CENTER FOR OPERATIONS RESEARCH AND ECONOMETRICS

CORE DISCUSSION PAPERS 1998/1

9801   Two-dimensional Gantt charts and a scheduling algorithm of Lawler.
Michel X. GOEMANS and David P. WILLIAMSON.

In this note we give an alternate proof that a scheduling algorithm of Lawler [3,4] finds the optimal solution for $1|prec|\sum_j w_j C_j$ when the precedence constraints are series-parallel. We do this by using a linear programming formulation of $1|prec|\sum_j w_j C_j$ introduced by Queyranne and Wang [10]. Queyranne and Wang proved that their formulation completely describes the scheduling polyhedron in the case of series-parallel constraints; a by-product of our proof of correctness of Lawler's algorithm is an alternate proof of this fact. In the course of our proof it is helpful to use what might be called *two-dimensional Gantt charts*. We think these may find independent use, and to illustrate this we show that some recent work in the area becomes transparent using 2D Gantt charts.

9802   Managers compensation and collusive behaviour under Cournot
Marco MARINI.

The aim of the present paper is to show that the existence of a concrete outside option for firms' executives can induce, under specific circumstances, every firm to adopt restrictive output practises. In particular, the paper characterizes the conditions for which, under Cournot oligopoly, existing firms behave more collusively than in a standard Cournot model. It is also shown that room exists for perfect and stable collusive agreements amongst firms. Other interesting findings are also twofold. Firstly, that the equilibrium executives' pay will usually be dependent upon the number of companies initially disposing of the technology and/or of the organizational knowledge required to set up the business. Secondly, that companies' procedures difficult to duplicate can constitute a beneficial form of competition policy in that they induce the firms to behave less collusively in the product market.
Keywords: Managers' Compensation, Oligopoly.

9803   The consequences of overlapping tax bases for redistribution and public spending in a federation.
Robin BOADWAY, Maurice MARCHAND and Marianne VIGNEAULT.

Tax and expenditure policies are studied in a federation with imperfectly mobile households. States implement a linear progressive tax and supply a public good. A vertical fiscal externality, reflecting the effect of the state policies on federal revenues, provides an incentive to state taxes to be too progressive. A horizontal fiscal externality causes non-optimal states taxes and expenditures of the migration effect. The federal government implements its own linear progressive tax and makes transfers to the states. The federal government implements its own linear progressive tax and makes transfers to the states. The federal government can nullify both externalities by appropriate fiscal policies, and redistributive taxation can be decentralized to the states.
JEL Classification: H2, H7
Keywords: fiscal federalism, overlapping tax bases, redistribution policies.

CENTER FOR OPERATIONS RESEARCH AND ECONOMETRICS

CORE DISCUSSION PAPERS 1998/2

9804   Optimal tax mix with merit goods.
Maria del Mar RACIONERO.

This paper deals with optimal taxation in a two-class economy with two private commodities and labour. We derive optimal non-linear income and linear commodity taxes in the presence of merit goods. We formulate merit good arguments via a pathology of individual choice. We assume weak separability between consumption and leisure and show that the standard optimal tax results are modified due to merit good considerations. We first find a subsidy on the merit good. Secondly, optimal income marginal tax rates are also shown to differ from the standard literature: it is positive on high-ability individuals and on low-ability individuals it is ambiguous because of a dampening effect due to merit good considerations. Finally, we derive the effective marginal tax rates.
Keywords: Merit goods, Non-linear income taxation.
JEL Classification: H21, H41

9805   Cash-in-advance contraints in the Diamond overlapping generations model: neutrality and optimality of monetary policies.
Bertrand CRETTEZ, Philippe MICHEL and Bertrand WIGNIOLLE.

This paper is a study of money in overlapping generations models with cash-in-advance constraints. We first offer a brief review of different features of the cash-in-advance constraint. Then we propose a general formulation and study the neutrality of money. We show that both neutrality and equilibrium dynamics depend on the form of the cash-in-advance constraint. We then show that optimal intergenerational resources sharing can be implemented through monetary transfers. Finally, we find that the Chicago Rule is implied by optimal monetary policy.
Keywords: cash-in-advance constraint, monetary policy, superneutrality, overlapping generations model.
JEL Classification: D91, E31, E61.

9806   Non-linear taxation of bequests, equal sharing rules and the tradeoff between intra- and inter-family inequalities.
Helmuth CREMER and Pierre PESTIEAU.

This paper studies the design of the tax and regulatory regime applied to bequests. It is based on the observation that the determination of tax rates, tax bases and sharing rules can be treated in an integrated way by considering the design of a non-linear bequest tax schedule. Families are heterogenous and differ in the parent's wealth. Each parent has two children who differ in their income (earning ability). The tax administration observes bequests (including individual shares) but neither the parent's wealth nor the children's earning abilities. Parents, on the other hand, are perfectly informed about their children's earning abilities. Parents are altruistic with their own utility depends on their children's utility. The optimal tax schedule is shown to strike a balance between the (often) conflicting "incentive" and "corrective" effects. When parents attach identical weights to their children, a (non-linear) estate taxation (based on the sum of bequests) is sufficient. When weights differ between children, a more general (possibly non-separable) tax function, based on individual bequests, is called for. Equal sharing rules appear to be appropriate only in extreme cases such as in presence of the so-called *Cinderella* effect.

CENTER FOR OPERATIONS RESEARCH AND ECONOMETRICS

CORE DISCUSSION PAPERS 1998/3

9807   Liquidity constraints and cycles.
        Céline ROCHON.

In this paper, we modify the model of Benhabib and Laroque in which the behaviour of non steady-state equilibria in the neighborhood of the golden rule steady state are studied, to include liquidity constraints. We observe, in an example, the appearance of new cycles.

Keywords: Overlapping Generations Models, Money, Liquidity Constraints, Cycles.

JEL Classification: E32, E37, E47.

9808   A parallel interior-point algorithm for linear programming on a shared memory machine.
        Erling D. ANDERSEN and Knud D. ANDERSEN.

The XPRESS [3] interior point optimizer is an "industrial strength" code for solution of large-scale sparse linear programs. The purpose of the present paper is to discuss how the XPRESS interior point optimizer has been parallelized for a Silicon Graphics multi processor computer. The major computational task, performed in each iteration of the interior-point method implemented in the XPRESS interior point optimizer is the solution of a symmetric and positive definite system of linear equations. Therefore, parallelization of the Cholesky decomposition and the triangular solve procedure are discussed in detail. Finally, computational results are presented to demonstrate the parallel efficiency of the optimizer. It should be emphasized that the methods discussed can be applied to the solution of large-scale sparse linear least squares problems.
Keywords: linear programming, interior-point methods, parallel computing.

9809   On a three way equivalence.
        Leonidas KOUTSOUGERAS.

In view of the well known core equivalence results in atomless economies, coincidence of market game equilibrium allocations with competitive allocations is tantamount to a three way equivalence between market game mechanisms, competitive equilibria and the core. Based on this idea I propose an equilibrium refinement of market games which allows me to use the core equivalence machinery to provide an exact market game characterization of competitive equilibria.

9810   Unique implementation in auctions and in public goods problems.
        Claude d'ASPREMONT, Jacques CRÉMER and Louis-André GÉRARD-VARET.

We present new conditions that guarantee the existence of mechanism with a unique or essentially unique equilibrium in auction and public goods problems with semi-linear utility functions. These conditions bear only on the information structures of the agents.

CENTER FOR OPERATIONS RESEARCH AND ECONOMETRICS

CORE DISCUSSION PAPERS 1998/4

9811   Mixing mixed-integer inequalities.
        Oktay GÜNLUCK and Yves POCHET.

Mixed-integer rounding (MIR) inequalities play a central role in the development of strong cutting planes for mixed-integer programs. In this paper, we investigate how known MIR inequalities can be combined in order to generate new strong valid inequalities. Given a mixed-integer region S and a collection of valid "base" mixed-integer inequalities, we develop a procedure for generating new valid inequalities for S. The starting point of our procedure is to consider the MIR inequalities related with the base inequalities. For any subset of these MIR inequalities, we generate two new inequalities by combining or "mixing" them. We show that the new inequalities are strong in the sense that they fully describe the convex hull of a mixed-integer region associated with the base inequalities. We also study some extensions of this mixing procedure, and discuss how it can be used to obtain new classes of strong valid inequalities for various mixed-integer programming problems. In particular, we present examples for production planning, capacitated facility location, capacitated network design, and multiple knapsack problems.
Keywords: mixed integer programming, mixed integer rounding, Gomory mixed integer cuts.

9812   Economic dynasties with intermissions.
        Louis GEVERS and Philippe MICHEL.

We consider a model of successive generations with a fixed proportion of selfish and altruistic members in each individual's offspring. In contrast with the others, selfish members bequeath nothing to their own children. We assume that parents cannot recognize their heirs' types and that negative bequests are forbidden. We study Markov perfect equilibria of this multistage game of incomplete information and their implications for wealth distribution.

9813   Sunspot equilibria out of the stable manifold.
        Gaetano BLOISE.

In this paper, we propose a simple geometrical method to study the occurrence of sunspot equilibria near an indeterminate steady state of a non-linear, two-dimensional economic model without any predetermined variable. We prove that, if the steady state is a saddle point of the perfect foresight dynamical system and the economy is truly non-linear, then there exist Markovian sunspot equilibria on a compact two-dimensional set.
Key words and phrases: Sunspot equilibrium, indeterminacy, saddle point, invariant set.

9814   Loss aversion in repeated games.
        Jonathan SHALEV.

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 a repeated situation, the value of the previous payoff is a natural reference point for evaluating each period's payoff, and loss aversion implies that decreases are treated more severely than increases. We characterize the equilibria of infinitely repeated games for the case of extreme loss aversion, and show how these are related to the equilibria of stochastic games with state-independent transitions.
Keywords: loss aversion, reference dependence, repeated games.
JEL Classification: C72

CENTER FOR OPERATIONS RESEARCH AND ECONOMETRICS

CORE, 34, Voie du Roman Pays, 1348 LOUVAIN-LA-NEUVE, Belgium.

CORE DISCUSSION PAPERS 1998/5

9815   A censored-GARCH model of asset returns with price limits.
Steven X. WEI

As one important form of market circuit breakers, *price limits* have been often imposed in stock and futures markets. This paper considers modeling the return process of such assets, focusing on the treatment of price limits. As a result, a *censored-GARCH model* is formulated and a Bayesian approach to this model is developed. An application is provided to Treasury bill futures over a period of high volatility and frequent limit moves. The impacts of price limits are demonstrated with the real data and confirmed with a simulation example.
Keywords: Price limits, censored-GARCH model, griddy Gibbs sampler-data augmentation.
JEL Classification: C13, C24 and G19

9816   Bid-ask price competition with asymmetric information between market makers.
Riccardo CALCAGNO and Stefano M. LOVO.

We consider the effect of asymmetric information on price formation process in a financial market where private information is held by a market maker. A Bayesian game is proposed in which there is price competition between two market makers with two different information partitions. At each stage players set bid and ask prices simultaneously and then trade occurs between market maker who proposes the most profitable price and liquidity traders. We characterize a set of partially revealing equilibria where the informed market maker's prices do not convey his private information. Informed player's equilibrium payoffs are proportional to prior beliefs of the market.
Keywords: bid ask, asymmetric information, repeated auction, insider trading.
JEL Classification: D82, D44, G10, G14

9817   Profit maximizing in auctions of public goods.
Dirk ALBOTH, Anat LERNER and Jonathan SHALEV.

A profit-maximizing auctioneer can provide a public good to a group of agents. Each group member has a private value for the good being provided to the group. We investigate an auction mechanism where the auctioneer provides the good to the group, only if the sum of their bids exceeds a reserve price declared previously by the auctioneer. For the two-bidder case with private values drawn from a uniform distribution we characterize the continuously differentiable symmetric equilibrium bidding functions for the agents, and find the optimal reserve price for the auctioneer when such functions are used by the bidders. We also examine another interesting family of equilibrium bidding functions for this case, with a discrete number of possible bids, and show the relation (in the limit) to the differentiable bidding functions.
Keywords: public goods, auctions, externalities.
JEL Classification: C00, C72, D44, D82, H41

CENTER FOR OPERATIONS RESEARCH AND ECONOMETRICS

CORE, 34, Voie du Roman Pays, 1348 LOUVAIN-LA-NEUVE, Belgium.

CORE DISCUSSION PAPERS 1998/6

9818   Import restraints and quality choice under vertical differentiation.
Nicolas BOCCARD and Xavier WAUTHY.

We consider the following stage game : a domestic government chooses an import quota, then a domestic and a foreign firm choose their quality level before engaging a price competition. We first show that the indirect effect of the quota on the sales of the domestic producer are different depending on whether his product quality is high or low. The analysis developed in Krishna [89] has to be amended when vertical, instead of horizontal, product differentiation applies. Despite the non-existence of pure strategy Nash equilibria, we characterise all equilibria of the pricing game and solve the quality choice game : for loose quotas, both firms choose top quality while only one differentiates for tighter quotas. The optimal quota for the domestic government reduces the price competition and enables both firms to upgrade to the highest possible quality level for the benefit of domestic consumers. On the contrary, the foreign firm would prefer a very loose quota that generates quality differentiation and larger profits for her.
Keywords: International Trade, Quality, Optimal Quota, Price Competition
JEL Classification: D43, F13, L13

9819   Heterogeneous probabilities in complete asset markets.
Laurent CALVET, Jean-Michel GRANDMONT and Isabelle LEMAIRE.

We show in this paper how, in a model of assets exchange in complete competitive markets, heterogeneity of the agent's subjective probabilities generates aggregate expenditures for Arrow-Debreu securities that have the gross substitutability property, with the consequences that competitive equilibrium is unique, stable in any tâtonnement process, and that the weak axiom of revealed preferences is satisfied in the aggregate. For this result, heterogeneity is required to be highest among people who have the largest risk aversion.
Keywords: Heterogeneity, subjective probabilities, complete asset markets.
JEL Classification: C62, D50, G10.

9820   Voluntary contributions with uncertainty: The environmental quality.
Pierre-André JOUVET.

This paper presents an overlapping generations model of environmental externalities with a de-pollution technology. Each agent concerned by the environmental degradation can voluntarily contribute in order to reduce it. Contributing to the environmental quality means financing depollution activities and uncertainty concerns its efficiency since it's not always clear or certain what effects will result from a reduction of pollution. We show that if an agent is sufficiently risk averse, voluntary contribution is a decreasing function of average efficiency of depollution technology. If on the contrary, the substitution effect is weaker than the pollution effect, the opposite holds. We show that precaution about environmental quality has two possible consequencies which depend on agent risk aversion. Therefore, understanding the implication of precautionary attitude, leads us to the consideration of the agents' risk aversion characterization and studying the effect of an increase in risk aversion implies a knowledge on prudent attitude. So, we have to conclude that precaution and risk aversion are two complementary and indissociable concepts.
Keywords: Environmental management, Uncertainty, Public goods, Voluntary contributions, Precaution, Risk.
JEL Classification: D62, D80, H41, Q29

CENTER FOR OPERATIONS RESEARCH AND ECONOMETRICS

CORE DISCUSSION PAPERS 1998/7

9821   Parabolic target space and primal-dual interior-point methods.
Yurii Nesterov.

In this paper we develop new primal-dual interior-point methods for linear programming, which are based on the concept of parabolic target space. We show that such schemes work in the infinity-neighborhood of the primal-dual central path. Nevertheless these methods possess the best known complexity estimate. We demonstrate that the adaptive-step path-following strategies can be naturally incorporated in such schemes.

Keywords: Linear programming, interior-point methods, target following methods.

9822   Voting for voters: a model of electoral evolution.
Salvador Barberà, Michael Maschler Jonathan Shalev.

We model the decision problems faced by the members of societies whose new members are determined by vote. We adopt a number of simplifying assumptions: the founders and the candidates are fixed; the society operates for k periods and holds elections at the beginning of each period; one vote is sufficient for admission, and voters can support as many candidates as they wish; voters assess the value of the streams of agents with whom they share the society, while they belong to it. In spite of these simplifications, we show that interesting strategic behavior is implied by the dynamic structure of the problem: the vote for friends may be postponed, and it may be advantageous to vote for enemies. We discuss the existence of different types of equilibria in pure strategies and point out interesting equilibria in mixed strategies.

Keywords: Voting, elections, clubs, game theory, noncooperative games, pure-strategy equilibrium profiles, refinements.

JEL Classification: C7, D7, D71.

9823   Strategic learning in games with symmetric information.
Olivier Gossner and Nicolas Vieille.

This paper studies situations in which agents do not initially know the effect of their decisions, but learn from experience the payoffs induced by their choices and their opponent's. We characterize equilibrium payoffs in terms of simple strategies in which an explanation phase is followed by a payoff acquisition phase.

Keywords: Public value of information, games with incomplete information, bandit problems.

JEL Classification: C72.

9824   Bayesian identification of semi-parametric binary response models.
Michel Mouchart, Jean-Marie Rolin and Eliana Scheihing.

In this paper, minimal conditions under which a semi-parametric binary response model is identified in a Bayesian framework are presented and compared to the conditions usually required in a sampling theory framework.

Running headline: Semi-parametric Binary Response Models.
Keywords: Binary response models, Non parametric Bayesian Statistics, Dirichlet processes, Identification
AMS MOS primary: 62F15

secondary: 62J02, 62G99

CENTER FOR OPERATIONS RESEARCH AND ECONOMETRICS

CORE DISCUSSION PAPERS 1998/8

9825   Identification problems in a class of mixture models with an application to the LISREL model.
Michel Mouchart and Ernesto San Martin.

Five different identification problems in mixture models are made explicit. Necessary and sufficient relationships among these problems of identification are analyzed using the concepts of weak and strong identification. This analysis is first particularized under a normality assumption and then used for LISREL models.

Keywords: Cut, hierarchical model, incidental parameters, latent variables, LISREL model, mixture model, strong identification, structural parameters, weak identification.

9826   Bayesian evaluation of a semi-parametric binary response model.
Eliana Scheihing and Michel Mouchart.

In this paper, we develop a Bayesian analysis of a semi-parametric binary choice model. The prior specification of the functional parameter, namely the distribution function of a latent variable, is of the Dirichlet process type and the prior specification of the Euclidean parameter, namely the coefficients of a linear combination of exogenous variables, is left arbitrary. The model identification is ensured by fixing the prior expectation of the functional parameter (see Mouchart et al. (1997)). Approximations for the posterior predictive distributions are obtained from two different sampling methods. Several questions are studied through an exploratory numerical analysis, such as the numerical convergence of the algorithms and of the methods and the general problem of contrasting semi-parametric and purely parametric specification.
Keywords: Discrete choice model, semi-parametric model, Dirichlet process, Gibbs sampling, Bayesian specification.
AMS-MOS: Primary: 62G05, Secondary: 62P20.

9827   Bayesian evaluation of non-admissible conditioning: the case of Fisher test.
Michel Mouchart and Eliana Scheihing.

We first analyse the general problem of admissible conditioning and next consider the evaluation of the loss of information when a non-admissible conditioning is used as an approximaton of the exact posterior distribution. Considering the case of Fisher test, we evaluate from a Bayesian point of view how much information is lost when the sampling process for a 2x2 contingency table is analysed conditionally on the two margins. This loss of information due to non-admissible conditioning is evaluated for different sampling models and with respect to the entropy divergence and to the Hellinger distance between the exact and the approximate posterior distributions and with respect to relative risks based on a quadratic loss function. The numerical results obtained through simulation indicate that for a specific range of parameters the loss of information increases with the sample size and decreases with the precision of the a priori distribution. Hence such an approximation is shown to be a non-asymptotic one.
Keywords: Approximate Bayesian solutions, Admissible conditioning, Contingency tables, Fisher test.

CENTER FOR OPERATIONS RESEARCH AND ECONOMETRICS

CORE DISCUSSION PAPERS 1998/9

9828   Investment decisions and normalization with incomplete markets: a remark.
Luigi Ventura.

Profit maximization is not a well defined objective when markets are incomplete. Several criteria of investment choice have therefore been put forward in the literature, some of which crucially hinge upon aggregation of shareholders' preferences, as is the case with the criteria proposed by Drèze (1974) and Grossman and Hart (1979). This note shows that these criteria are normalization dependent, i.e. their outcome depends on the good chosen to express individuals' marginal rates of substitution.
Keywords: investment decisions, normalization, incomplete markets.
JEL Classification: D52, D70, D81, L20.

9829   The equivalence of the Dekel-Fudenberg iterative procedure and weakly perfect rationalizability.
P. Jean-Jacques Herings and Vincent J. Vannetelbosch.

Two approaches have been proposed in the literature to refine the rationalizability solution concept: either assuming that players make small errors when playing their strategies, or assuming that there is a small amount of payoff uncertainty. We show that both approaches lead to the same refinement if errors are made according to the concept of weakly perfect rationalizability, and there is payoff uncertainty as in Dekel and Fudenberg [*J. of Econ. Theory* 52 (1990), 243-267]. For both cases, the strategies that survive are obtained by starting with one round of elimination of weakly dominated strategies followed by many rounds of elimination of strictly dominated strategies.
Keywords: rationalizability, refinements.
JEL Classification: C72

9830   Strategic complements and substitutes in bilateral oligopolies.
Francis Bloch and Hélène Ferrer.

This note analyzes the effect of product complementarity in a bilateral oligopoly. We show that offers of traders on the two sides of the market are strategic complements (substitutes) if and only if the two goods are substitutes (complements). The outcome of the bilateral oligopoly game converges monotonically to the competitive equilibrium, as the elasticity of substitution between the goods decreases to $-\infty$.
Keywords: bilateral oligopolies, strategic substitutes and complements.
JEL Classification: D43, D51

9831   A Bayesian approach to the econometrics of first-price auctions.
Gian Luigi Albano and Frédéric Jouneau.

We propose a Bayesian approach to empirical auction models. We argue that the Bayesian paradigm is more suitable to the study of empirical strategic models than its frequentist counterpart. We perform an estimation of our model on an auction of hand-made miniature sculptures organized by Christie's in London.
Keywords: first-price auction, private values, Bayesian inference, Gibbs sampling.
JEL Classification: D44, C11, C15

CENTER FOR OPERATIONS RESEARCH AND ECONOMETRICS

CORE, 34, Voie du Roman Pays, 1348 LOUVAIN-LA-NEUVE, Belgium.

CORE DISCUSSION PAPERS 1998/10

9832   Transfers to sustain core-theoretic cooperation in international stock pollutant control.
Marc Germain, Philippe Toint, Henry Tulkens and Aart de Zeeuw.

International environmental agreements aiming at correcting negative externalities generated by transboundary pollution are difficult to achieve for many reasons. Important obstacles arise from asymmetry in costs and benefits, and instability may occur due to the fact that coalitions of countries may attempt to do better for themselves outside of any proposed agreement. In a static context it has already been shown that it is possible to achieve stability in the sense of the core of a cooperative game, by means of appropriately defined transfers between the countries involved. However, the transboundary pollution problems that are most important are caused by accumulated pollutants so that a dynamic analysis is required. This paper provides a transfer scheme that yields a core property in a dynamic context. The possibility of computing such transfers numerically is discussed.
Keywords: transfrontier pollution; stock pollutant; dynamic cooperative games; coalitions; core solution.
JEL Classification: C73, D62, F42, H4, Q3.

9833   On Nash equivalence classes of generic normal form games.
Fabrizio Germano.

We introduce a procedure that uses basic topological characteristics of equilibrium correspondences of standard equilibrium concepts, to define broad equivalence classes of finite generic games in normal form. The proposed procedure is viewed as a potentially useful way of both organizing the underlying spaces of games as well as of comparing different equilibrium concepts with each other. The focus of the paper is mainly on equivalence classes induced by the Nash equilibrium concept. However, equivalence classes induced by the concepts of rationalizability, iterated dominance and correlated equilibrium are also considered.
Keywords: non-cooperative games, classification and equivalence classes, geometry of equilibrium correspondences.
JEL Classification: C70, C72.

9834   Two results about generic non cooperative voting games with plurality rule.
Francesco De Sinopoli.

In this paper we prove that for generic (non cooperative) voting games under plurality rule an equilibrium that induces a mixed distribution over the outcomes (i.e. with two or more candidates elected with positive probability) is isolated. From that we deduce also that the set of equilibrium distributions over outcomes is finite. Furthermore we offer an example (due to Govindan and McLennan) that shows the impossibility of extending such results to a general framework.

9835   Repeated games played by cryptographically sophisticated players.
Olivier Gossner.

We explore the consequences of the assumptions used in modern cryptography when applied to repeated games with public communication. Technically speaking, we model agents by polynomial Turing machines and assume the existence of a trapdoor function. Under these conditions, we prove a Folk Theorem in which the minmax level of players has to be taken in correlated strategies instead of mixed strategies.
Keywords: repeated games, bounded rationality, correlation, Turing machines, cryptography.
JEL Classification: C72.

CENTER FOR OPERATIONS RESEARCH AND ECONOMETRICS

CORE DISCUSSION PAPERS 1998/11

9836   Productivity growth in industrialized countries.
Léopold Simar and Paul W. Wilson.

Several recent papers in the *American Economic Review* examined important questions regarding productivity growth and its sources in industrialized countries: Färe, Grosskopf, Norris, and Zhang (FGNZ), 1994 and Ray and Desli (RD), 1997. We examine two sets of issues raised by these papers, and reassess what can be learned about productivity, efficiency, and technology from the data used by both papers. The first set of issues are primarily economic in nature. The Malmquist measure of efficiency change was decomposed by FGNZ into measures of "pure efficiency change" and change in scale efficiency. RD offered an alternative decomposition of the Malmquist index in which the FGNZ measure of pure efficiency change appears, but in which both the scale efficiency change and technical change measures differ. But, in RD's alternative decomposition, the component which is supposed to measure changes in returns to scale confounds the different effects of movement of production units in input/output space and changes in the shape of the technology over time. We offer in this paper an alternative decomposition which avoids this problem. The second set of issues we examine concern estimation and inference. We provide a statistical model suggested by the original framework of FGNZ which allows us to estimate confidence intervals and formally test many of the claims made by both papers. The tool we used is the bootstrap methodology of Simar and Wilson (1997a,b).

9837   Inflation, welfare and public goods.
Gaetano Bloise, Sergio Currarini and Nicholas Kikidis.

In this paper we study the welfare effects of monetary policy in a simple overlapping generation economy in which agents voluntary contribute to a public good. Inflation has two effects at equilibrium: it increases voluntary contributions and it misallocates private consumption across time. We show that the aggregate effect is welfare improving for "not too high" inflation rates. Moreover, there exists an optimal inflation rate.
Keywords: public goods provision, overlapping generations, inflation.

9838   On the political sustainability of redistributive social insurance systems.
Georges Casamatta, Helmuth Cremer and Pierre Pestieau.

We consider social insurance schemes with a two-part benefit formula: a flat (constant) term and a variable term which is proportional to individuals' contributions. The factor of proportionality defines the type of social insurance. We adopt a two-stage political economy approach. At the first, constitutional stage, the type of social insurance is chosen "behind the veil of ignorance", according to the Rawlsian or the utilitarian criterion. At this stage, private insurance can also be prohibited or allowed. At the second stage, tax rate and benefit level are chosen by majority voting. Three main results emerge. First, it may be appropriate to adopt a system which is less redistributive than otherwise optimal, in order to ensure political support for an adequate level of coverage in the second stage. Second, supplementary private insurance may increase the welfare of the poor, even if it is effectively bought only by the rich. Third, the case for prohibiting (supplementary) private insurance may become stronger when the efficiency of private insurance markets increases.

CENTER FOR OPERATIONS RESEARCH AND ECONOMETRICS

CORE DISCUSSION PAPERS 1998/12

9839   Aggregation and mixed integer rounding to solve MIPs.
Hugues Marchand and Laurence A. Wolsey.

A separation heuristic for mixed integer programs is presented that theoretically allows one to derive several families of "strong" valid inequalities for specific models and computationally gives results as good as or better than those obtained from several existing separation routines including flow cover and integer cover inequalities. The heuristic is based on aggregation of constraints of the original formulation and mixed integer rounding inequalities.

Keywords: mixed integer programming, cutting planes, Gomory mixed integer cuts.

9840   Fiscal policy when individuals differ regarding to altruism and labor supply.
Philippe Michel and Pierre Pestieau.

This paper studies the incidence of tax-transfer policy in a growth model wherein individuals differ according to their level of intergenerational altruism and have an endogenous labor supply. The main results is that public debt is neutral at the macro level but redistributes resources from nonaltruists to altruists. Capital income taxation can hurt the nonaltruists who do not have any wealth more than the altruists who own all of it. Whether or not the altruists supply a positive amount of labor makes a big difference as to the incidence of alternative tax transfer policies.

Keywords: Ricardian equivalence, altruism, tax incidence.

9841   Pareto improving price regulation when the asset market is incomplete.
Jean-Jacques Herings and Heracles Polemarchakis.

The asset market is incomplete.
Fix-price equilibria exist.
Price regulation Pareto improves on a competitive allocation.

Keywords: incomplete asset market, fix-price equilibria, Pareto improvement.
JEL Classification: D45, D52, D60.

9842   The symmetric traveling salesman polytope revisited.
Denis Naddef and Yves Pochet.

We propose in this paper a tour of the symmetric traveling salesman polytope, focusing on inequalities that can be defined on sets. The most known inequalities are all of this type. Many papers have appeared which give more and more complex valid inequalities for this polytope, but no intuitive idea on why these inequalities are valid has ever been given.
In order to help in understanding these inequalities, we develop an intuition into the validity of such inequalities by giving a unifying way of defining them through a sequential lifting procedure. This procedure is based on lifting the slack variables associated with subtour elimination inequalities defined on sets of nodes (called teeth). We apply this procedure to some known classes of valid inequalities for the TSP, respectively Comb, Brushes, Star and Path, Bipartition inequalities, where the lifting coefficients are sequence independent. We also give an example where a facet defining inequality is derived from the lifting procedure, but where the lifting coefficients are sequence dependent. We finally study the Ladder inequalities and show that they can be generated by an extension of the general procedure, where the lifted variables are different from the slack variables of subtour elimination inequalities.

CENTER FOR OPERATIONS RESEARCH AND ECONOMETRICS

CORE DISCUSSION PAPERS 1998/13

9843   Strategic stability and non cooperative voting games: The plurality rule.
Francesco De Sinopoli.

In this paper we show, via some simple examples, that also in the class of games we are dealing with, there are perfect equilibria that are not proper and, moreover, some "proper" outcome is not induced by any stable set. Furthermore, we show that the perfect concept does not appear restrictive enough, since, independently of preferences, it can exclude at most the election of only one candidate. Finally, the stable set's conformity to the iterated dominance principle implies the superiority of this solution concept, even in the peculiar class of plurality games.

9844   Asymmetric ACD models: introducing price information in ACD models with a two state transition model.
Luc Bauwens and Pierre Giot.

This paper proposes a class of asymmetric Autoregressive Conditional Duration models, which extends the ACD model of Engle and Russell (1997). The asymmetry consists of letting the duration process depend on the state of the price process in the beginning and at the end of each duration. If the price has increased, the parameters of the ACD can differ from what they are if the price has decreased. Thus the model is also a transition model for the price process, with durations following an ACD process. The logarithmic version of the model is applied to the bid/ask price revision process by the specialist for the IBM stock on the New York Stock Exchange. The empirical evidence in favour of asymmetry is compelling.

9845   Continua of underemployment equilibria.
Jacques H. DRÈZE and P. Jean-Jacques HERINGS.

In this paper the existence of unemployment is partly explained as being the result of coordination failures. This is achieved by considering a standard general equilibrium model and splitting the set of commodities in two groups. The first group contains commodities like gold. The prices of these commodities are fully flexible, even in the short run, and their markets always clear. The prices of the commodities in the second group are rigid in the short run (for instance labour services or some consumer goods) and households and firms may expect restricted supply possibilities. Whe show that such expectations are self-enforcing, even if all prices of commodities in the second group are competitive. In that case it is shown that as a result of coordination failures a continuum of equilibria results, among which an equilibrium with approximately no trade in the commodities of the second group, and a Walrasian equilibrium. In fact, these coordination failures also arise at other price systems, but then unemployment is the result of both a wrong price system and coordination failures. Moreover, some properties of the set of equilibria are analysed. Generically, there exists a continuum of non-indifferent equilibrium allocations. Under a condition implied by gross substitutability, there exists a continuum of equilibrium allocations in the neighbourhood of a competitive allocation. Examples show that the latter property may not hold in general.

CENTER FOR OPERATIONS RESEARCH AND ECONOMETRICS

CORE DISCUSSION PAPERS 1998/14

9846   Proliferation under threat of entry: pre-emptive investment or "hopeful monsters"?
Ilhem BAGHDADLI and Dominique HENRIET.

Proliferation is a strategic behavior which follows various logics: the wish for pre-emption is one of these but does not stand alone. Far from it. However, the literature associates almost systematically the question of proliferation to that of pre-emption, in such a way that the interest in the incumbent's offer of proliferation can only be measured in terms of its pre-emptive power. The decision to proliferate is a choice which must be made by the incumbent even before he is aware of the particular characteristics of his future challengers. At the moment of choosing his position in the product space, the incumbent does not know on which market he could be opposed, and he is equally unaware of the cost at which his hypothetical rival is capable of undertaking production. Therefore he runs the risk of choosing a position which he may be unable to sustain once the market is mature, particularly if he was to stand up to more technologically advanced opponents or those with an organization superior to his own. In this setting we show that brand proliferation looks like a development of "hopeful monsters" that can limit the risk run by the firm of being excluded from the mature markets.

9847   Volatility impulse response functions for multivariate GARCH models.
Christian M. HAFNER and Helmut HERWARTZ.

In the empirical analysis of financial time series, multivariate GARCH models have been used in various forms. In most cases it is not well understood how the use of a restricted model has to be paid with loss of valuable information. We investigate the structural implications of two alternative models for the response of the conditional (co-)variances to independent shocks. The impulse response analysis, adopted to volatility models, appears to be a convenient methodology to obtain information on the interaction of financial series. We define *volatility impulse response functions* and provide an empirical analysis for a bivariate exchange rate series. For the analyzed series, the impulse response function of the correlation reveals strong discrepancies between the estimated diagonal and BEKK models. This indicates that the diagonality restriction may hide important structural properties of the series.
Keywords: Multivariate GARCH, impulse response functions, exchange rate volatility.

9848   Taxing market power.
Jean J. GABSZEWICZ and Lisa GRAZZINI.

We investigate the effectiveness of tax and transfer policies in correcting market distortions when the economy is imperfectly competitive. We perform this analysis in the context of an exchange model representing a bilateral oligopoly situation, which constitutes a particular example of a Shapley-Shubik strategic market game.
Keywords: Imperfect competition, Taxation, Strategic market game
JEL Classification: H30, L13, C72, D51

9849   Lot-sizing problems: modelling issues and a specialized branch-and-cut system *BC - PROD*.
Gaetan BELVAUX and Laurence A. WOLSEY.

bc-prod is a prototype modelling and optimization system designed and able to tackle a wide variety of the discrete-time lot-sizing problems arising both in practice and in the literature. To use *bc − prod*, the user needs to formulate his/her problem as a mixed integer program using XPRESS-MP's *mp − model*, a standard mathematical programming modelling language taking into account a reserved set of key-words for specific lotsizing objects, such as production variables, storage and demand data, etc. The problem is then solved by the XPRESS-MP branch-and-bound system including lot-sizing specific preprocessing, cutting planes for different aspects of lot-sizing problems, plus general cutting planes, and a lot-sizing specific primal heuristic. Results are presented for a wide variety of big bucket and small bucket models with set-up and start-up costs and times.
Keywords: lot-sizing, production planning, integer programming, modelling system, branch-and-cut.

CENTER FOR OPERATIONS RESEARCH AND ECONOMETRICS

CORE, 34, Voie du Roman Pays, 1348 LOUVAIN-LA-NEUVE, Belgium.

CORE DISCUSSION PAPERS 1998/15

9850   Bayesian specification and identification of a class of mixture models.
Michel MOUCHART and Ernesto SAN MARTIN.

This note argues that a Bayesian framework is almost inescapable when specifying statistical models of the LISREL type, i.e. models involving not only latent and manifest variables but also incidental parameters. Indeed, a careful specification, making every hypothesis explicit and interpretable both contextually and statistically, requires a fully probabilistic framework, which is one of the most attractive features of the Bayesian approach. Such an environment allows one to develop a complete analysis of identification distinguishing five levels of identification problems. From this analysis the paper proceeds, on one hand, by giving some sufficient conditions for the identification of the statistical model, and, on the other hand, by studying the identification problem in the predictive model.

Keywords: Bayesian Identification, Complete Parameters, Incidental Parameters, Hierarchical Model, Minimal Predictive Sufficiency, Mixture Model, Strong Sifting Sequences, Specification, Strong Identification, Structural Parameters.

9851   Employment durations of French young people.
Anna Cristina D'ADDIO.

Using the 1990-1992 wave of the French Labour Force Survey this paper analyzes the effects of different factors on the probability of leaving unemployment of French young people. It also studies duration dependence of the hazard rate while controlling for unobserved heterogeneity separately for men and women. A semi-parametric and two parametric hazard functions have been estimated using grouped duration data. A gamma mixing distribution is used to capture individual unobserved heterogeneity. When the correction for unobserved heterogeneity is not incorporated the model chosen is (for both groups) the Weibull that shows a negative duration dependence. Whenever unobserved heterogeneity is modelled the exponential hazard function (no duration dependence) is retained and again for both populations analyzed. This result seems to suggest that observed true negative duration dependence should be explained more through unobserved heterogeneity than through structural factors, a conclusion to be thought in terms of the mover-stayer paradigm.
Keywords: proportional hazard models, grouped duration data, discrete-time data, unobserved heterogeneity.
JEL Classification: C41, C52, J64

9852   A necessary condition for optimality in renegotiation design.
Nicolas BOCCARD.

Williamson (1979) claims that in a buyer-seller relationship with observable but unverifiable investments and state of nature, the hold up of future benefits leads to underinvestment. Aghion, Dewatripont and Rey (1994) resolve it provided that the initial contract can specify a default option and allocate the bargaining power to either of the party in renegotiation. The necessity to rely on large financial hostage or a "once-for-all" monetary penalty to implement the latter hypothesis is open to criticism but we show that the extreme allocation of the bargaining power is generically a necessary condition to implement the first best investments. Edlin and Reichelstein's (1996) first best result with non-extreme allocation of the bargaining power is therefore a non-generic counter-example.

CENTER FOR OPERATIONS RESEARCH AND ECONOMETRICS

CORE, 34, Voie du Roman Pays, 1348 LOUVAIN-LA-NEUVE, Belgium.

CORE DISCUSSION PAPERS 1998/16

9853   Intertemporal general equilibrium and monetary theory.
        Jacques H. DRÈZE and Heracles M. POLEMARCHAKIS.

The introduction of banks that issue money and supply balances and pay out their profits as dividends is the natural modification of the model of general competitive equilibrium that encompasses monetary economies.
Competitive equilibria exist. Nevertheless, eventhough there is a well defined money market, competitive equilibrium allocations are indeterminate. On an event tree with N nodes, of which S terminal, there are $N + S$ degrees of nominal and, possibly real, indeterminacy. Monetary policy removes some degrees of indeterminacy through a choice of instruments, set according to a state-contingent rule.
Interest rates are suitable instruments for the control of expected inflation but not of the variability of inflation.
Monetary policy is also effective due to redistributive effects and nominal rigidities.
Keywords: Money policy, equilibrium.
JEL Classification: D50, E40, E50.

9854   International treaties on global pollution: a dynamic time-path analysis.
        Parkash CHANDER.

In this paper we show that the formation of coalitions by subsets of countries might diminish the likelihood of a successful world-wide treaty on global pollution. Non-member countries may be less willing to sign a world-wide treaty than they would be in the absence of such coalitions. In fact, the coalition formation may raise the reservation utility of non-member countries above the world-wide treaty level and thus take away their incentives to sign it.

9855   Distinguishing technical and scale efficiency on non-convex and convex technologies: theoretical
        analysis and empirical illustrations.
        Kristiaan KERSTENS and Philippe VANDEN EECKAUT.

This paper defines a decomposition of technical efficiency for a series of nonparametric deterministic reference technologies related to the Free Disposal Hull. More specifically, introducing several returns to scale assumptions into this non-convex production model allows one to distinguish between technical and scale inefficiencies.
These technologies and the resulting efficiency decomposition are illustrated with several data sets and contrasted with results based on the traditional, convex Data Envelopment Analysis models. In particular, data on UK rates departments are extensively analysed. Furthermore, samples of French urban transit companies and of Belgian municipalities serve to verify certain empirical regularities.
Keywords: Decomposition of technical efficiency, FDH, DEA.
JEL Classification: D24.

9856   Repeated communication through the mechanism *and*.
        Olivier GOSSNER and Nicolas VIEILLE.

We consider the "and" communication mechanism that inputs messages from two players and outputs the public signal "yes" if both messages are "yes", and outputs "no" otherwise. We prove that no correlation can securely be implemented through finite or infinite repetition of this mechanism.

CENTER FOR OPERATIONS RESEARCH AND ECONOMETRICS

CORE, 34, Voie du Roman Pays, 1348 LOUVAIN-LA-NEUVE, Belgium.

CORE DISCUSSION PAPERS 1998/17

9857   The effects of economic integration on the provision of mandatory education as a redistributive policy.
Elena DEL REY CANTELI.

The aim of this paper is to investigate the implications of increased student mobility on the level of education provided after opening the borders between two similar countries. As a preliminary result, it will be shown that some public provision of mandatory education can be welfare improving when an optimal linear income tax exists. Compared to the autarchic optimal provision level, mandatory education will be underprovided in both countries at the symmetrical Nash equilibrium.
Keywords: Public provision of private goods, education, efficiency, optimal taxation, fiscal competition.
JEL Classification: H42, H21, H52, H87.

9858   Daily wages and piece rates in agrarian economies.DAILY WAGES AND PIECE
Jean-Marie BALAND, Jean DREZE and Luc LERUTH.

The paper presents an analysis of the coexistence of daily-wage and piece-rate contracts in agrarian economies. We show that, when individual effort is taken into account, daily-wage labourers typically form a convex set in the space of working ability. The most able and the least able labourers work on piece rates, as they can thus choose their own level of effort. We also prove that, on a monopsonistic labour market, the use of both contracts in equilibrium results from the profitability of market segmentation. Imperfect substitutability between workers under different contracts and the downwards rigidity of daily wages can also explain the coexistence of the two types of contracts in more general settings, e.g. perfect competition.

Keywords: India, labour contracts, agricultural labour.

JEL Classification: 053, J41, J43

9859   Scheduling projects with labor constraints.
Cristina C.B. CAVALCANTE, Cid CARVALHO de SOUZA, Martin W.P. SAVELSBERGH, Y. WANG and Laurence A. WOLSEY.

In this paper we consider a labor constrained scheduling problem (LCSP) which is a simplification of a practical problem arising in industry. Jobs are subject to precedence constraints and have specified processing times. Moreover, for each job the labor requirement varies as the job is processed. Given the amount of labor available in each period, the problem is to finish all the jobs as soon as possible, that is, to minimize *makespan*, subject to the precedence and labor constraints. Several Integer Programming (IP) formulations for this problem are discussed and valid inequalities for these different models are introduced. It turns out that a major drawback in using the IP approach is the weakness of the lower bound relaxations. However, we report computational experiments showing how the solution of the linear relaxation of the IP models can be used to provide good schedules. Solutions arising from these LP-based heuristics are considerably improved by local search procedures. We further exploit the capabilities of local search for LCSP by designing a Tabu Search algorithm. The computational experiments on a benchmark data set show that the Tabu algorithm generates the best known upper bounds for almost all these instances. We also show how IP can be used to provide reasonably good lower bounds for LCSP when the makespan is replaced by suitably modified objective functions. Finally some directions for further investigations which may turn IP techniques into a more interesting tool for solving such a problem are suggested.
Keywords: Project Scheduling, Labor Constraints, Integer Programming, Valid Inequalities, Tabu Search, LP-based Ordering Heuristics.

CENTER FOR OPERATIONS RESEARCH AND ECONOMETRICS

CORE, 34, Voie du Roman Pays, 1348 LOUVAIN-LA-NEUVE, Belgium.

CORE DISCUSSION PAPERS 1998/18

9860   Global quadratic optimization via conic relaxation.
Yurii NESTEROV

We present a convex conic relaxation for a problem of maximizing an indefinite quadratic form over a set of convex constraints on the squared variables. We show that for all these problems we get at least $\frac{12}{37}$-relative accuracy of the approximation. In the second part of the paper we derive the conic relaxation by another approach based on the second order optimality conditions. We show that for l_p-balls, $p \geq 2$, intersected by a linear subspace, it is possible to guarantee $(1 - \frac{2}{p})$-relative accuracy of the solution. As a consequence, we prove $(1 - \frac{1}{e \ln n})$-relative accuracy of the conic relaxation for an indefinite quadratic maximization problem over an n-dimensional unit box with homogeneous linear equality constraints. We discuss the implications of the results for the discussion around the question $P = NP$.

9861   Optimization formulations and static equilibrium in congested transportation networks.
André de PALMA and Yurii NESTEROV.

In this paper we study the concepts of equilibrium and optimum in static transportation networks with elastic and non-elastic demands. The main mathematical tool of our paper is the theory of variational inequalities. We demonstrate that this theory is useful for proving the existence theorems. It also can justify Beckmann's formulation of the equilibrium problem. The main contribution of this paper is to propose a new definition of equilibrium, the *normal equilibrium*, which exists under very general assumptions. This concept can be used, in particular, when the travel costs are discontinuous and unbounded. As examples we consider the models of signalized intersections, traffic lights and unbounded travel-time relationships. For some of those cases, the standard concepts of user and Wardrop equilibria cannot be used.

9862   Indeterminacy of equilibrium allocations in monetary open economies.
Matteo SALTO.

In an open economy, outside money in positive supply does not eliminate the real indeterminacy which arises under uncertainty and incomplete asset markets. If money supply is subject to shocks or is not perfectly credible in all countries, the level of a fixed exchange rate matters. Analogous results obtain in cash - in - advance models.
Keywords: Incomplete markets, exchange rates, monetary economy.

JEL Classification: D52, E50, F41

9863   Assets, human capital, and growth.
Chrissopighi BRAILA and Alessandro TURRINI.

In this paper we illustrate the possible normative relevance of the links between human capital and financial assets via an example related to growth. When the financial structure is complete, growth is indeterminate because individual allocations between human capital and a tradable asset are indeterminate. When the financial structure is incomplete, the growth rate depends on the payoff structure of the assets. An issue of optimality for the structure of asset returns is raised.
Keywords: Incomplete Markets, Human Capital, Growth.

JEL Classification: D52, J24, O4

9864   Job creation, job destruction, and the international division of labour.
Marion JANSEN and Alessandro TURRINI.

We incorporate equilibrium unemployment due to imperfect matching into a model of trade in intermediate inputs (Ethier (1982)). Firms are assumed to be price takers and their size is given by technology. Firms enter the market as long as expected profits cover the search cost they incur initially. Trade increases productivity in the final good and then demand for each intermediate input. Steady state unemployment is reduced after trade integration because more vacancies are opened. When the rate of job destruction is made endogenous, international trade reduces the equilibrium rate of job destruction, and this induces an indirect positive effect on job creation. We also show that the more volatile environment faced by firms that is often associated with deeper trade integration is unlikely, per-se, to increase unemployment.
Keywords: Job creation, job destruction, unemployment, international trade, increasing returns.

JEL Classification: 411, 812

9865   Optimal income taxation: An ordinal approach.
Marc FLEURBAEY and François MANIQUET.

In a model where agents have unequal production skills and different preferences, we build social welfare functions which rely only on ordinal non-comparable information on individual preferences. Social welfare functions are required to satisfy properties of compensation for inequalities in skills, and responsibility for preferences. Then assuming skills and preferences are unobservable, we use these social welfare functions to design optimal income tax schemes. We obtain ethical foundations for, among others, a maximized minimal income, a zero marginal tax rate for low incomes, and increasing marginal tax rates.

9866   Smooth transition GARCH models: A Bayesian perspective.
Michel LUBRANO.

This paper proposes a new kind of asymmetric GARCH where the conditional variance obeys two different regimes with a smooth transition function. In one formulation, the conditional variance reacts differently to negative and positive shocks while in a second formulation, small and big shocks have separate effects. The introduction of a threshold allows for a mixed effect. A Bayesian strategy, based on the comparison between posterior and predictive Bayesian residuals, is built for detecting the presence and the shape of nonlinearities. The method is applied to the Brussels and Tokyo stock indexes. The need for an alternative parameterisation of the GARCH model is emphasised as a solution to numerical problems.
Keywords: Bayesian, asymmetric GARCH, specification tests, nonlinear modelling, stock indexes.
JEL Classification: C11, C22, C51, G14