches économiques de Louvain*
Claude d'ASPREMONT,	associate editor *Games and Economic Behavior* *Journal of Mathematical Economics* *Social Choice and Welfare*
Jean J. GABSZEWICZ,	associate editor *Journal of Economics*
Louis GEVERS,	co-editor *Social Choice and Welfare*
Victor GINSBURGH,	member of editorial board *Annales d'économie et de statistique* *Recherches économiques de Louvain*
Jean-Michel GRANDMONT,	associate editor *Journal of Economic Theory* *Journal of Economic Dynamics and Control*

Maurice MARCHAND, associate editor
Journal of Public Economics
International Tax and Public Finance

José PARIS, editor
ACTU-ERE

Pierre PESTIEAU, associate editor
Public Finance
Economica
Journal of Population Economics
European Journal of Political Economy
Regional Science and Urban Economics

Heracles POLEMARCHAKIS, co-editor
Journal of Mathematical Economics
associate editor
Journal of Economic Growth

Jean-Marie ROLIN, member of the editorial committee
Biométrie-Praximétrie

Yves SMEERS, editor at large
Interfaces
European editor
Energy Journal
associate editor
Energy Economics
member of the editorial committee
RAIRO, Recherche Opérationnelle

Jacques THISSE, associate editor
Journal of Industrial Economics
Journal of Economics and Management Strategy
Journal of Regional Science and Urban Economics
Japanese Economic Review

Henry TULKENS, associate editor
International Tax and Public Finance
Journal of Productivity Analysis
Recherches économiques de Louvain

Laurence WOLSEY, associate editor
Mathematical Programming

3.6 Doctoral Dissertations

Eight Research Associates at CORE successfully defended their Doctoral Dissertation:

On August 30, 1996, Indrajit RAY, "Correlation, coalitions and strategic games", (Docteur en Sciences économiques, Université catholique de Louvain), under the supervision of Heracles POLEMARCHAKIS.

On September 26, 1996, Tanguy VAN YPERSELE, "Political competition and economic rivalry", (Docteur en Sciences économiques, Université catholique de Louvain), under the supervision of Jean J. GABSZEWICZ.

On November 27, 1996, Vincent VANNETELBOSCH, "Bargaining and rationality", (Docteur en Sciences économiques, Université catholique de Louvain), under the supervision of Pierre DEHEZ (Département des Sciences économiques).

On November 30, 1996, Vera SONGWE, "Price selection mechanisms in imperfectly competitive economies", (Docteur en Sciences économiques, Université catholique de Louvain), under the supervision of Heracles POLEMARCHAKIS.

On December 2, 1996, Sougata PODDAR, "Oligopoly, uncertainty and entry", (Docteur en Sciences économiques, Université catholique de Louvain), under the supervision of Jean J. GABSZEWICZ.

On January 24, 1997, Margarita SAMARTIN, "Financial intermediation and public intervention", (Docteur en Sciences économiques, Université catholique de Louvain), under the supervision of Heracles POLEMARCHAKIS and Sudipto BHATTACHARYA (London School of Economics).

On May 6, 1997, Josef C. PERREZ, "Strategic investments, credit-rationing and unemployment", (Docteur en Sciences économiques, Université catholique de Louvain), under the supervision of Claude d'ASPREMONT.

On June 30, 1997, Philippe VANDEN EECKAUT, "Free disposal hull and the measurement of efficiency and productivity: Theory, application & software", (Docteur en Sciences économiques, Université catholique de Louvain), under the supervision of Henry TULKENS.

4 CORE Lecture Series

The "CORE Foundation" was set up a few years ago with the goal of taking new initiatives and stimulating research activities at CORE. One of these initiatives was the creation of a CORE Lecture Series. Every year, a young internationally renowned scientist is invited to give a set of lectures in one of the research areas of CORE.

During the period covered by this report, Jim RENEGAR, School of Operations Research and Industrial Engineering, Cornell University, presented a series of lectures entitled "Complexity of Non-Linear Equations and Continuous Optimization".

Over the last fifteen years, much penetrating mathematical theory has been developed with regards to the efficiency of algorithms for solving non-linear algebraic equations and continuous optimization problems. Although certain tools are used repeatedly — for example, Newton's method — the theory reaches broadly in tying various areas of pure mathematics to an understanding of computation; algebraic geometry, probability theory, logic and functional analysis each play a role. The author explained the crucial ideas underlying those parts of the theory whose development he followed most closely. Although the rigorous theory itself is often difficult, most of the crucial ideas are readily motivated.

The series of lectures were as follows:

PROGRAMME

October 1, 1996.

Solving systems of polynomial equations

Discussion focused in part on homotopy methods. Insight into the expected behavior of these algorithms was provided via theorems from elementary algebraic geometry and integral geometry.

October 2, 1996.

Deciding solvability and approximating solutions of general algebraic formulae

Algebraic, logic, differential topology and numerical analysis come together in the very general setting first explored by Tarsky more than a half-century ago. The related complexity theory has advanced tremendously in the last decade.

October 7, 1996.

Interior-point methods for convex programming

Central results in the enormously influential Nesterov-Nemirovskii theory was presented in a repackaged form that has proven to be readily digestible by non-specialists.

October 8, 1996.

Convex programming, condition numbers, complexity theory, the barrier method, the conjugate-gradient method, the Hahn-Banach theorem and Hilbert spaces

All tied together in one lecture.

October 9, 1996.

Controlling condition numbers through careful reformulation

How one reformulates a problem to be solved by interior point methods has large influence on the condition numbers of the systems of linear equation that must be solved when applying the methods, thus affecting the necessary accuracy of computation. "Nearly optimal" reformulations were discussed.

5 Seminars and Workshops

The three regular weekly seminars in operations research, mathematical economics and econometrics were held from September through June. CORE also continued its participation in the sponsorship of the Séminaire Economique de Louvain.

5.1 The Operations Research Seminar

1. September 24, 1996. Miguel CONSTANTINO, University of Lisbon.
   Lot-sizing with start-ups and backlogging.

2. October 15, 1996. Erling D. ANSERSEN, Odense University, Denmark.
   Interior-point methods for linear programming.

3. October 22, 1996. Levent TUNCEL, University of Waterloo, Canada.
   Symmetry and scale invariance in algorithms for convex optimization.

4. October 29, 1996. Kurt ANSTREICHER, CORE and University of Iowa.
   The volumetric cutting plane method for convex programming.

5. November 12, 1996. Pascal VAN HENTENRYCK, Brown University.
   Helios: A modeling language for global optimization.
   (Joint seminar with Département INGI).

6. November 19, 1996. Jose-Nino MORA, CORE and Massachusetts Institute of Technology.
   A mathematical programming approach to dynamic and stochastic resource allocation: Formulations, bounds and policies.

7. November 26, 1996. Regina URBANIAK, Konrad-Zuse-Zentrum, Berlin.
   Composition and decomposition of test sets.

8. December 10, 1996. Kevin GLAZEBROOK, University of Newcastle.
   Submodular returns and greedy heuristics for queueing scheduling problems.

9. December 17, 1996. Jonathan LEE, University of Kentucky.
   Using continuous nonlinear relaxation to solve constrained maximum-entropy sampling problems.

10. February 11, 1997. Cid CARVALHO DE SOUZA, Universidade Estadual de Campinas.
    Integer programming formulations for the minimum length partition of a rectangle with points in its interior.

11. February 18, 1997. Yaoguang WANG, Max-Planck-Institut für Informatik, Saarbrücken.
    Bicriteria job sequencing with release dates.

12. March 4, 1997. Moshe DROR, Ecole Centrale de Paris and University of Arizona.
    Cost allocation and inventory centralization: Cooperative game theory framework.

13. March 11, 1997. Yurii NESTEROV, CORE.
    Quality of semidefinite relaxation for nonconvex quadratic optimization.

14. March 25, 1997. Knud ANDERSEN, CORE and Odense University.
    QCOPT a large scale interior-point code for solving convex quadratically constrained quadratic problems on self-scaled cone form.

15. April 15, 1997. Costas C. PANTELIDES, Imperial College of Science, Technology and Medicine, London.
    General frameworks for process scheduling.

16. April 22, 1997. François VANDERBECK, University of Cambridge.
    Lot-sizing with start-up times.

17. May 6, 1997. Martine LABBÉ, Université libre de Bruxelles.
    A dual ascent procedure for the uncapacitated network design with bifurcated routing.

18. May 13, 1997. Olivier DAXHELET and Yves SMEERS, CORE.
    Optimisation can help solve (some of) your economic problems: An example from competition and regulation in telecommunication.

19. June 3, 1997. Eric GOURDIN, Université libre de Bruxelles.
    A generalized benders decomposition algorithm to solve bilinear and quadratic problems.

5.2 The Economic Theory Seminar

1. September 30, 1996. Jonathan SHALEV, CORE and Tel-Aviv University.
   Loss aversion in a multi-period model.

2. October 1, 1996. Benyamin SHITOVITZ, Haifa University.
   The bargaining set of an oligopoly in markets with a continuum of traders.

3. October 14, 1996. Mordecai KURZ, Stanford University.
   The equity premium and GARCH behavior of asset prices.

4. October 21, 1996. Paulo KLINGER MONTEIRO, CORE and Instituto de Matematica Pura e Aplicada, Rio de Janeiro.
   Optimal selling mechanisms for multiproduct monopolists: Incentive compatibility in the presence of budget constraints.

5. October 28, 1996. Paul BELLEFLAMME, Facultés Universitaires Notre-Dame de la Paix, Namur.
   Adoption of network technologies in oligopolies.

6. November 4, 1996. Jean-François MERTENS, CORE.
   The limit-price mechanism.

7. November 18, 1996. Ali KHAN, The John Hopkins University.
   On Loeb measure spaces and their significance for non-cooperative game theory.

8. November 25, 1996. Tahar ABDESSALEM, Ecole polytechnique de Tunisie.
   A decentralized scheme for the provision of public goods with exclusion.

9. December 2, 1996. Rabah AMIR, Wissenschaftszentrum Berlin.
   One-way spillovers, endogenous innovator/imitator roles and research joint ventures.

10. December 9, 1996. Ivar EKELAND, Université de Paris-Dauphine.
    Exterior differential calculus and aggregation theory: A presentation and some new results.

11. December 11, 1996. Yves SPRUMONT, Université de Montréal.
    Ordinal cost sharing.
    (Joint with the Doctoral Seminar).

12. December 16, 1996. Jean-François RICHARD, University of Pittsburgh.
Empirical analysis of game theoretic models with experimental and non-experimental data. (Joint with the Econometrics Seminar).

13. January 27, 1997. Jonathan SHALEV, CORE and Tel-Aviv University.
Loss aversion and bargaining.

14. February 10, 1997. Moshe JUSTMAN, Ben Gurion University.
The political dynamics of education, endogenous growth and inequality in a mixed economy.

15. February 17, 1997. Anat LERNER, Open University of Israel.
A pie allocation among sharing groups.

16. February 24, 1997. Tomas SJÖSTRÖM, Harvard University.
Overlapping generations and moral hazard.

17. March 3, 1997. Paulo KLINGER MONTEIRO, CORE and Instituto de Matematica Pura e Aplicada, Rio de Janeiro.
Auctions of identical goods.

18. March 10, 1997. Thorsten HENS, Universität Bielefeld.
An evolutionary approach to financial innovation.

19. March 20, 1997. Jacques DRÈZE, CORE.
Walrays-Keynes equilibria coordination and macroeconomics.
(Joint with the Séminaire Economique de Louvain).

20. March 24, 1997. Christian GOLLIER, Université de Toulouse.
Learning and irreversibility: An economic interpretation of the precautionary principle.

21. April 7, 1997. Ben POLAK, Yale University and London School of Economics.
Preference for information.

22. April 14, 1997. Massimo MORELLI, CORE and Iowa State University.
Coalition formation and payoff distribution in majority games.

23. April 21, 1997. Andy NEWMAN, Columbia University and Yale University.
Matching in an imperfect world.

24. April 21, 1997. Hervé CRÈS, University of Copenhagen.
    On allocative stability.

25. April 28, 1997. Gaetano BLOISE, CORE and European University Institute, Firenze.
    Informational costs and equilibrium in repeated games.

26. May 5, 1997. Etienne WASMER, London School of Economics, CREST and DELTA, and Yves ZENOU, Université Panthéon-Assas.
    Equilibrium urban unemployment.

27. May 5, 1997. Olivier SCAILLET, IRES, Université catholique de Louvain.
    Cross price forecasts with interest rate options.
    (Joint with the Econometrics Seminar).

28. May 12, 1997. Robert EVANS, University of Cambridge.
    Reputation and experimentation.

29. June 2, 1997. Nicolas BOCCARD, CORE.
    The Hotelling model with capacity precommitment.

30. June 9, 1997. John HILLAS, New York State University, Stony Brook.
    Definitions of strategic stability and the relation between them.

31. June 23, 1997. Bernard DE MEYER, CORE.
    From repeated games to Brownian games.

5.3 The Econometrics Seminar

1. September 25, 1996. Michel MOUCHART, Institut de Statistique and CORE.
   Semi- and non-parametric Bayesian analysis of duration models.
   (Joint with the Statistics Seminar).

2. October 2, 1996. Eric RENAULT, GREMAQ, Université de Toulouse.
   Multivariate time series analysis of option prices.

3. October 9, 1996. Nour MEDDAHI, GREMAQ, Université de Toulouse.
   Aggregations and marginalization of GARCH and stochastic volatility models.

4. October 23, 1996. Christian ROBERT, CREST, INSEE, Paris.
   Discretizations of continuous state space Markov chains for MCMC convergence assessment. (Joint with the Statistics Seminar).

5. October 30, 1996. Steven X. WEI, CORE and University of Toronto.
   Do limit rules of future prices matter in GARCH processes ?

6. November 6, 1996. Gilles TEYSSIERE, University of London.
   Double long-memory financial time series.

7. November 13, 1996. Christian HAFNER, CORE and Humbold-Universität zu Berlin.
   Estimating high frequency foreign exchange rate volatility with nonparametric ARCH models.

8. November 20, 1996. Yoshinori KAWASAKI,
   A model selection approach to seasonal unit root analysis.

9. November 27, 1996. Dominique GUEGAN, ENSAE-CREST, Paris.
   Prediction in chaotic time series: Methods and comparisons with an application to financial intra-day data.

10. December 4, 1996. Amlan ROY, Queen Mary & Westfield College, University of London.
    Bayesian inference and asset pricing.

11. December 11, 1996. Marno VERBEEK, Katholieke Universiteit Leuven and Universiteit Tilburg.
    Order as an instrumental variable: An application to the return to schooling.

12. December 18, 1996. Marcia SCHAFGANS, London School of Economics.
    Semiparametric estimation of the intercept of a sample selection model: Theory and applications.
    (Joint with the Statistics Seminar).

13. February 5, 1997. Kees Jan VAN GARDEREN, CORE.
    Aggregation and prediction criteria in non-linear models.

14. February 12, 1997. Léopold SIMAR, Institut de Statistique and CORE.
    A statisticam model for DEA estimators.
    (Joint with the Statistics Seminar).

15. February 26, 1997. Michael NEWTON, University of Wisconsin-Madison.
Partial predictive recursion: A new algorithm for nonparametric analysis of censoring, truncation, or random effects.

16. March 5, 1997. Juan RODRIGUEZ-POO, University of Santander.
Longitudinal data with nonstationary errors: A nonparametric three-stages approach.

17. March 12, 1997. Bas J.M. WERKER, Université libre de Bruxelles.
Adaptive estimation in time series.
(Joint with the Statistics Seminar).

18. March 19, 1997. Laurence BROZE and Frédéric JOUNEAU. CORE and GREMARS, Université de Lille III.
Estimation of a latent linear model based on the rank statistics of the dependent variable.

19. March 26, 1997. Luc BAUWENS, CORE.
Bayesian option pricing using asymmetric GARCH models.

20. April 16, 1997. Thomas HECKELEI, Institute of Agricultural Policy, Bonn Universität.
Generic robust Bayesian regression.

21. April 23, 1997. Herman VAN DIJK, Erasmus Universiteit, Rotterdam.
Bayesian analysis of evolving trend and seasonal models.

22. April 30, 1997. Grant HILLIER, University of Southampton.
On the density of the maximum likelihood estimator.

23. May 5, 1997. Olivier SCAILLET, IRES, Université catholique de Louvain.
Cross price forecasts with interest rate options.
(Joint with the Economic Theory Seminar).

24. May 7, 1997. Nobuhiko TERUI, Tohoku University.
Estimation and inference on continuous time nonlinear business cycle models.
(Joint with the Statistics Seminar).

25. May 14, 1997. Frank KLEIBERGEN and Richard PAAP, Erasmus Universiteit, Rotterdam.
Priors, posterior odds and Lagrange multiplier statistics in Bayesian analysis of cointegration. (Joint with the Statistics Seminar).

5.4 The Séminaire Economique de Louvain

1. September 26, 1996. Adolpho RODRIGUEZ, Ministère des Affaires Sociales, Costa-Rica.
Les enjeux des réformes des systèmes de pensions en Amérique Latine.

2. October 3, 1996. Domenico SINISCALCO, Université de Turin and Fondazione ENI, Enrico Mattei, Milan.
Sustainable development: From theory to the real world.

3. October 7, 1996. Vincent BODART, FMI, Washington.
Régime de change, volabilité et interdépendance internationale des marchés financiers: le cas du SME.

4. November 7, 1996. Harris DELLAS, Université catholique de Louvain and Plutarchos Sakellaris University of Maryland.
On the cyclicality of the demand for education: Theory and evidence.

5. November 14, 1996. Christian GOURIÉROUX, CREST and CEPREMAP, Paris.
Etude du carnet d'ordres.

6. November 21, 1996. Lucrezia REICHLIN, Université libre de Bruxelles.
Regional dynamics.

7. November 28, 1996. Yanis VAROUFAKIS, Chaire Hoover and University of Sydney.
Solidarity as a neglected analytical economic category.

8. December 5, 1996. Bruno VAN POTTELSBERGHE DE LA POTTERIE, Université libre de Bruxelles.
The emerging technological bommerang: Alternative measures of technology transfer among industrialized countries.

9. December 12, 1996. Martine CARRÉ, MAD, Paris.
   Stabilisation de la dette publique, conflits d'intérêts et critères de convergence de Maastricht.

10. February 6, 1997. Jeroen HINLOOPEN, European University Institute, Firenze.
    Subsidizing cooperative and noncooperative R &D in a differentiated oligopoly.

11. February 13, 1997. Jeremy KENDALL, London School of Economics & Political Science.
    The UK voluntary sector, the utility of generic nonprofit sector economic theory in understanding its development and current roles, and the sector's evolving role in personal social services.

12. February 14, 1997. Massimo MOTTA, Universitat Pompeu Fabra, Barcelona.
    Advertising bans.

13. February 20, 1997. Paul GEROSKI, London Business School.
    Innovations, patents and cash flow.

14. February 27, 1997. Manfred J. HOLLER, Hamburg Universität.
    The representation of power when goods are public.

15. February 28, 1997. Frank VERBOVEN, Katholieke Universiteit Leuven.
    International price discrimination and economic integration: A study of the European automobile market.

16. March 13, 1997. Arnoud W.A. BOOT, Universiteit Amsterdam.
    Can relationship banking survive competition ?

17. March 20, 1997. Jacques H. DRÈZE, CORE.
    Walras-Keynes equilibria coordination and macroeconomics.
    (Joint with the Economic Theory Seminar).

18. March 27, 1997. Gérard ROLAND, Université libre de Bruxelles.
    Separation of powers and accountability: Towards a formal approach to comparative politics.

19. April 24, 1997. Herman K. VAN DIJK, Erasmus Universiteit, Rotterdam.
    Distribution and mobility of wealth of nations.

20. May 6, 1997. Thomas PIKETTY, CNRS-CEPREMAP, Paris.
    La redistribution fiscale face au chômage.

21. May 15, 1997. Duane J. SEPPI, Universität Wien.
    Liquidity-based competition for order flow.

22. May 22, 1997. Pierre MELLA BARRAL, London School of Economics.
    The dynamics of default and debt reorganization.

23. May 22, 1997. Kjell G. NYBORG, London Business School.
    Bidder behavior in multiple unit auctions: Evidence from Swedish treasury auctions.

24. May 29, 1997. Daniel S. HAMERMESH, University of Texas at Austin.
    The timing of work over time.

25. June 5, 1997. Hisashi YAGINUMA, IRES, Université catholique de Louvain.
    Overseas activity of Japanese firms and its impact on the industrial technology.

26. June 12, 1997. Gerard VAN DEN BERG, Vrije Universiteit Amsterdam.
    Measuring the effects of sanctions in the Dutch social security system.

27. June 19, 1997. Sandro ZARRI, Université de Genève and Universität Mannheim.
    Markov perfect equilibrium in a finite horizon random bilateral exchange system: Existence.

5.5 Combinatorial Optimization Seminars

1. June 4, 1997. Susanne HEIPCKE, University of Buckingham.
   An introduction/tutorial on constraint programming specialised to discrete (optimisation) problems.

2. June 4, 1997. Susanne HEIPCKE, University of Buckingham.
   An introduction to SCHEDENS (a specialised program for scheduling problems).

6 Doctoral Program

The ***European Doctoral Program in Quantitative Economics*** is a joint project of CORE, Université catholique de Louvain, Belgium, of the Universität Bonn, Germany, of the London School of Economics, Great Britain, of the Ecole des Hautes Etudes en Sciences Sociales, France, and as an associate member, of the University of Tel Aviv. Students in the program complete all the requirements for a doctorate in one of the participating universities. In addition, they spend at least one full academic year, typically their second year in the program, in one of the other universities.

The program started in 1977. The number of graduates of the program to date is 100 and 75 are currently enrolled.

A seminar for doctoral students was organized by Heracles POLEMARCHAKIS. The doctoral seminar met as follows:

1. October 1, 1996. Benyamin SHITOVITZ, Haifa University.
   The bargaining set of an oligopoly in markets with a continuum of traders.

2. October 23, 1996. Francesco MAGRIS and Stefano BOSI, CORE.
   Endogenous business cycles: Capital-labour substitution and liquidity constraint.

3. November 7, 1996. Sergio CURRARINI, CORE.
   Ratio equilibria and voting in a public goods economy with jurisdictions.

4. November 14, 1996. Nicolas BOCCARD, CORE and Xavier WAUTHY, IRES.
   Capacity precommitment in the Hotelling model.

5. November 21, 1996. Leonidas KOUTSOUGERAS, Manchester University.
   Nash-Walras equivalence in market games.

6. November 28, 1996. Jean J. GABSZEWICZ and Alessandro TURRINI, CORE.
   Product quality and workers' skills: When industry matters.

7. December 11, 1996. Yves SPRUMONT, Université de Montréal.
   Ordinal cost sharing.

8. January 22, 1997. Jean-Michel COULOMB, CORE and Université de Paris X.
   A note on 'big-match'.

9. March 12, 1997. Annick LARUELLE, IRES.
   The EU decision-making procedures: Some insight from non cooperative game theory.

10. April 11, 1997. Sayantan GHOSAL, Queen Mary and Westfield College, University of London.
    Cournot-Nash equilibria in limit exchange economies with complete markets and consistent prices.

11. April 17, 1997. Hervé CRES, University of Copenhagen.
    Social choice theory (I).

12. April 18, 1997. Hervé CRES, University of Copenhagen.
    Social choice theory (II).

13. April 22, 1997. Hervé CRES, University of Copenhagen.
    Social choice theory (III).

14. May 1, 1997. Dan SASAKI, University of Copenhagen.
    Ignorance as a commitment device.

15. May 16, 1997. Tito PIETRA, Universita di Modena.
    Extrinsic uncertainty and the informational role of prices.

16. May 21, 1997. Jonathan SHALEV, CORE and Tel Aviv University.
    Electoral evolution: The quota one case.

17. May 29, 1997. Dov SAMET, Tel Aviv University.
    What priors and common priors are.

18. June 26, 1997. Indrajit RAY, University of York.
    A simple model of slot allocation: Competition between firms when the consumers are boundedly rational.

7 Meetings held at CORE

7.1 Workshop on "Location and Regional Convergence/Divergence"

organized by the Centre for Economic Policy Research (CEPR), London and coordinated by Jacques THISSE, CORE.

PROGRAMME

October 25, 1996

1. Diego PUGA, Centre for Economic Performance, London School of Economics.
   The rise and fall of economic agglomerations.

2. Philippe MARTIN, Institut Universitaire des Hautes Etudes Internationales, Genève, and CEPR, London, and Gianmarco OTTAVIANO, Università di Bologna, Università Bocconi, Milano, and CEPR, London.
   Growth and agglomeration.

3. Tobias ADRIAN, London School of Economics.
   Transport costs and regional convergence.

October 26, 1996

1. Roger VICKERMAN, University of Kent.
   Transport investment, infrastructure and regional convergence.

2. Antonio CICCONE, University of California and Universitat Pompeu Fabra, Barcelona.
   Externalities and interdependent growth: Theory and evidence.

3. Angel DE LA FUENTE, Institut d'Analisi Economica, Barcelona, and CEPR.
   On the sources of growth and convergence: A close look at the Spanish regions.

4. Mario FORNI, Università di Modena and Lucrezia REICHLIN, Université libre de Bruxelles and CEPR.
   Regional dynamics.

5. Linda H. DOBKINS, Emroy Henry College and Yannis IOANNIDES, Tufts University.
   The evolution of city size distributions in the United States.

6. Gordon H. HANSON, University of Texas and Antonio SPILLIMBERGO, Inter-American Development Bank.
   Illegal immigration, border enforcement, and relative wages: Evidence from apprehensions at the US-Mexico border.

7.2 Workshop on "Organisation and Competition in Energy Market"

organized by Claude d'ASPREMONT and Yves SMEERS.

PROGRAMME

November 20, 1996

1. Sougata PODDAR, University of Copenhagen.
   Capacity and entry deterrence under demand uncertainty.

2. Sebastien STEINMETZ, CORE and Laboratoire d'Econométrie, Ecole Polytechnique de Paris.
   Coordination and organisation in the supply of electricity: Production planning and organisational structure at EDF.

3. Claude d'ASPREMONT, CORE.
   Pricing schemes and Cournotian equilibria.

4. Emmanuel CANON, Olivier DAXHELET, Frédéric JONARD and Yves SMEERS, CORE.
   Pricing rules in primes.

7.3 Public Economics Workshop

organized by the Young Research Section of the Institut Belge de Finances Publiques/Belgisch Instituut voor Openbare Financiën, coordinated by Maurice MARCHAND, CORE, Université catholique de Louvain and Eric SCHOKKAERT, Katholieke Universiteit Leuven. This meeting was supported by the Pôle d'Attraction Interuniversitaire n° P4/01 (UCL, ULB and KUL).

PROGRAMME

May 16, 1997.

1. Tom VAN PUYENBROECK, Katholieke Universiteit Leuven.
   Regulatory mechanisms financed through distortionary taxes.

2. Olivier DEBANDE, Université libre de Bruxelles.
   Market structure and regulation.

3. Inje MAYERES, Katholieke Universiteit Leuven.
   The control of transport externalities in an applied general equilibrium model.

4. Kris DEJAEGHERE, Vrije Universiteit Brussel.
   Supply-induced demand in the health sector.

5. Lisa GRAZZINI, CORE, Université catholique de Louvain.
   Tax harmonisation: Does the unanimity rule play a role ?

6. Annick LARUELLE, IRES, Université catholique de Louvain.
   The EC decision-making procedure: Some insights from game theory.

7. Gregory DE WALQUE, Facultés Universitaires Notre-Dame de la Paix, Namur.
   Taxing excess wages to promote employment.

8. Pierre PICARD, IRES, Université catholique de Louvain.
   Optimal employment subsidy with heterogeneous workers under asymmetric information.

7.4 European Workshop on General Equilibrium Theory

organized by Heracles POLEMARCHAKIS.

Co-organizing Committee: Yves BALASKO, Université de Genève, David CASS, European University Institute, Bernard CORNET, Université de Paris I, Joan M^a ESTEBAN, Universitat Autonoma de Barcelona, Jean-Michel GRANDMONT, CORE, Université Catholique de Louvain and CREST, Paris, Birgit GRODAL, University of Copenhagen, Werner HILDENBRAND, Universität Bonn, Alan KIRMAN, GREQAM, Université d'Aix-Marseille, Andreu MAS-COLELL, Universitat Pompeu Fabra, Barcelona.

PROGRAMME

May 23, 1997.

Information

1. John GEANAKOPLOS, Yale University.
   Default and efficiency in a general equilibrium model with incomplete markets.

2. Enrico MINELLI, Università di Brescia and CORE.
   Information at a competitive equilibrium.

3. Beth ALLEN, Federal Reserve Bank of Minneapolis and Minnesota University.
   On the existence of core allocations in a large economy with incentive compatibility constraints.

4. Alexander KOVALENKOV, Universitat Autonoma de Barcelona.
   On a "folk" strategy-proof approximately Walrasian mechanism.

5. Massimo MORELLI, CORE and Iowa State University.
   Moral hazard and overlapping generations with endogenous occupational choice.

May 24, 1997.

Oligopoly and Coalitions

1. Michael FLORIG, CERMSEM, Université de Paris I.
   Oligopoly equilibria in large, but finite, linear exchange economies.

2. Nir DAGAN, Universitat Pompeu Fabra.
   Bargaining, coalitions, and competition.

3. Fabrizio GERMANO, Université de Lausanne.
   Bertrand-Edgeworth equilibria in finite exchange economies.

4. Leonidas KOUTSOUGERAS, Manchester University.
   On an Edgeworth characterization of rational expectations equilibria in atomless asset market economies.

Incomplete Markets

1. Ivar EKELAND, Université de Paris-Dauphine.
   Exterior differential calculus and aggregation theory.

2. Jean-Jacques HERINGS, CentER, Tilburg.
   Pareto improving price regulation when asset markets are incomplete.

3. Philip KALMUS, London School of Economics.
   Pareto improving trade restrictions: An example.

4. Chiaki HARA, University of Cambridge and Churchill College.
   Coalition production economies with incomplete stock markets.

5. Rose-Anne DANA, CEREMADE, Université de Paris-Dauphine.
   Optimal risk-sharing and pricing rules when agents have non-additive expected utility and homogeneous expectations.

6. Cuon LE VAN, CEPREMAP.
   On the different notions of arbitrage and existence of equilibrium.

7. François MAGNIEN, INSEE.
   No-arbitrage condition and existence of equilibria in asset markets with a continuum of traders.

8. Paulo KLINGER MONTEIRO, CORE and IMPA, Brésil.
   Discreteness of equilibria in incomplete markets with a continuum of states.

May 25, 1997.

Extensions

1. Jean-Philippe MEDECIN, CERMSEM, Université de Paris I.
   Existence of general equilibrium for spatial economies.

2. Yuri YEGOROV, Universitat Pompeu Fabra.
   Equilibrium in continuous space under decentralized production.

3. Birgit GRODAL, University of Copenhagen.
   Clubs and the market.

4. Peter HAMMOND, Stanford University.
   On the contrast between policies toward trade and migration.

Macroeconomics

1. Sami DAKHLIA, Washington University.
   Testing for a unique equilibrium in computable general equilibrium models.

2. James SEFTON, National Institute of Economics and Social Research, London.
   A solution method for consumption decisions in a dynamic stochastic general equilibrium model.

3. Kjetil STORESLETTEN, Stockholm University.
   Persistent idiosyncratic shocks and incomplete markets.

4. Jayasri DUTTA, University of Cambridge.
   The distribution of wealth with imperfect altruism.

5. Erik CANTON, Tilburg University.
   Fiscal policy in a stochastic model of endogenous growth.

7.5 CORE-FEEM Second Coalition Formation Workshop

organized for the Fondazione ENI Enrico Mattei (FEEM) by Carlo CARRARO, Universita degli Studi di Venezia, Domenico SINISCALCO, Universita degli Studi di Torino and for CORE by Claude d'ASPREMONT, Université catholique de Louvain, Massimo MORELLI, Iowa State University, Jonathan SHALEV, Tel-Aviv University and Henry TULKENS, Université catholique de Louvain.

PROGRAMME

June 13, 1997.

1. Francis BLOCH, H.E.C., Paris.
   Noncooperative models of coalition formation in games with spillovers.

2. Shlomo WEBER, Southern Methodist University, Texas.
   Group formation in games with externalities.

3. Massimo MORELLI, CORE and Iowa State University.
   Economic integration as a partition function game.

4. Sang-Seung YI, Dartmouth College, New Hampshire.
   Endogenous formation of research coalitions with spillovers.

June 14, 1997.

1. Debraj RAY, Boston University, Massachusetts.
   A theory of endogenous coalition structure.

2. Marco MARIOTTI, University of London.
   Agreements in strategic form games.

3. Hsueh-Ling HUYNH, Boston University, Massachusetts.
   On a simple static model of migration.

4. Andy NEWMAN, Columbia University, New York.
   Matching in an imperfect world.

5. Jonathan SHALEV, CORE and Tel-Aviv University.
   Electoral evolution: The quota one case.

6. Sayantan GHOSAL, Queen Mary College, London.
   Buyers' and sellers' cartels in market with indivisible goods.

8 Academic Visits

Academic visits by CORE members to other institutions:

July 1996:

Isabel GRILO,	University of Sienna
Yves SMEERS,	Ministry of Energy, Kiev, Ukraine

September 1996:

Knud ANDERSEN,	DASH Associates, Leamington Spa
Laurence BROZE,	Université de la Réunion, La Réunion
Victor GINSBURGH,	University of Chicago
Isabel GRILO,	Ouagadoudou University, Burkina Faso
Paulo KLINGER MONTEIRO,	Universidade Nova de Lisboa
Michel MOUCHART,	Pontifica Universidad Catolica, Santiago
José NINO-MORA,	Newcastle University
	Cambridge University

October 1996:

Bernard DE MEYER,	Laboratoire d'Econométrie de l'Ecole Polytechnique, Paris
Victor GINSBURGH,	University of Chicago
Michel MOUCHART,	Pontifica Universidad Catolica, Santiago
	Universidad de Chile, Santiago
	Unifersidad Austral de Chile, Valvidia
Jonathan SHALEV,	Universitat Autonoma, Barcelona

November 1996:

Cécile CORDIER,	DASH Associates, Leamington Spa
Jean J. GABSZEWICZ,	Ecole Polytechnique de Tunis
Victor GINSBURGH,	University of Chicago
Christian HAFNER,	CREST, Paris
Paulo KLINGER MONTEIRO,	Universidade Nova de Lisboa
Bernard LEJEUNE,	Université de Paris XII (Val-de Marne)

Michel MOUCHART,	Universidad de Chile, Santiago
José NINO-MORA,	Massachusetts Institute of Technology
Léopold SIMAR,	The University of Texas at Austin
	Rice University, Houston

December 1996:

Jacques DRÈZE,	University of Tokyo
	University of Toshiba
	University of Waseda
Victor GINSBURGH,	University of Chicago
Pierre PESTIEAU,	Université d'Abidjan
Jean-Marie ROLIN,	Universidad de Chile, Santiago
	Universidad Austral de Chile, Valvidia
Vincent VANNETELBOSCH,	Universitat de Valencia

January 1997:

Gian Luigi ALBANO	Fondazione Eni "Enrico Mattei", Milan
Kurt ANSTREICHER,	Konrad-Zuse für Informationstechnik Berlin
Luc BAUWENS,	GREQAM, Ecole des Hautes Etudes en Sciences Sociales, Marseille.
Stefano BOSI,	DELTA, Ecole Normale Supérieure, Paris
Pierre PESTIEAU,	Université de Montréal
	GREQAM, Ecole des Hautes Etudes en Sciences Sociales, Marseille
Léopold SIMAR,	Humboldt Universität zu Berlin
	Weierstrass Institute for Applied Analysis and Stochastics, Berlin
Yves SMEERS,	Temple University, Philadelphia
Henry TULKENS,	International Monetary Fund, Washington D.C.

February 1997:

Claude d'ASPREMONT,	Université Louis Pasteur, Strasbourg
Christian HAFNER,	Queen Mary & Westfield College, London
José NINO-MORA,	Universitat Pompeu Fabra de Barcelona
	Universidad Carlos III de Madrid
Pierre PESTIEAU,	GREQAM, Ecole des Hautes Etudes en Sciences Sociales, Marseille
Léopold SIMAR,	Société Royale de Chimie, Bruxelles
Henry TULKENS,	International Monetary Fund, Washington D.C.
Kees Jan VAN GARDEREN,	Center for Economic Studies, Leuven

March 1997:

Luc BAUWENS,	GREQAM, Ecole des Hautes Etudes en Sciences Sociales, Marseille
Laurence BROZE,	Université de la Réunion, La Réunion
Claude d'ASPREMONT,	Université Louis Pasteur, Strasbourg
Maurice MARCHAND,	Queen's University, Kingston
José NINO-MORA,	Northwestern University
Pierre PESTIEAU,	Institut d'Economie Industrielle, Toulouse
	International Monetary Fund, Washington D.C.
Jonathan SHALEV,	Institut Henri Poincaré, Paris
	Université Cergy-Pontoise
Yves SMEERS,	University of Arizona, Tucson

April 1997:

Kurt M. ANSTREICHER,	Technische Universiteit Delft
	Erasmus Universiteit Rotterdam
Luc BAUWENS,	Tinbergen Institute, Rotterdam
Cécile CORDIER,	DASH Associates, Blisworth
Claude d'ASPREMONT,	GREQAM, Ecole des Hautes Etudes en Sciences Sociales, Marseille

Jean J. GABSZEWICZ,	Université de la Réunion, La Réunion
Victor GINSBURGH,	Université de la Réunion, La Réunion
Alois KNEIP,	Schloss Glienicke, Berlin
Maurice MARCHAND,	Queen's University, Kingston
	Ecole des Hautes Etudes Commerciales, Montréal
Pierre PESTIEAU,	Institut d'Economie Industrielle, Toulouse
	GREQAM, Ecole des Hautes Etudes en Sciences Sociales, Marseille
Jean-Marie ROLIN,	Institut National de Statistique et d'Economie Appliquée, Rabat
	ENSAI, Rennes
Jonathan SHALEV,	CentER, Universiteit Tilburg.
	Universität Bielefeld
Henry TULKENS,	Federal University of Pernambuco, Recife

May 1997:

Knud ANDERSEN,	Odense University
Luc BAUWENS,	GREQAM, Ecole des Hautes Etudes en Sciences Sociales, Marseille.
Claude d'ASPREMONT,	Université Louis Pasteur, Strasbourg
Jacques DRÈZE,	Lithuanian Economic Association, Vilnius
Jean J. GABSZEWICZ,	Université de la Réunion, La Réunion
Victor GINSBURGH,	GREQAM, Ecole des Hautes Etudes en Sciences Sociales, Marseille
	Université de la Réunion
Alois KNEIP,	Université Joseph Fourier, Grenoble
	Université de Toulouse III
Michel MOUCHART,	Universität Munich
Pierre PESTIEAU,	GREQAM, Ecole des Hautes Etudes en Sciences Sociales, Marseille

Jonathan SHALEV,	Universität des Saarlandes, Saarbrücken
Léopold SIMAR,	Institut von Karman de dynamique des fluides, Bruxelles
Vincent VANNETELBOSCH,	Universidad del Pais Vasco, Bilbao

June 1997:

Gian Luigi ALBANO,	Universidad Carlos III, Madrid
Kurt M. ANSTREICHER,	Eidgenössische Technische Hochschule Zürich
Luc BAUWENS,	GREQAM, Ecole des Hautes Etudes en Sciences Sociales, Marseille.
Stefano BOSI,	Université d'Evry-Val d'Esonne
Claude d'ASPREMONT,	GREQAM, Ecole des Hautes Etudes en Sciences Sociales, Marseille
Jean J. GABSZEWICZ,	Université de la Réunion
Victor GINSBURGH,	GREQAM, Ecole des Hautes Etudes en Sciences Sociales, Marseille
	Université de la Réunion
Alois KNEIP,	Universität Heidelberg
Michel MOUCHART,	University of Kassel
	Université Jean Monnet, Saint-Etienne
Yves SMEERS,	Ecole Polytechnique, Paris
Jonathan SHALEV,	Tel Aviv University

9 Conferences and Meetings

CORE members attended the following conferences and most presented a paper:

July 1996:

European Economic Association Annual Congress, Istambul,
Nicolas BOCCARD, Paola DONATI, Henry TULKENS and Alessandro TURRINI.

Journées "DELTA", Paris,
Stefano BOSI

Summer School in Tel Aviv,
Paola DONATI

TMR/Savings Workshop, Tilburg,
Pierre PESTIEAU

NBER Conference on International Social Security Comparisons, Cambridge,
Pierre PESTIEAU

International Institute of Public Finance Congress, Tel Aviv,
Pierre PESTIEAU and Henry TULKENS

International Workshop on Game Theory and Politics, Universidad de Santiago de Compostela,
Vincent VANNETELBOSCH

The Seventh Stony Brook Summer Institute on Game Theory, SUNY, Stony Brook,
Vincent VANNETELBOSCH.

August 1996:

European Meeting of the Econometric Society (ESEM 96), Istambul,
Luc BAUWENS, Nicolas BOCCARD, Bernard LEJEUNE, Alessandro TURRINI and Kees Jan VAN GARDEREN

Annual Congress of the International Institute of Public Finance, Tel Aviv,
Pierre PESTIEAU and Henry TULKENS.

Workshop on "The Transition to Deregulated and Internationalized Market for Electricity", Stockholm School of Economics,
Yves SMEERS and Jing-Yuan WEI

Summer School on Mixed Integer Programming, Cortona,
Laurence WOLSEY

September 1996:

SOR96, Braunschweig,
Kurt M. ANSTREICHER

Alterner Contractors Meeting, Sophia Antipalis,
Ilias DEDOPOULOS

Les Journées de Probabilités, Centre International de Rencontres Mathématiques (CIRM), Luminy,
Bernard DE MEYER

European Economic Association Summer School on "Computational Methods for the Study of Dynamic Economies", Florence,
Paola DONATI.

Workshop on Political Economy and Trade, Aix-en-Provence,
Jean GABSZEWICZ

Workshop on "Asymptotic Methods in Stochastic Dynamics and Nonparametric Statistics", Berlin,
Alois KNEIP

Congrès Annuel de l'Association Française d'Economie Sociale, Rennes,
Pierre PESTIEAU

Workshop on Production Planning and Control, Mons,
Yves POCHET and Laurence WOLSEY

CEPR European Research Workshop on International Trade, Glasgow,
Alessandro TURRINI, Tanguy VAN YPERSELE

October 1996:

Latin American Congress of Statistical Societies (CLATSE III), Santiago,
Michel MOUCHART

Fourth Annual Meeting of the Belgian Statistical Society, La Roche-en-Ardenne,
José PARIS, Léopold SIMAR

6th AFIR (Aktuarielle Ausätze für Finanz-Risiken) International Colloquium, Nürnberg,
José PARIS

Workshop on "Regional Strategies, Decentralization and Subsidiarity", Toulouse,
Pierre PESTIEAU, Tanguy VAN YPERSELE

Workshop on "Application of Differential Geometry to Econometrics: Theory and Application", European University Institute, Florence,
Kees Jan van GARDEREN

Workshop on Combinatorial Optimization, Oberwolfach,
Laurence WOLSEY

Workshop on Test Sets, Konrad-Zuse-Zentrum für Informationstechnik Berlin,
Laurence WOLSEY

November 1996:

XVIIème Rencontre Franco-Belge de Statisticiens, Marne-la-Vallée,
Michel MOUCHART, Jean-Marie ROLIN, Léopold SIMAR

INFORMS National Meeting, Atlanta,
José NINO MORA and Léopold SIMAR

Journées de Contact Sciences Actuarielles, Bruxelles,
José PARIS

Journées "Générations Imbriquées", Marseille,
Pierre PESTIEAU

Congrès des Economistes Belges de Langue Française, Bruxelles,
Pierre PESTIEAU

Second Georgia Productivity Workshop, University of Georgia, Athens,
Henry TULKENS and Philippe VANDEN EECKAUT

December 1996:

Seventh European Conference Series in Quantitative Economics and Econometrics, Florence,
Luc BAUWENS

Financial Econometrics Workshop, Universiteit Tilburg,
Luc BAUWENS and Christian HAFNER

Institutional Economic Association Conference on "The Institutional Foundation of Economic Development in East Asia", Tokyo,
Jacques DRÈZE

ISPE Seminar on "The Economics of Status", Bonn,
Pierre PESTIEAU

Colloque sur "Repenser radicalement la solidarité", Louvain-la-Neuve,
Pierre PESTIEAU

ESF Meeting on Regional Growth and Employment, Barcelona,
Alessandro TURRINI

January 1997:

Conference on "Pressure groups, self-regulation and enforcement mechanisms", Fondazione ENI "Enrico Mattei", Milan,
Gian Luigi ALBANO and Lisa GRAZZINI

ORBEL XI, 11th Conference on Quantitative Methods for Decision Making, Facultés Universitaires Notre-Dame de la Paix, Namur,

Gaëtan BELVAUX, Cécile CORDIER, Marko LOPARIC and Yves POCHET (co-organizer)

LISREL Workshop, Institut de Statistique, Université catholique de Louvain, Michel MOUCHART (organizer).

Workshop on "Foundations of Computational Mathematics", Rio de Janeiro, Yurii NESTEROV

Energy Modelling Forum, Stanford University, Stanford,
Yves SMEERS

February 1997:

MEMIPS Workshop, Buckingham,
Gaëtan BELVAUX

3ème Cycle FNRS en Programmation Mathématique, Han-sur-Lesse,

Gaëtan BELVAUX, Cécile CORDIER, Patricio ESPINOSA, Yves POCHET and Laurence WOLSEY

Workshop on "Public Policy and the Corporation", Faculté universitaire catholique de Mons,
Lisa GRAZZINI

International Workshop: "The Art of Nonparametric Statistics", Institut de Statistique, Université catholique de Louvain,

Alois KNEIP (co-organizer), Michel MOUCHART, Jean-Marie ROLIN and Léopold SIMAR (co-organizer).

Be Developer Conference, Paris,
Thierry LE BOULENGE

Workshop on Intergenerational Equity, Leuven,
Oliver PADDISON

TMR Network-Workshop on "Savings, pensions and portfolio choice", Naples,
Pierre PESTIEAU

Power Conference, University of California at Berkeley,
Yves SMEERS

March 1997:

3ème cycle de Recherche Opérationnelle, Zinal,
Kurt M. ANSTREICHER

Public Economics Workshop (PAI), Katholieke Universiteit Leuven,
Claude d'ASPREMONT, Sergio CURRARINI, Maurice MARCHAND, Pierre PESTIEAU, Frans SPINNEWYN, Henry TULKENS

NATO Advanced Studies Institute on "Operations Research and Decision Aid Methodologies in Traffic and Transportation Modelling", Balatonfured,
Ilias DEDOPOULOS

Biannual Workshop in Public Economics I, Leuven
Oliver PADDISON

Forum des retraites, Bordeaux,
Pierre PESTIEAU

Journées du groupe MODE, SMAI, Institut Henri Poincaré, Paris
Laurence WOLSEY

April 1997:

European Doctoral Program Jamboree, Chantilly,
Stefano BOSI, Sergio CURRARINI, Paola DONATI, Francesco MAGRIS, Oliver PADDISON, Constantinos PAPADOPOULOS, Heracles POLEMARCHAKIS, Matteo SALTO and Alessandro TURRINI

Assemblée Annuelle de l'Académie Pontificale des Sciences Humaines, Rome,
Jacques DRÈZE

Workshop on Large Scale Optimization, Haifa,
Yurii NESTEROV

Workshop on Planning and Scheduling Problems, Cambridge,
José NINO-MORA

Colloquium "MAPA", Institut Interfacultaire de Mathématique pure et appliquée, Université catholique de Louvain,
Léopold SIMAR

May 1997:

Workshop on Bayesian Econometrics and Statistics, Krakow,
Luc BAUWENS

Journées des Jeunes Economètres, Dijon,
Laurence BROZE and Frédéric JOUNEAU

Journées de Micro-Economie Appliquée, Marrakesch,
Laurence BROZE, Claude d'ASPREMONT and Frédéric JOUNEAU

NBER Conference on "General Equilibrium and Economic Theory", Yale University, New Haven,
Bernard DE MEYER

150ème Anniversaire de l'Académie des Sciences d'Autriche, Vienne,
Jacques DRÈZE

Ecole de Printemps, GREQAM, Marseille,
Jean J. GABSZEWICZ, Victor GINSBURGH and Lisa GRAZZINI

AIO-Cursus in Financial Markets, Maastricht,
Pierre GIOT

Workshop on "Nonlinear Dynamics", Torino
Jean-Michel GRANDMONT

Conference on "Nonlinear Economic Dynamics", GREQAM, Marseille,
Jean-Michel GRANDMONT

XXXIXèmes Journées de Statistique, Carcassonne,
Alois KNEIP, Michel MOUCHART, Jean-Marie ROLIN and Léopold SIMAR

Joint International Seminar in International Trade and CEPR Geography Seminar (NBER/CEPR conference), Paris,

Gianmarco OTTAVIANO, Jacques THISSE (co-organizer)

Workshop on "Growth and Geography", CEPR, Paris

Gianmarco OTTAVIANO

Biannual Workshop in Public Economics II, Louvain-La-Neuve,

Oliver PADDISON

NBER Conference on "International Social Security Comparisons", Bordeaux,

Pierre PESTIEAU

Conférence sur la "Compétitivité de l'Energie Nucléaire", Société Française d'Energie Nucléaire, Paris,

Yves SMEERS

June 1997:

8th Summer School in Economic Theory, Jerusalem,

Nicolas BOCCARD, Paola DONATI, Lisa GRAZZINI, Konstantinos PAPADOPOULOS, Heracles POLEMARCHAKIS, Matteo SALTO and Claude WAMPACH.

CODE Conference on Organizational Design, Political Decisions and Incentives, Barcelona,

Claude d'ASPREMONT

BoWo Workshop on Aggregation, Bonn,

Jean-Michel GRANDMONT, Frédéric JOUNEAU, Alois KNEIP and Heracles POLEMARCHAKIS

Geneva-Venice Workshop in Economic Theory, Venice,

Paulo KLINGER MONTEIRO, Massimo MORELLI, Matteo SALTO and Heracles POLEMARCHAKIS

Seventh International Conference on Panel Data, Paris,

Bernard LEJEUNE

3rd International Conference of the Society for Advancement of Economic Theory, Antalya,

Massimo MORELLI and Jonathan SHALEV

Workshop on "The Political Economy of Economic Policy", European Science Foundation, Florence,

Gianmarco OTTAVIANO

SCSS Exploratory Grant Meeting, European Science Foundation, Geneva,

Gianmarco OTTAVIANO

Annual Congress of the European Society for Population Economics, Essex,

Pierre PESTIEAU

Summer Meetings of the North American Econometric Society, Pasadena

Jonathan SHALEV

ESF Meeting on Regional Growth and Employment, Geneva,

Alessandro TURRINI

Appendix

This section gives abstracts of the discussion papers that appeared in the period covered by this report. They are listed in numerical order.

9634 Joseph C. PERREZ, Strategic investment in technology and unemployment.

Strategic investment is studied in a model where oligopolists take decisions sequentially. First period investment determines second period wealth and output, and this is anticipated correctly by Cournot oligopolists. In our model with linear technology firms invest less as competition intensifies. In a situation of unemployment output, employment and well being increase with competition.

9635 Bernard de MEYER, The maximal variation of a bounded martingale and the central limit theorem.

Mertens and Zamir's (1977) paper is concerned with the asymptotic behaviour of the maximal L^1-variation $\xi_n^1(p)$ of a $[0,1]$-valued martingale of length n starting at p. They prove the convergence of $\xi_n^1(p)/\sqrt{n}$ to the normal density evaluated at its p-quantile.

This paper generalises this result to the conditional L^q-variation for $q \in [1,2)$.

The appearance of the normal density remained unexplained in Mertens and Zamir's proof: it appeared there as the solution of a differential equation. Our proof however justifies this normal density as a consequence of a generalisation of the CLT discussed in the second part of this paper.

9636 Konstantinos TRIANTIS and Philippe VANDEN EECKAUT, Fuzzy pairwise dominance and implications for technical efficiency performance assessment.

Classically, the concept of efficiency measurement is based on the definition of a frontier that envelops the observed production plans. The efficiency score itself is based on the distance of an observed production plan from this frontier. The frontier along with the required technological assumptions (such as convexity) needed for its definition may be replaced with the concept of pairwise dominance. This concept leads to a classification scheme for all production plans instead of a ranking based on efficiency scores. Also, the traditional assumption of

deterministic or crisp production plans may be substituted with the weaker assumption of fuzzy production plans as proposed by fuzzy set theory. This paper attempts to merge these two concepts and to define a new classification scheme based on fuzzy dominance.

9637 Yurii NESTEROV, Michael J. TODD and Ping-Yuan YE, Primal-dual methods and infeasibility detectors for nonlinear programming problems.

In this paper we present several "infeasible-start" path-following and potential-reduction primal-dual interior-point methods for nonlinear conic problems. These methods try to find a recession direction of the feasible set of a self-dual homogeneous primal-dual problem. The methods under consideration generate an ε-solution for an ε-perturbation of an initial strictly (primal and dual) feasible problem in $O(\sqrt{\nu}\ \ln\frac{\nu}{\varepsilon\rho_f})$ iterations, where ν is the parameter of a self-concordant barrier for the cone, ε is a relative accuracy and ρ_f is a feasibility measure.

We also discuss the behavior of path-following methods as applied to infeasible problems. We prove that strict infeasibility (primal or dual) can be detected in $O(\sqrt{\nu}\ \ln\frac{\nu}{\rho_\cdot})$ iterations, where $\rho_\cdot$ is a primal or dual infeasibility measure.

9638 Byeong U. PARK, Robin C. SICKLES and Léopold SIMAR, Stochastic panel frontiers: A semiparametric approach.

This paper complements the results of Hausman and Taylor (1981) and Cornwell, Schmidt and Sickles (1990) and generalized Park and Simar (1994) by examining the semiparametric efficient estimation of panel models in which the random effects and the regressors have certain patterns of correlation. A model in which the estimator may have particular promise is the stochastic panel frontier model. In that model inefficiency may be correlated with certain determinants of technology or proxies for heterogeneity in the application of that technology. Generalized least squares or other estimators that fail to address this dependency structure are inconsistent. We examine semiparametric efficient estimation for three different models based on differing dependency structures. Efficiency of the slope parameters and the asymptotic properties of the level of the frontier function are explored. We illustrate our new estimator in an analysis of productive efficiency between selected North American and European airline firms after domestic deregulation in the U.S. and prior to recent European reforms implemented in the course of EC integration.

9639 Alois KNEIP, Byeong U. PARK and Léopold SIMAR, A note on the convergence of nonparametric DEA efficiency measures.

Efficiency scores of production units are measured by their distance to an estimated production frontier. Nonparametric DEA estimators are based on a finite sample of observed production units and radial distances are considered. We investigate the consistency and the speed of convergence of these estimated efficiency scores (or of the radial distances) in the very general setup of multi-output and multi-input case. It is shown that the speed of convergence relies on the smoothness of the unknown frontier and on the number of inputs and of outputs. Furthermore, one has to distinguish betwen the output- and the input-oriented case.

9640 Pierre WUNSCH, Estimating menus of linear contracts for mass transit firms (in the spirit of Laffont and Tirole).

Relying on numerical methods, we estimate menus of linear contracts as proposed by Laffont and Tirole (1986) for the regulation of firms in a framework with moral hazard and adverse selection. The main idea is to circumscribe the uncertainty about the unknown cost parameters by using regular inference techniques in econometrics. More precisely, the asymmetry of information is assumed to be limited to the unexplained variance of a cost estimation based on a cross-section of 177 transit firms. The menus are made contingent upon the technical characteristics of the networks and depend on simple assumptions dictated mostly by empirical evidence for the industry under review.

9641 Vincent J. VANNETELBOSCH, Rationalizability and equilibrium in N-person sequential bargaining.

This paper deals with N-person sequential bargaining games with complete information (perfect or almost perfect information). For N-person sequential bargaining games, uniqueness of the SPE has been obtained by allowing the players to exit with partial agreements. Adopting a non-equilibrium approach, we show that N-person sequential bargaining games without exit are only solvable by a refinement of rationalizability for multi-stage games (trembling-hand rationalizability) if the players are sufficiently impatient. Nevertheless, N-person sequential bargaining games with exit are solvable by trembling-hand rationalizability whatever the players' impatience. That is, once we take up the non-equilibrium approach, the exit opportunity still

fulfils its original aim: we achieve a unique solution by introducing the exit opportunity.

9642 Vincent J. VANNETELBOSCH, N-person sequential bargaining with endogenous procedure.

In this note, we consider a negotiation model wherein a simultaneous voting game, which endogenizes the choice of the bargaining procedure, is introduced. That is, in stage 1 of the negotiation (i.e. before starting the bargaining), the $N \geq 3$ players vote to decide which procedure (clockwise or anticlockwise) with exit will be adopted during the bargaining. Then, in stage 2 of the negotiation, the players bargain over the cake following the chosen bargaining process. We show that the more patient the players the more likely the anticlockwise bargaining procedure will be the outcome of the voting game. Note that, in comparison to the clockwise procedure, the anticlockwise procedure leads to a less fair bargaining outcome.

9643 Margarita SAMARTIN, A model for financial intermediation and public intervention.

Based on Chari and Jagannathan (1988), this paper models information-induced and "pure-panic" runs in an environment of risk-averse agents.

In this framework, deposits are needed to provide insurance against investors' unexpected demand for liquidity and therefore, a role for a financial intermediary is justified.

Conditions to assure bank-runs as an equilibrium phenomenon are derived and a welfare analysis of two devices that have traditionally been used by banks in order to prevent runs (namely, suspension of convertibility versus deposit insurance), is presented.

9644 Hsiao-Chi CHEN, James W. FRIEDMAN and Jacques-François THISSE, Boundedly rational Nash equilibrium: A probabilistic choice approach.

This paper proposes an equilibrium concept for n-person finite games based on boundedly rational decision making by players. The players are modeled as following random choice behavior in the manner of the logit model of discrete choice theory as set forth by Luce, McFadden and others. The behavior of other players determines in a natural way a lottery facing each player i. At equilibrium, each player is using the appropriate choice probabilities, given the choice probabilities used by the others

in the game. The rationality of the players is parameterized on a continuum from complete rationality to uniform random choice. Using results by McKelvey and Palfrey, we show existence of an equilibrium for any finite n-person game and convergence to Nash equilibrium. We also identify conditions such that, for given rationality parameters the path of choices over time when the players use fictitious play (their beliefs about other players' choices are given by the empirical distributions of those players) converges to equilibrium.

9645 Simon P. ANDERSON, André de PALMA and Jacques-François THISSE, Privatization and efficiency in a differentiated industry.

We consider a market in which a public firm competes against private ones, and ask what happens when the public firm is privatized. In the short run, privatization is harmful because prices rise: the disciplinary role of the public firm is lost. In the long run, privatization leads to further entry; the net effect is beneficial if consumer preference for variety is not too weak. A sufficient statistic for the social surplus to be higher in the long run is that the public firm makes a loss. This suggests that profitable firms should not necessarily be privatized.

9646 Igor V. EVSTIGNEEV, Werner HILDENBRAND and Michael JERISON, Metonymy and cross section demand.

Cross section consumer expenditure data are frequently used to make conclusions about consumer demand behavior. Such conclusions, however, can only be justified under certain assumptions, which are often left unstated in the empirical demand literature. An assumption of this type, the *metonymy* hypothesis, was stated rigorously and then exploited by Härdle, Hildenbrand and Jerison when analyzing the monotonicity property of aggregate demand functions. The purpose of the present paper is to examine the metonymy hypothesis in more detail. We prove that the distribution of demand vectors derived from a not necessarily metonymic population is identical to the distribution derived from some metonymic one. This implies, in particular, that the metonymy hypothesis cannot be rejected or confirmed on the basis of data from a single cross section.

9647 Beate BROCKMÜLLER, Oktay GÜNLÜK and Laurence WOLSEY, Designing private line networks – Polyhedral analysis and computation.

We study a capacitated network design problem arising in the design of private line networks. Given a complete graph, a

subset of its node set (the "hub" set), and point-to-point traffic demands, the objective is to install capacity on the edges (using several batch sizes and nonlinear costs), and route traffic in the resulting capacitated network, so that 1) all the demand between a pair of nodes is routed along a single path, and 2) the demand is either sent directly from source to sink, or via a number of hub nodes. We first formulate an initial integer program, and various approximations to it. Valid inequalities are then derived for a special knapsack problem involving both integer and 0-1 variables arising from the capacity constraints on an edge. These and related inequalities are then used to strengthen the formulations. Computational results with branch-and-bound and branch-and-cut are presented.

9648 Kees Jan van GARDEREN, Exact geometry of autoregressive models.

This paper derives exact expressions for the statistical curvature and related geometric quantities in the first order autoregressive models. We present a method that combines the algebra of differential- and difference operators to simplify the problem, and to obtain results valid for all sample sizes. The exact covariance matrix for the sufficient statistic is also derived.

9649 Bernardo BORTOLOTTI, Trials and errors: Plea bargaining as a learning device.

The plea bargaining procedure, namely the viability of a stage of bargaining between prosecutor and defendant in criminal suits, is analyzed in the framework of a two-sided incomplete information game. It is shown that, for a given parameter configuration, there exists a Bayesian equilibrium with perfect screening of the guilty defendant. In the repeated game, a prosecutor who systematically resorts to the informative strategy and updates her beliefs in a Bayesian fashion asymptotically learns the "truth" in terms of proportion of guilty parties in the whole population of the indictees.

9650 Jean-François MERTENS, The limit-price mechanism.

We extend the "double auction" mechanism to a multi-commodity setup, or alternatively Shapley's "window"-mechanism to allow for limit orders.

9651 Nicolas BOCCARD, Tanguy VAN YPERSELE and Pierre WUNSCH, Comparative advantage, redistribution and the political process.

This paper analyses the interaction between comparative advantages, social protection and the political system. Considering entirely symmetrical countries whose production factors are immobile, we suggest that redistributive policies can be "exported" or "imported" depending on their impact on trade patterns. This points to the need of coordinating social policies in a second best world. However, we also show that competition from other countries could force a reduction in the exclusion from the labour market when the political process reduces to an insider-outsider story between employed and unemployed workers.

9652 Alessandro TURRINI, Liberalization, quality and welfare. Removing the Italian VER on Japanese car exports.

Both the theoretical and the empirical literature on international trade agree that quantitative restrictions on trade have an impact on the average quality of exports. Yet, in evaluating (ex-ante) trade policy effects, there are no studies taking into account the role of the change in quality. In this paper the choice of quality is endogenized in a two-stage game in a model which is calibrated to the Italian car market, one of the most protected in Europe. Simulating the removal of the VER on Japanese exports, there are substantial gains from liberalization when only quantity effects are considered. Results change dramatically if quality effects are taken into account: the downgrading in Japanese exports entails a strong reduction in consumers' gains.

9653 Helmuth CREMER and Pierre PESTIEAU, Income redistribution in an economic union: The trade off between inter- and intranational redistribution.

This paper studies the design of redistributive policies between and within the member countries of an economic union. There are two types of countries, which differ in their proportion of high income individuals. Both the supra-national and the national governments attempt to redistribute income within their respective boundaries. However, the central government cannot observe an individual country's ability to pay; it only observes the aggregate (internal) redistributive effort of each country. We derive the optimal incentive compatible tax-transfer policy of the central government and show that there is a tradeoff between inter- and intranational redistribution. Specifically, to reduce

informational rents of the rich countries, the optimal policy induces a distortion in the poor countries'(internal) redistributive policies. Interestingly, both insufficient as well as excessive redistribution can arise.

9654 Philippe MICHEL and Pierre PESTIEAU, Optimal population without repugnant aspects.

This paper addresses the issue of optimum population with two concerns: avoiding both the *absolute* repugnant solution that amounts to giving to an infinite number an infinitesimal amount and the *marginal* repugnant solution in which equilibrium consumption decreases with income. To avoid these two solutions, we introduce a critical level of utility that depends on individuals' marginal income.

9655 Amrita DHILLON and Jean-François MERTENS, Relative utilitarianism and improved axiomatisation.

In a framework of preferences over lotteries, we show that an axiom system consisting of weakened versions of Arrow's axioms has a unique solution. "Relative Utilitarianism" consists of first normalising individual von Neumann–Morgenstern utilities between 0 and 1 and then summing them. This axiomatisation largely supersedes the one in Dhillon and Mertens (1993).

9656 Sonia WEYERS, Common knowledge without differentiating counterfactuals.

In this paper, I present results on communication and common knowledge in a group with a learning mechanism which is less demanding than the one most commonly used in the existing literature. More specifically, I consider that people distinguish between reality and counterfactuals but not between different counterfactual possibilities. This learning process is qualitatively similar to the two person learning process used by Geanakoplos and Polemarchakis. First I present two results on group communication, one static and one dynamic. The static result presents a sufficient condition for common knowledge based on groupwise comparisons and the dynamic result states that common knowledge will be reached in finite time. This is the problem studied by Cave. The static result is independent of Cave's work. In the dynamic result, I weaken the requirements on the learning process. Second, I examine the case of pairwise communication in a group of n individuals. In a static result I state a sufficient condition for common knowledge of the value

of a function, in which only n pairwise comparisons are involved. Each of these comparisons is based on the distinction between reality and counterfactuals as was described above. Finally, I discuss the difficulty of using the above learning mechanism for pairwise communication.

9657 Pascal BELAN, Philippe MICHEL and Pierre PESTIEAU, Pareto improving social security reform with endogenous growth.

It is generally accepted that moving from an unfunded to a funded social security system implies a welfare loss for the transition generation, that is the generation that has to pay twice: first, saving for its own retirement and second, contributing to the pensions of the then retired generation. This paper shows that in a setting of endogenous growth with positive externality such a transition can be Pareto-improving.

9658 Yaoguang WANG, Bicriteria job sequencing with release dates.

We consider the single machine job sequencing problem with release dates. The main purpose of this paper is to investigate efficient and effective approximation algorithms with a bicriteria performance guarantee. That is, for some (ρ_1, ρ_2), they find schedules simultaneously within a factor of ρ_1 of the minimum total weighted completion times and within a factor of ρ_2 of the minimum makespan.

The main results of the paper are summarized as follows. First, we present a new $O(n \log n)$ algorithm with the performance guarantee $\left(1+\frac{1}{\beta}, 1+\beta\right)$ for any $\beta \in [0,1]$. For the problem with integer processing times and release dates, the algorithm has the bicriteria performance guarantee $\left(2-\frac{1}{p_{max}}, 2-\frac{1}{p_{max}}\right)$, where p_{max} is the maximum processing time. Next, we study an elegant approximation algorithm introduced recently by Goemans. We show that its randomized version has expected bicriteria performance guarantee $(1.7735, 1.51)$ and the derandomized version has the guarantee $(1.7735, 2-\frac{1}{p_{max}})$.

To establish the performance guarantee, we also use two LP relaxations and some randomization techniques as Goemans does, but take a different approach in the analysis, based on a decomposition theorem. Finally, we present a family of bad instances showing that it is impossible to achieve $\rho_1 \leq 1.5$ with this LP lower bound.

9659 George NORMAN and Jacques-François THISSE, Technology choice and market structure: Strategic aspects of flexible manufacturing.

> This paper shows that the adoption of flexible manufacturing techniques by firms leads to a tougher price regime. This need not benefit consumers since the tougher regime deters entry and facilitates segmented market structures. The ability of flexible manufacturing to deter entry is moderated by two forces: non-prohibitive costs of re-anchoring flexible manufacturing processes and entrants choosing to produce niche products using designated technologies rather than to adopt flexible manufacturing. If flexible manufacturing leads to market preemption it can be expected to be characterized by excessive product variety. Alternatively, flexible manufacturers may prefer to accommodate entry by small-scale, niche firms.

9660 Léopold SIMAR and Paul W. WILSON, Estimating and bootstrapping Malmquist indices.

> This paper develops a consistent bootstrap estimation procedure for obtaining confidence intervals for Malmquist indices of productivity and their decompositions. Although the exposition is in terms of input-oriented indices, the techniques can be trivially extended to the output orientation. The bootstrap methodology is an extension of earlier work described in Simar and Wilson (1996). Some empirical examples are also given, using data on Swedish pharmacies.

9661 Helmuth CREMER and Pierre PESTIEAU, Social insurance and labor mobility. A political economy approach.

> This paper presents a political economy approach to payroll tax competition between countries adopting different systems of social insurance. It considers two such systems: the *Bismarckian* one where benefits are partially linked to payroll taxes and the *Beveridgean* one where benefits are flat. A third system, referred to as *private*, with no redistributive feature (and relying on the concept of actuarial fairness) is also considered. Our main objective is to assess the relative robustness of Bismarckian and Beveridgean social insurance systems in various symmetric and asymmetric settings. Quite surprisingly, the common belief that the Bismarckian system is more tax-competition proof turns out to be wrong in a number of cases. The fundamental instability of a Beveridgean system nevertheless appears when the social insurance *system* itself (and not just the *level* of protection) is

chosen in a strategic way at some prior (constitutional) stage. It may then be a dominant strategy for all countries to adopt a Bismarckian system even when the Beveridgean system is less affected by tax competition. In other words, the choice of social insurance systems resemble a *prisoners* dilemma type game.

9662 João Pedroso PEDROSO RAMOS DOS SANTOS, Niche search and evolutionary optimisation.

We start this paper by an introduction to evolutionary algorithms and to their biological background. We present a survey of the most important evolutionary schemes found in the literature.

We then describe niche search, a genetic-based optimisation approach that we have designed and implemented. It is characterised by an evolutionary search on two layers: the individual layer (which is comparable to search described in other genetic algorithms), and the niche layer.

Neither of these searches is directed: both individuals and niches evolve based on the selection of the fittest.

The numerical results obtained by niche search are quite promising, as our implementation has successfully handled all the tests carried out. The computational performance is considerably better than that of other algorithms of the same family analysed in the literature.

9663 Philippe MONGIN and Claude d'ASPREMONT, Utility theory and ethics.

This chapter discusses various technical constructions and philosophical interpretations of utility theory with a view of establishing its relevance to social ethics.

9664 Sergio CURRARINI, Ratio equilibria and voting in a public goods economy with jurisdictions.

In two related papers, Kaneko (1977, 1977a) has proved an equivalence theorem relating the set of ratio equilibria of a public goods economy to the core of a strong voting game. This paper extends in two ways Kaneko's analysis to economies with jurisdictions, each producing a specific public good. First, for economies in which a central authority exists, we provide sufficient conditions on the voting rules and on the institutional set-up for Kaneko's equivalence result to generalize. Next, for economies with independent jurisdictions, we propose a concept of (noncooperative) equilibrium and prove the nonemptiness of the set of equilibrium allocations under the assumption that

each public good is non inferior in the jurisdiction producing it. For this case, we also study a cooperation process among independent jurisdictions.

9665 Jan K. BRUECKNER, Jacques-François THISSE and Yves ZENOU, Why is central Paris rich and downton Detroit poor ? An amenity-based theory.

This paper presents an amenity-based theory of location by income. The theory shows that the relative location of different income groups depends on the spatial pattern of amenities in a city. When the center has a strong amenity advantage over the suburbs, the rich are likely to live at central locations. When the center's amenity advantage is weak or negative, the rich are likely to live in the suburbs. The virtue of the theory is that it ties location by income to a city's idiosyncratic characteristics. It thus predicts a multiplicity of location patterns across cities, consistent with real-world observation.

9666 Jonathan H. HAMILTON and Jacques-François THISSE, Nonlinear pricing in spatial oligopoly.

A model of duopoly competition in nonlinear pricing when firms are imperfectly informed about consumer locations is analyzed. A continuum of consumers purchase a variable amount of a product from one of two firms located at the endpoints of the market. At the Nash equilibrium in quantity-outlay schedules, consumers buy the same quantities as they would from the same firm if it were a monopolist facing the same informational asymmetries, but they receive greater surplus. Hence, no efficiency gains result from competition. If consumers have the option to reveal their locations and have the firms deliver the goods, all consumers choose to reveal their locations in equilibrium. Thus, the inefficiencies from information asymmetries may not arise because firms can deliver the good to consumers. In contrast, with a monopoly seller, consumers have no incentives to reveal their locations.

9667 Pierre André JOUVET, Philippe MICHEL and Pierre PESTIEAU, Altruism, voluntary contributions and neutrality. The case of environmental quality.

This paper develops a dynamic model wherein production generates pollution that is viewed as a public bad by consumers. There are two types of consumers: those who are altruist à la Barro-Becker and leave bequests to their children and those who are pure life-cyclers. Both types of consumers voluntarily contribute to the quality of environment. It appears that if

bequests by altruists and voluntary contributions by all are positive, redistribution is neutral. To achieve optimality, one needs a tax on capital to reach the optimal level of pollution and a differential subsidy on altruistic and non altruistic consumers' contributions.

9701 Marc GERMAIN, Philippe TOINT and Henry TULKENS, Financial transfers to ensure cooperative international optimality in stock pollutant abatement.

It is well known that the transnational character of many environmental problems requires cooperation amongst the countries involved, if a social optimum is at all to be achieved. Most of the numerous contributions dealing with the problems raised by the cooperation issue bear only on pollutants that do not accumulate: they are thus only relevant in a static, or a-temporal, context. On the other hand, many contributions which deal with the dynamic dimension of the problem when the pollutant accumulates leave aside the issue of the voluntary implementation of the international optimum. The aim of the present contribution is to overtake the two above limitations. Using both cooperative and differential game theories, we design a scheme of financial transfers between countries such that aggregate abatement costs are covered in a way that makes cooperation both individually rational and strategically stable.

9702 Jean-Jacques HERINGS and Vincent J. VANNETELBOSCH, Refinements of rationalizability for normal-form games.

In normal-form games, rationalizability (Bernheim [3], Pearce [11]) on its own fails to exclude some very implausible strategy choices. Three main refinements of rationalizability have been proposed in the literature: cautious, perfect, and proper rationalizability. Nevertheless, some of these refinements also fail to eliminate unreasonable outcomes and suffer from several drawbacks. Therefore, we introduce the trembling-hand rationalizability concept, where the players' actions have to be best responses also against perturbed conjectures. We also propose another refinement: weakly perfect rationalizability, where players' actions that are not best responses are only played with a very small probability.

We show the relationship between perfect rationalizability and weakly perfect rationalizability as well as the relationship between proper rationalizability and weakly perfect rationalizability: weakly perfect rationalizability is a weaker refinement than

both perfect and proper rationalizability. Moreover, in two-player games it holds that weakly perfect rationalizability is a weaker refinement than trembling-hand rationalizability. The other relationships between the various refinements are illustrated by means of examples. For the relationship between any other two refinements we give examples showing that the remaining set of strategies corresponding to the first refinement can be either smaller or larger than the one corresponding to the second refinement.

9703 Sam BUCOVETSKY, Maurice MARCHAND and Pierre PESTIEAU, Tax competition and revelation of preferences for public expenditures.

This paper considers a federal country composed of local jurisdictions which differ in their taste for public goods and finance public spending by a source-based tax on capital income. The taste for public goods is private information of jurisdictions. By transferring differential grants to jurisdictions the central government aims at both reducing the misallocation of capital due to the diverging jurisdictional tax rates on capital income and getting closer to the optimal balance between private and public consumption in every jurisdiction. The purpose of the paper is to characterize the optimal grant policy of the central government. It is shown that there persist at the optimum both some misallocation of capital and some violation of the Samuelson rule in every jurisdiction.

9704 Marc FLEURBAEY and Philippe MICHEL, Intertemporal equity and the extension of the Ramsey criterion.

We examine social orderings applied to infinite intergenerational consumption paths. Basic dilemmas between several reasonable axioms lead to a taxonomy and characterization of different kinds of orderings, some of which are well known extensions of the Ramsey criterion. We show how filters and ultrafilters can be used to understand the general structure of these extensions and to construct orderings which meet as many axioms as possible.

9705 Xavier WAUTHY and Yves ZENOU, Compensating wage differentials, workers' heterogeneity and imperfect competition in the labor market.

In this paper, we explore a simple model which focuses on the joint role of workers' heterogeneity and imperfect competition in the endogeneous formation of labor market equilibria. We

show that, compared to the competitive case, imperfect competition leads to a misallocation of workers and to an increase of the level of unemployment when the population is heterogeneous. When workers are all identical, competitive and Nash allocations become the same.

9706 Jonathan SHALEV, Loss aversion and bargaining.

We consider bargaining situations where two players evaluate outcomes with reference-dependent utility functions, analyzing the effect of differing levels of loss aversion on bargaining outcomes. We find that as with risk aversion, increasing loss aversion for a player leads to worse outcomes for that player in bargaining situations.

An extension of Nash's axioms is used to define a solution for bargaining problems with exogenous reference points. Using this solution concept we endogenize the reference points into the model and find a unique solution giving reference points and outcomes that satisfy two reasonable properties, which we predict would be observed in a steady state.

The resulting solution also emerges in two other approaches, a strategic (non-cooperative) approach using Rubinstein's alternating offers model and a dynamic approach in which we find that even under weak assumptions, outcomes and reference points converge to the steady state solution from any non-equilibrium state.

9707 Alessandro TURRINI, Human capital formation in an open economy with increasing wage differentials.

Several developed countries are witnessing a trend towards an increasing gap in the earnings between skilled and unskilled workers. Though it is widely recognised that human capital formation programs through education and training should be strengthened in the presence of increasing wage differentials, it seems that this is not currently occurring to a satisfactory extent. We show an example where technology and terms of trade shocks that enhance the wage differential between high and low-skilled labour aggravate the underinvestment in public education arising from majority voting, thus leading to an undesirable outcome, both in terms of efficiency and equity.

9708 Sougata PODDAR, Capacity and entry deterrence under demand uncertainty.

> I consider a two period model with an incumbent firm and a potential entrant each of whom produces a homogeneous good. There is a demand uncertainty: it can be high or low and it realizes in the second period. The question I ask: How by choosing capacity at an earlier period of actual production of output and *more importantly* not knowing which state of demand is going to realize *and* knowing that there is a potential entrant, the incumbent firm can influence the outcome of the game by changing its initial condition. To that end, I study how the impact of the distribution of uncertainty deeply affects the incumbent's decision regarding entry deterrence / accommodation. I compare the results with the case where there is no uncertainty.

9709 Sougata PODDAR, Capacity and entry deterrence under asymmetric information on demand.

> I consider a two period model with an incumbent firm and a potential entrant each of whom produces a homogeneous good. There is a demand uncertainty and the information regarding the demand is asymmetric: the incumbent possesses private information concerning the state of demand while the entrant only knows the probability distribution. I show that under certain cost structure of the incumbent (which is common knowledge), using capacity as a signalling device, the incumbent can reliably convey the information to the potential entrant regarding the state of demand; while in some other cost environment such a signalling has no effect. Outcomes are more desirable when signalling truly reveals and more importantly convinces the entrant about the true state of demand compared to those where signalling does not reveal.

9710 Kevin D. GLAZEBROOK and José NINO-MORA, Scheduling multiclass queueing networks on parallel servers: Approximate and heavy-traffic optimality of Klimov's rule.

> We address the problem of scheduling a multiclass queueing network on M parallel servers to minimize the time-average holding cost. We analyze a heuristic index rule, based on Klimov's solution to the single-server model: when a server becomes free it selects a customer with largest Klimov's index. We present closed-form performance guarantees for this heuristic, with respect to (1) the optimal cost in the original parallel-servers network, and

(2) the optimal cost in a "corresponding" single-server network, attended by a server working M times faster. Simpler expressions are derived for the special case that there is no customer feedback, where the heuristic becomes the $c\mu$-rule. Our analysis is based on comparing the cost of the heuristic to the value of (the dual of) a strong linear programming relaxation, which equals the optimal cost for the "corresponding" single-server network. This relaxation follows from a set of approximate conservation laws satisfied by the network. Our proof of these laws relies on the first set of work decomposition laws known for this model, which we obtain from a classical flow conservation law.

9711 Paulo KLINGER MONTEIRO and Frank H. PAGE Jr., Optimal selling mechanisms for multiproduct monopolists: Incentive compatibility in the presence of budget constraints.

We demonstrate the existence of an optimal, individually rational, and incentive compatible selling mechanism for a multiproduct monopolist facing a market populated by consumers *with budget constraints*. Our main contribution is to show that, in general, when facing consumers with budget constraints the monopolist is able to maximize profits over the set of individually rational and incentive compatible selling mechanisms only if other goods are available and only if the monopolist's goods are nonessential relative to other goods.

9712 M. Ali KHAN and Yeneng SUN, On Loeb measure spaces and their significance for non-cooperative game theory.

In this expository paper, Loeb measure spaces are constructed on the basis of sequences, and shown to satisfy many useful properties, including some regularity properties of correspondences involving distribution and integration. It is argued that Loeb measure spaces can be effectively and systematically used for the analysis of game-theoretic situations in which "strategic negligibility" and/or "diffuseness" of information are substantive and essential issues. Positive results are presented, and the failure of analogous results for identical models based on Lebesgue measure spaces is illustrated by several examples. It is also pointed out that the requirement of Lebesgue measurability, by going against the non-cooperative element in the situation being modelled, is partly responsible for this failure.

9713 Kristiaan KERSTENS and Philippe VANDEN EECKAUT, Estimating returns to scale using nonparametric deterministic technologies: A new method based on goodness-of-fit.

The purpose of this note is to define a new and more general method to obtain qualitative information about returns to scale for individual observations. In a second section the traditional methods developed for estimating returns to scale on nonparametric deterministic reference technologies (Data Envelopment Analysis (DEA) models) are reviewed. Section 3 provides a new and more general method that is suitable for all reference technologies. Its usefulness is illustrated by considering variations on an existing non-convex production model, known as the Free Disposal Hull (FDH). When different returns to scale assumptions are introduced into the FDH, then previous methods for determining returns to scale do no longer apply.

9714 Bernard DE MEYER, The dual bounds for the Brownian games.

Let S denote $\{x \in I\!R^K | \exists k, k' : x_k \leq 0, x_{k'} \geq 0\}$. For a point $x \in S$, a subspace $\mathcal{A}$ of $I\!R^{K \times I}$ and an I dimensional Brownian motion W, we denote by $\mathcal{Q}(S, \mathcal{A}, x)$ the set of the S-valued local martingales $Y := x + \int_0^\bullet A_t dW_t$ where A is an $\mathcal{A}$-valued progressively measurable process.

Our main results states that $\mathcal{Q}(S, \mathcal{A}, x)$ is uniformly bounded in L^α for an $\alpha \in (0, 1)$ under the additional hypothesis: $\forall A \in \mathcal{A}, \forall p \in I\!R^K_+ - \{0\} : p^\top A = 0 \Longrightarrow A = 0$.

These bounds are derived for their application to the analysis of the so called Brownian games (see [1] and [2].).

9715 Bernard DE MEYER, Brownian games: Uniqueness and regularity issues.

This paper extends the analysis of the dual Brownian game $\Gamma^*(x, T)$ initiated in [2]. The existence of a value $\psi^*(x, T)$ for $\Gamma^*(x, T)$ as well as the existence of optimal strategies was proved there. In this paper we will prove successively that player 2's optimal strategy is unique, that it depends continuously (even in an Hölderian way) on x, and that, under a strict ellipticity condition, the mapping $\psi^*(\bullet, T)$ is $\mathcal{C}^{2,\alpha}$ for a strictly positive α.

Brownian games were essentially introduced to prove the existence of a solution to a non linear elliptic PDE problem. The regularity of ψ^* proved here joint to the results proved in [2] indicates that ψ^* is the solution to this PDE problem.

9716 Luc BAUWENS and Pierre GIOT, A Gibbs sampling approach to cointegration.

> This paper reviews the application of Gibbs sampling to a cointegrated VAR system. Aggregate imports and import prices for Belgium are modelled using two cointegrating relations. Gibbs sampling techniques are used to estimate from a Bayesian perspective the cointegrating relations and their weights in the VAR system. Extensive use of spectral analysis is made to get insight into convergence issues.

9717 Yves SMEERS and Jing-Yuan WEI, Spatially oligopolistic model with opportunity cost pricing for transmission capacity reservations – A variational inequality approach.

> Two markets co-exist in an unbundled electricity supply industry: the one of the electricity supply and the one of transmission capacity reservations. The first one could be assumed as an oligopoly, and the second one, as a natural monopoly, is regulated. The prices in the first market are determined by an oligopolistic equilibrium. The prices in the second market are set equal to the opportunity costs. The strong interaction of the behavior of the two markets requires a new concept of equilibrium. In this equilibrium, the two markets must be simultaneously in their own equilibrium: Nash equilibrium in the first market and market-clearing equilibrium in the second. An equilibrium of the market is defined and a variational inequality approach is used to solve the problem. A simulation using this model is done for an electricity supply market organized across 4 European countries.

9718 Marc GERMAIN and Philippe L. TOINT, An iterative process for international negotiations on acid rain in Northern Europe using a general convex formulation.

> This paper proposes a dynamic game theoretical approach of international negotiations on transboundary pollution. This approach is distinguished by a discrete time formulation and by a suitable formulation of the local information assumption on cost and damage functions: at each stage of the negotiation, the parties assign the best possible cooperative state, given the available information, as an objective for the next stage. It is shown that the resulting sequences of states converges from a non-cooperative situation to a Pareto optimum in a finite number of stages. Furthermore, a financial transfer structure is also

presented, which guarantees that the desired sequence of states is individually rational and strategically stable if one starts from a Nash equilibrium. The concepts are applied in a numerical simulation of the SO_2 transboundary pollution problem related to acid rain in Northern Europe. This simulation shows the need for an improved formulation of the financial transfers if one starts from another initial state. Such a formula is proposed and tested numerically.

9719 Yurii NESTEROV, Quality of semidefinite relaxation for nonconvex quadratic optimization.

In this paper we prove that the semidefinite relaxation of Boolean quadratic maximization problem with indefinite matrix provides us with a fixed absolute accuracy estimate for the exact solution.

9720 Hugues MARCHAND and Laurence A. WOLSEY, The 0-1 knapsack problem with a single continuous variable.

Constraints arising in practice often contain many 0-1 variables and one or a small number of continuous variables. Existing knapsack separation routines cannot be used on such constraints. Here we study such constraint sets, and derive valid inequalities that can be used as cuts for such sets, as well for more general mixed 0-1 constraints.

Specifically we investigate the polyhedral structure of the knapsack problem with a single continuous variable, called the *continuous 0-1 knapsack* problem. First different classes of facet-defining inequalities are derived based on projection and lifting. The order of lifting, particularly of the continuous variable, plays an important role. Secondly we show that the flow cover inequalities derived for the single node flow set, consisting of arc flows into and out of a single node with binary variable lower and upper bounds on each arc, can be obtained from valid inequalities for the continuous 0-1 knapsack problem. Thus the separation heuristic we derive for continuous knapsack sets can also be used to derive cuts for more general mixed 0-1 constraints. Initial computational results on a variety of problems are presented.

9721 Laurence BROZE and Frédéric JOUNEAU, Estimation of a latent linear model based on the rank statistics of the dependent variable.

In this paper we study a new type of latent model in which only the rank statistics of the dependent variable is observed.

This problem appears naturally in the microeconometric literature, in particular in the case of the parametric estimation of a production function when the output is poorly observed. A full information approach seems difficult. So we consider another model which describes part of the information of the first one. This second model is Probit model with serial correlations. The inferential problems (test and estimation) have been studied in the literature but not from this viewpoint. We show by simulations that the proposed estimators behave nicely even in relatively small samples. We also perform the estimation of a production function on a real data set.

9722 Jonathan HAMILTON, Jacques-François THISSE and Yves ZENOU, Skill acquisition and wage competition with heterogeneous workers and firms.

We study labor market competition with heterogeneous firms and consumers. Worker types are continuously distributed within the population and a finite number of firms have specific skill requirements. Specific human capital investment is the cost of training a worker to be able to work for a particular firm and depends on the difference between the worker's skill type and the firm's skill requirement. A firm's profit equals its output minus wages, its share of training costs, and a fixed cost. We solve for symmetric free-entry Nash equilibria of the wage offer game under two different information structures. When firms can identify worker types before employment, firms can pay different net wages to workers with different training costs. When firms cannot identify worker training costs in advance, firms pay workers equal wages, but workers absorb training costs. The level of fixed costs, the size of the labor market, and the cost of investment in human capital all affect the equilibrium settings. We also consider different tax instruments to increase allocative efficiency and to finance investment in general human capital.

9723 Jonathan SHALEV, Loss aversion equilibrium.

The Nash equilibrium solution concept for strategic form games is based on the assumption of expected utility maximization. Reference dependent utility functions (in which utility is determined not only by an outcome, but also by the relationship of the outcome to a reference point) are a better predictor of behavior than expected utility. In particular, loss aversion is an important element of such utility functions.

We extend strategic form games to include loss aversion characteristics of the players. We define loss-aversion equilibrium,

a solution concept endogenizing reference points. Reference points emerge as expressions of anticipation which are fulfilled in equilibrium.

We show existence of loss-aversion equilibrium for any extended game, and compare it to Nash equilibrium. Comparative statics show that an increase in loss aversion of one player can affect his and other players' payoffs in different directions.

9724 Moshe JUSTMAN and Jacques-François THISSE, Local public funding of higher education when skilled labor is mobile.

Inter-jurisdictional labor mobility when public funding of higher education is sub-federal leads to a disparity between the centralized output-maximizing allocation of resources to education and decentralized equilibria. We show that when local governments choose their level of spending on higher education at a Nash equilibrium, the size and direction of this disparity depend strongly on the political balance of forces at the sub-federal level. The more common case of under-investment can be alleviated through inter-jurisdictional subsidies of local education expenditures based on net migration flows.

9725 Jon LEE, Orienting matroids representable over both $GF[3]$ and $GF[5]$.

For matroids representable over both $GF[3]$ and $GF[5]$, we provide a recipe for constructing an orientation.

9726 Yves SMEERS and Jing-Yuan WEI, Spatially oligopolistic model with nodal opportunity cost pricing for transmission capacity reservations.

Two markets co-exist in an unbundled electricity supply industry: the one of the electricity supply and the one of transmission capacity reservations. The first one could be assumed as an oligopoly, and the second one, as a natural monopoly, is regulated. The prices in the first market is determined by an oligopolistic equilibrium. The prices in the second market are set equal to opportunity costs. The strong interaction of the behavior of the two markets requires a new concept of equilibrium. In this equilibrium, the two markets must be simultaneously in their own equilibrium: Nash equilibrium in the first and market-clearing equilibrium in the second. A 3-bus example is presented to show the main result of the model.

9727 Rabah AMIR and John WOODERS, One-way spillovers, endogenous innovator/imitator roles and research joint ventures.

> We consider a two-period duopoly characterized by a one-way spillover structure in process R&D and a very broad specification of product market competition. We show that *a priori* identical firms always engage in different levels of R&D, at equilibrium, thus giving rise to an innovator/imitator configuration and ending up with different sizes. We also provide a general analysis of the social benefits of, and firms' incentive for, forming research joint ventures. The key properties of the game are submodularity (R&D decisions are strategic substitutes) and lack of global concavity.

9728 Maithreesh GHATAK, Massimo MORELLI and Tomas SJÖSTRÖM, Moral hazard and overlapping generations with endogenous occupational choice.

> This paper introduces a general equilibrium, overlapping generations model of the principal-agent problem. Bargaining power, occupational choice, and the returns to each occupation are endogenous. Individuals live for two periods and must work when young. When old, they have a choice between becoming principals or remaining agents. Successful workers are paid high wages and may become *self financed* principals when old; unsuccessful workers are paid low wages and can become principals only by borrowing money. In a "high wage" equilibrium, an *imperfect* credit market (which makes it costly to borrow money due to, for example, moral hazard between lender and borrower) mitigates the moral hazard problem on the labor market: young workers work harder than in the static model (for a given wage) in order to succeed and become *self-financed* principals (the "American Dream" effect). The extra effort makes it possible for principals to pay high wages. However, there is a coordination problem. For the same parameter values that give rise to the "high wage" equilibrium, there also exist equilibria where wages are so low that even successful agents need to borrow money if they are to become principals. Effort is then low because wages are low, and because there is no "American Dream".

9729 Kurt M. ANSTREICHER, Marcia FAMPA, Jon LEE and Joy WILLIAMS, Using continuous nonlinear relaxations to solve constrained maximum-entropy sampling problems.

> We consider a new nonlinear relaxation for the Constrained Maximum-Entropy Sampling Problem - the problem of choosing

the s x s principal submatrix with maximal determinant from a given n x n positive definite matrix, subject to linear constraints. We implement a branch-and-bound algorithm for the problem, using the new relaxation. The performance on test problems is far superior to a previous implementation using an eigenvalue-based relaxation. A parallel implementation of the algorithm exhibits approximately linear speed-up for up to 8 processors, and has successfully solved problem instances which were heretofore intractable.

9730 Erling D. ANDERSEN and Knud D. ANDERSEN, The APOS linear programming solver: An implementation of the homogeneous algorithm.

The purpose of this work is to present the APOS linear programming (LP) solver intended for solution of large-scale sparse LP problems. The solver is based on the homogeneous interior-point algorithm which in contrast to the primal-dual algorithm detects a possible primal or dual infeasibility reliably. It employs advanced (parallelized) linear algebra, it handles dense columns in the constraint matrix efficiently, and it has a basis identification procedure. Moreover, recently the solver has been incorporated into the commercially available XPRESS-MP software.

This paper discusses in details the algorithm and linear algebra employed by the APOS LP solver. In particular the homogeneous algorithm is emphasized. Furthermore, extensive computational results are reported. These results include comparative results for the XPRESS-MP simplex and barrier code and the freely available BPMPD code developed by Cs. Mészáros. Finally, computational results are presented to demonstrate the possible speed-up, when using a parallelized version of the APOS LP solver on a Silicon Graphics Challenge computer.

9731 Irène GIJBELS, Enno MAMMEN, Byeong U. PARK and Léopold SIMAR, On estimation of monotone and concave frontier functions.

A way for measuring the efficiency of enterprises is via the estimation of the so-called production frontier, which is the upper boundary of the support of the population density in the input and output space. It is reasonable to assume that the production frontier is a concave monotone function. Then, a famous estimator is the data envelopment analysis (DEA) estimator, which is the lowest concave monotone increasing function covering all sample points. This estimator is biased downwards since it never exceeds the true production frontier. In this paper we

derive the asymptotic distribution of the DEA estimator, which enables us to assess the asymptotic bias and hence to propose an improved bias corrected estimator. This bias corrected estimator involves consistent estimation of the density function as well as of the second derivative of the production frontier. We also discuss briefly the construction of asymptotic confidence intervals. The finite sample performance of the bias corrected estimator is investigated via a simulation study and the procedure is illustrated for a real data example.

9732 Isabel GRILO, Oz SHY and Jacques-François THISSE, Price competition when consumer behavior is characterized by conformity or vanity.

It has long been recognized that the pleasure of consuming a good may be affected by the consumption choice of other consumers. At least two types of motivations may explain such a behavior. In some cases social pressures may lead to conformity; while in some other cases individuals may feel the need of exclusiveness under the form of vanity. Such externalities have proven to be important in several markets where the decision to buy a product is positively or negatively affected by the number of consumers purchasing the same product. However, the market and welfare implication of these effects are still unclear. To investigate them, we propose to graft the consumption externality model onto the spatial duopoly model.

When conformity is present but not too strong, both firms remain in business but price competition is fiercer and results in lower prices. The market share of the large firm increases with the population size; as the population keeps rising, the large firm serves the entire market and sets a price which has the nature of a limit price. When conformity is strong enough, different equilibria may exist. These equilibria are such that only one firm has a positive market share or both firms split the market. At the other extreme, when vanity is at work, price competition is relaxed.

9733 Mohamed JELLAL, Jacques-François THISSE and Yves ZENOU, Demand uncertainty, mismatch, and (un)employment.

We consider a finite number of firms which compete imperfectly for heterogenous workers. Firms produce a homogeneous good sold on a competitive market and face demand-induced price fluctuations. It is then shown that unemployment may arise in equilibrium because of uncertainty on product demand and job mismatch. However, unemployment does not arise when the

variance of the demand shock is small enough and/or the cost of mismatch is sufficiently low. Full employment always prevails when there is free entry. Hence, unemployment may persist as long as the incumbent firms choose their skill requirements to protect their supranormal profits.

9734 Victor GINSBURGH, On the declining price anomaly in wine auctions.

The anomaly is concerned with the observation that in multiple-item auctions of identical objects, prices tend to decline over time. We show that in the case of wine auctions which have been analyzed frequently, the anomaly is likely to be caused by the fact that most bids are entered by absentees. If only absentees are interested in a multiple-lot auction and have sent different written valuations for the various lots, it is obvious that the auctioneer will sell the lots to satisfy bids in decreasing order of valuation.

9735 Massimo MORELLI, Coalition formation and payoff distribution in majority games.

In this paper we provide a cooperative solution as well as a non-cooperative analysis to study coalition formation and payoff distribution in weighted majority games. The cooperative solution concept proposed here, the **Anonymous Core**, keeps the spirit of Core-like competition (reflecting individual rationality as well as group rationality), but it is non-empty and it is precisely characterized for every vector of weights. Agents of the same type must receive equal treatment within the winning coalitions, and some consistency is required on blocking coalitions, following a similar logic to that underlying the Von-Neumann and Morgenstern's Stable Set. We show that in any weighted majority game every agent within the winning coalition is expected to obtain a payoff share proportional to her bargaining power. The latter is what defines the different types, and it is obtained endogenously. We introduce a non-cooperative coalitional bargaining game which resembles the rules of the game describing the formation of coalitional governments. We obtain an algorithm for the computation of all the Symmetric Markov Subgame Perfect Equilibria of such game, and show that the set of such equilibria has a one-to-one correspondence with the Anonymous Core for homogeneous weighted majority games.

9736 Gian Maria MARTINI and Cinzia ROVESTI, Antitrust policy and price collusion: Public agencies versus delegation ?

> In a simple economic setting with asymmetric information we compare different social institutions which fight against industry cartels on prices. Firstly, we analyse the case where an Antitrust Authority is created and we distinguish two situations depending whether the agency has the possibility to commit itself to a policy or not. Secondly, we develop an alternative framework in which consumers can act legally against price collusion practices. Then, we compare the results in terms of social welfare associated to the three schemes. Even if a general result in favour to a "delegated" antitrust action to consumers cannot be established, we show that in many instances private suits can be more effective than interventions of an Antitrust Authority.

9737 Gian Luigi ALBANO and Alessandro LIZZERI, A monopolistic market for certification.

> If buyers do not observe the quality of a product and production of quality is costly, market allocations can be very inefficient. Certification intermediaries are institutions that provide information about quality to buyers. The amount of information in the market determines the incentives that producers have to provide high quality goods. In this paper, we model information revelation as a strategic variable of intermediaries. The amount of disclosed information is shown to deeply influence both the intermediary's profits and the distribution of quality produced in equilibrium. We show that a monopoly intermediary will provide noisy signals of quality and that the quality produced in equilibrium is the same as the one that would be chosen by a monopsonistic buyer who optimally designs a mechanism. Efficiency is increased by the intermediary but less quality is produced in equilibrium than under complete information.

9738 M. Ali KHAN and Yeneng SUN, On the decomposition and characterization of risk.

> We show that the main theorem in Al-Najjar's 1995 *Econometrica* paper is false. We provide additional references for the residual implications that are valid, but point out that these standard implications are incapable of bearing the interpretative weight that Al-Najjar places on them.

9739 Yves SMEERS and Jing-Yuan WEI, Competititon in both quantity and quality: Spatial competition models with regulated transportation prices.

An oligopoly with spatially dispersed producers and consumers and with multi-period demands is modeled in the paper. Generation firms compete both in quantity and in quality for electricity supply. That is, they compete in generation capacity and electric energy supply as well as in reserved capacity demanded by consumers for reliability. Two models are formulated under the following underlying assumptions on oligopolistic competition: (1) Ramsey model; (2) the producers are assumed to behave in the Cournot manner with regulated transportation prices. Variational inequality approach is used for computing equilibria of the model. These models are applied to simulate the long run electricity market.

9740 Kurt M. ANSTREICHER, Towards a practical volumetric cutting plane method for convex programming.

We consider the volumetric cutting plane method for finding a point in a convex set that is characterized by a $\mathcal{C} \subset \Re^n$ separation oracle. We prove polynomiality of the algorithm with each added cut placed directly through the current point, and show that this "central cut" version of the method can be implemented using no more than $25n$ constraints at any time.

9741 Pierre-André JOUVET, Philippe MICHEL and Jean-Pierre VIDAL, Intergenerational altruism and the environment.

This paper constructs an overlapping generations model of pollution externality wherein individuals are altruistically linked to their offspring as in Barro (1974). It is shown that steady-state consumption can be a decreasing function of the intergenerational degree of altruism. Despite individuals' altruism, the competitive equilibrium is not optimal. We thus study the social optimum and prove that it can be decentralised.

9742 Paulo KLINGER MONTEIRO, Optimal all-pay auction when signals are correlated.

In this note I prove the existence of the optimal-pay auction when signals are correlated.

9743 Paulo KLINGER MONTEIRO and Mário R. PÁSCOA, Discreteness of equilibria in incomplete markets with a continuum of states.

We discuss the issue, raised by Mas-Colell (1991) whether the local uniqueness (relative to the L^∞ topology) may be a generic property of equilibria in incomplete markets economies with a continuum of states.

9744 Yurii NESTEROV, Semidefinite relaxation and nonconvex quadratic optimization.

In this paper we consider the semidefinite relaxation of some global optimization problems. We prove that in some cases this relaxation provides us with a constant relative accuracy estimate for the exact solution.

9745 Kurt M. ANSTREICHER, Ellipsoidal approximations of convex sets based on the volumetric barrier.

Let $\mathcal{C} \subset \mathbf{R}^n$ be a convex set. We assume that $\| x \|_\infty \leq 1$ for all $x \in \mathcal{C}$, and that $\mathcal{C}$ contains a ball of radius $1/R$. For $x \in \mathbf{R}^n$, $r \in \mathbf{R}$, and B an $n \times n$ positive definite matrix, let $E(x, B, r) = \{y | (y - x)^T B(y - x) \leq r^2\}$. A β *-rounding* of $\mathcal{C}$ is an ellipsoid $E(x, B, r/\beta) \subset \mathcal{C} \subset E(x, B, r)$. In the case that $\mathcal{C}$ is characterized by a separation oracle, it is well known that an $O(n^{3/2})$ -rounding of $\mathcal{C}$ can be obtained using the shallow cut ellipsoid method in $O(n^3 \ln(nR))$ oracle calls. We show that a modification of the volumetric cutting plane method obtains an $O(n^{3/2})$ -rounding of $\mathcal{C}$ in $O(n^2 \ln(nR))$ oracle calls. We also consider the problem of obtaining an $O(n)$ -rounding of $\mathcal{C}$ when $\mathcal{C}$ has an explicit polyhedral description. Our analysis uses a new characterization of circumscribing ellipsoids centered at, or near, the volumetric center of a polyhedral set.

9746 Kurt M. ANSTREICHER, Linear programming in $O\left(\frac{n^3}{\ln n} L\right)$ operations.

We show that the complexity to solve linear programming problems, using standard linear algebra, can be reduced to $O([n^3/\ln n]L)$ operations, where n is the number of variables in a standard form problem with integer data of bit size L. Our technique combines partial updating with a preconditioned conjugate gradient method, in a scheme first suggested by Nesterov and Nemirovskii.

9747 Wolfgang HÄRDLE and Christian HAFNER, Discrete time option pricing with flexible volatility estimation.

By extending the GARCH option pricing model of Duan (1995) to more flexible volatility estimation it is shown that the prices of out-of-the-money options strongly depend on volatility features such as asymmetry. Results are provided for the properties of the stationary pricing distribution in the case of a threshold GARCH model. For a stock index series with a pronounced leverage effect, simulated threshold GARCH option prices are substantially closer to observed market prices than the Black/Scholes and simulated GARCH prices.