2008/1 Evaluating the impact of average cost based contracts on the industrial sector in the European emission trading scheme
Giorgia OGGIONI and Yves SMEERS

The inception of the Emission Trading System in Europe (EU-ETS) has made power price more expensive. This affects the competitiveness of electricity intensive industrial consumers and may force them to leave Europe. Taking up of a proposal of the industrial sector, we explore the possible application of special contracts, based on the average cost pricing system, which would mitigate the impact of CO_2 cost on their electricity price. The model supposes fixed generation capacities. A companion paper treats the case with capacity expansion.

We first consider a reference model representing a perfectly competitive market where all consumers (households and industries) are price-takers and buy electricity at the short-run marginal cost. We then change the market design assuming that large industrial consumers pay power either at a single or at a nodal average cost price.
The analysis of these problems is conducted with simulation models applied to the Northwestern European market. The equilibrium models developed are implemented in the GAMS environment.
AMS Classification: 46N10, 90C33, 91B24, 91B42
Keywords: average cost pricing, complementarity conditions, EU-ETS, Northwestern Europe market.

2008/2 Privatization and policy competition for FDI
Oscar AMERIGHI and Giuseppe DE FEO

In this paper, we provide an explanation of why privatization may attract foreign investors interested in entering a regional market. Privatization turns the formerly-public firm into a less aggressive competitor since profit- maximizing output is lower than the welfare-maximizing one. The drawback is that social welfare generally decreases. We also investigate tax/subsidy competition for FDI before and after privatization. We show that policy competition is irrelevant in the presence of a public firm serving just its domestic market. By contrast, following privatization, it endows the big country with an instrument which can be used either to reduce the negative impact on welfare of an FDI-attracting privatization or to protect the domestic industry from foreign competitors.
JEL Classification: F12, F23, H25, H73, L13, L33
Keywords: foreign direct investment, tax competition, public firm, privatization.

2008/3 On cycling in the simplex method of the Transportation Problem
Wlodzimierz SZWARC

This paper shows that cycling of the simplex method for the $m \times n$ Transportation Problem where $k-1$ zero basic variables are leaving and reentering the basis does not occur once it does not occur in the $k \times k$ Assignment Problem. A method to disprove cycling for a particular k is applied for $k=2,3,34,5$ and 6.
Keywords: Transportation Problem, Assignment Problem, cycling, basic solution, node, link, directed weighted tree.

2008/4 The real estate risk premium: A developed/emerging country panel data analysis
John-John D'ARGENSIO and Frédéric LAURIN

The objective of this paper is to identify the determinants of office capitalization rates for a panel of 52 countries (developed and emerging countries) between 2000 and 2006. Our assumption, based on a Capital Asset Pricing Model, is that the capitalization rate should be at least proportional to the country's risk perception, as measured by the risk premium on the 10-year government bond yield. Because of the endogeneity of the latter variable, our empirical methodology requires that we estimate first a model explaining the 10-year bond yield. It will be the occasion to discuss the determinants of the risk premium on the bond market. Using a SURE random effect Hausman-Taylor estimator (Hausman & Taylor, 1981), we also take into account the possible correlation between the country risk characteristics on the bond markets and those that determine the real estate market. Our results show that government bond yield is the main determinant of the capitalization rate. We estimate that a 1 percentage point increase in the government bond yield will raise the capitalization rate by about 0.19 percentage point. Real estate variables play also a role, but to a lesser extent. Turning to determinants of the 10-year bond yield, macroeconomic fundamentals are significant determinants of the country risk premium, especially the capacity to honor short-term financial engagements. In addition, the country's risk history has also very important effect on the investors' current risk perception.
JEL Classification: R33, G12, C33, G15

2008/5 Efficiency gains and mergers
Giuseppe DE FEO

In the theoretical literature, strong arguments have been provided in support of the efficiency defense in antitrust merger policy. One of the most often cited results is due to Williamson (1968) that shows how relatively small reduction in cost could offset the deadweight loss of a large price increase. Furthermore, Salant et al. (1983) demonstrate that (not for monopoly) mergers are unprofitable absent efficiency gains. The general result, drawn in a Cournot framework by Farrell and Shapiro (1990), is that (not too large) mergers that are profitable are always welfare improving.

In the present work we challenge the conclusions of this literature in two aspects. First, we show that Williamson's results underestimate the welfare loss due to a price increase and overestimate the effect of efficiency gains. Then, we prove that the conditions for welfare improving mergers defined by Farrell and Shapiro (1990) hold true only when consumers are adversely affected. This seems an argument to disregard their policy prescriptions when antitrust authorities are more "consumers-oriented". In this respect, we provide a necessary and sufficient condition for a consumer surplus improving merger: in a two firm merger, efficiency gains must be larger than the pre-merger average markup.
JEL Classification: D43, L11, L22
Keywords: mergers, efficiency gains, Cournot oligopoly.

2008/6 Equilibria in markets with non-convexities and a solution to the missing money phenomenon in energy markets
Gabriella MURATORE

In this paper we address the issue of finding efficient partial equilibria in markets with non-convexities. This is a problem that has intrigued generation of economists. Beside its theoretical importance this issue is fundamental in energy markets which do not give the right price signals and incentives to maintain existing and invest in new generating capacity. By considering a competitive environment in which consumers maximize utility independently of other agents actions while suppliers are profit maximizers given other market agents actions, we are able to find efficient prices in markets with non-convexities. Based on this result we propose a design for an energy-only market able to give investors the correct price signals.
Keywords: energy markets, equilibrium prices, non convex economies.

2008/7 Energy only, capacity market and security of supply. A stochastic equilibrium analysis
Andreas EHRENMANN and Yves SMEERS

Former generation capacity expansion models were formulated as optimization problems. These included a reliability criterion and hence guaranteed security of supply. The situation is different in restructured markets where investments need to be incentivised by the margin resulting from electricity sales after accounting for fuel costs. The situation is further complicated by the payments and charges on the carbon market. We formulate an equilibrium model of the electricity sector with both investments and operations. Electricity prices are set at the fuel cost of the last operating unit when there is no curtailment, and at some regulated price cap when there is curtailment. There is a CO2 market and different policies for allocating allowances. Todays situation is quite risky for investors. Fuel prices are more volatile than ever; the total amount of CO2 allowances and the allocation method will only be known after investments has been decided. The equilibrium model is thus one under uncertainty. Agents can be risk neutral or risk averse. We model risk aversion through a CVaR of the net margin of the industry. The CVaR induces a risk neutral probability according to which investors value their plants. The model is formulated as a complementarity problem (including the CVaR valuation of investment). An illustration is provided on a small problem that captures the essence of today electricity world: a choice restricted to coal and gas, a peaky load curve because of wind penetration, uncertain fuel prices and an evolving carbon market (EU-ETS). We show that we might have problem of security of supply if we do not implement a capacity market.
Keywords: capacity adequacy, risk functions, stochastic equilibrium models.

2008/8 An integrated model for warehouse and inventory planning
Géraldine STRACK and Yves POCHET

We propose a tactical model which integrates the replenishment decision in inventory management, the allocation of products to warehousing systems and the assignment of products to storage locations in warehousing management. The purpose of this article is to analyse the value of integrating warehouse and inventory decisions. This is achieved

by proposing two methods for solving this tactical integrated model which differ in the level of integration of the inventory and warehousing decisions. A computational analysis is performed on a real world database and using multiple scenarios differing by the warehouse capacity limits. Our observation is that the total cost of the inventory and warehousing systems can be reduced drastically by taking into account the warehouse capacity restrictions in the inventory planning decisions, in an aggregate way. Moreover additional inventory and warehouse savings can be achieved by using more sophisticated integration methods for inventory and warehousing decisions.
Keywords: multi-item inventory model, tactical warehouse model, integrated model, Lagrangian relaxation.

2008/9 Gas models and three difficult objectives
Yves SMEERS

Competition, security of supply and sustainability are at the core of EU energy policy. The Commission argues that making the European gas market more competitive (completing the internal gas market) will be instrumental in the pursuit of these objectives. We examine the question through the eyes of existing models of the European gas market. Can model tell us anything on this problem? Do they confirm or infirm the analysis of the Commission appearing in fundamental documents such the Green Paper, the Sector Inquiry or the new legislation package? We argue that results of existing models contradict a fundamental finding (paragraph 77) of the Sector Inquiry. We further elaborate on the basis of the economic assumption underlying the models, that changing the assumptions implicitly contained in paragraph 77 cast doubts on a large part of the reasoning justifying the completion of the internal gas market. We also explain that models could help arriving at a better definition of the relevant market, which is so important in the reasoning of the Commission. Last we also find model results that question the effectiveness of ownership unbundling. As to security of supply, we explain that models can also contribute to assess the value of additional infrastructure in the context of security of supply, but this potential seems largely untapped. Last we note that sustainability has not yet penetrated models of gas markets. We conclude by suggesting other area of immediate concern, possibly of higher technical difficulty, that modellers could address in future research.

2008/10 Data games. Sharing public goods with exclusion
Pierre DEHEZ and Daniela TELLONE

A group of agents considers collaborating on a project which requires putting together elements owned by some of them. These elements are pure public goods with exclusion i.e. nonrival but excludable goods like for instance knowledge, data or information, patents or copyrights. The present paper addresses the question of how should agents be compensated for the goods they own. It is shown that this problem can be framed as a cost sharing game – called "data game" – to which standard cost sharing rules like the Shapley value or the nucleolus can then be applied and compared.
JEL Classification: C71, D46, M41
Keywords: cost sharing, compensation, Shapley value.

2008/11 Prodigality and myopia. Two rationales for social security
Pierre PESTIEAU and Uri POSSEN

Among the rationales for social security, there is the fact that some people have to be forced to save. To explain undersaving, rational prodigality and hyperbolic preferences are often cited but treated separably. In this paper we study those two particular behaviors that lead to forced saving within an optimal income tax second-best setting.
JEL Classification: H55, D91
Keywords: social security, myopia, dual-self model, prodigality.

2008/12 Social protection performance in the European Union: comparison and convergence
Tim COELLI, Mathieu LEFEBVRE and Pierre PESTIEAU

In this paper we use data on five social inclusion indicators (poverty, inequality, unemployment, education and health) to assess the performance of 15 European welfare states (EU15) over a ten-year period from 1995 to 2004. Aggregate measures of performance are obtained using index number methods similar to those employed in the construction of the widely used Human Development Index (HDI). These are compared with alternative measures derived from data envelopment analysis (DEA) methods. The influence of methodology choice and the assumptions made in scaling indicators upon the results obtained is illustrated and discussed. We also analyse the evolution of performance over time, finding evidence of some convergence in performance and no sign of social dumping.
JEL Classification: H50, C14, D24
Keywords: performance measure, best practice frontier, social protection.

2008/13 Modeling international financial returns with a multivariate regime switching copula
Loran CHOLLETE, Andréas HEINEN and Afonso VALDESOGO

In order to capture observed asymmetric dependence in international financial returns, we construct a multivariate regime-switching model of copulas. We model dependence with one Gaussian and one canonical vine copula regime. Canonical vines are constructed from bivariate conditional copulas and provide a very flexible way of characterizing dependence in multivariate settings. We apply the model to returns from the G5 and Latin American regions, and document two main findings. First, we discover that models with canonical vines generally dominate alternative dependence structures. Second, the choice of copula is important for risk management, because it modifies the Value at Risk (VaR) of international portfolio returns.
JEL Classification: C32, C35, G10
Keywords: asymmetric dependence, canonical vine copula, international returns, regime-switching, risk management, Value-at-Risk.

2008/14 Compatibility choice in vertically differentiated technologies
Filomena GARCIA and Cecilia VERGARI

We analyse firms' incentives to provide two-way compatibility between two network goods with different intrinsic qualities. We study how the relative importance of vertical

differentiation with respect to the network effect influences the price competition as well as the compatibility choice. The final degree of compatibility allows firms to manipulate the overall differentiation. Under weak network effect, full compatibility may arise: the low quality firm has higher incentives to offer it in order to prevent the rival from dominating the market. Under strong network effect we observe multiple equilibria for consumers' demands. However, in any equilibrium of the full game, coordination takes place on the high quality good which, we assume, always maintains its overall quality dominance.
JEL Classification: L13, L15
Keywords: compatibility, vertical differentiation, network effect.

2008/15 Interdependent preferences in the design of equal-opportunity policies
Juan D. MORENO-TERNERO

We study mechanisms to construct equal-opportunity policies for resource allocation. In our model agents enjoy welfare as a function of the effort they expend, and the amount of a socially provided resource they consume. Nevertheless, agents have interdependent preferences, i.e., they not only care about their own allocation, but also about their peers' allocations. As in the standard approach to equality of opportunity, the aim is to allocate the social resource so that welfare across individuals at the same relative effort level is as equal as possible. We show how pursuing this same aim while assuming that agents have interdependent preferences might crucially alter the results.
JEL Classification: D63, H00, I18
Keywords: equality of opportunity, interdependent preferences, social policies, compensation, responsibility.

2008/16 Von Neumann-Morgenstern farsightedly stable sets in two-sided matching
Ana MAULEON, Vincent VANNETELBOSCH and Wouter VERGOTE

We adopt the notion of von Neumann-Morgenstern farsightedly stable sets to predict which matchings are possibly stable when agents are farsighted in one-to-one matching problems. We provide the characterization of von Neumann-Morgenstern farsightedly stable sets: a set of matchings is a von Neumann-Morgenstern farsightedly stable set if and only if it is a singleton set and its element is a corewise stable matching. Thus, contrary to the von Neumann-Morgenstern (myopically) stable sets, von Neumann-Morgenstern farsightedly stable sets cannot include matchings that are not corewise stable ones. Moreover, we show that our main result is robust to many-to-one matching problems with responsive preferences.
JEL Classification: C71, C78
Keywords: matching problem, von Neumann-Morgenstern stable sets, farsighted stability.

2008/17 Information revelation in markets with pairwise meetings: complete information revelation in dynamic analysis
Tanguy ISAAC

We study information revelation in markets with pairwise meetings. We focus on the one-

sided case and perform a dynamic analysis of a constant entry flow model. The same question has been studied in an identical framework in Serrano and Yosha (1993) but they limit their analysis to the stationary steady states. Blouin and Serrano (2001) study information revelation in a one-time entry model and obtain results different than Serrano and Yosha (1993). We establish that the main difference is not due to the steady state analysis but is due to the differences concerning the entry assumption.
JEL Classification: D49, D82, D83
Keywords: information revelation, asymmetric information, decentralized trade.

2008/18 Axiomatic resource allocation for heterogeneous agents
Juan D. MORENO-TERNERO and John E. ROEMER

We analyze a model of resource allocation in which agents' abilities (to transform the resource into an interpersonally comparable outcome) and initial endowments may differ. We impose ethical and operational axioms in this model and characterize some allocation rules as a result of combining these axioms. Two focal (and polar) egalitarian rules are singled out. On the one hand, the rule that allocates the resource equally across agents. On the other hand, the rule tha allocates the resource so that the distribution of final outcomes is lexicographically maximized.
JEL Classification: D63
Keywords: resource allocation, egalitarianism, priority, solidarity, composition.

2008/19 Mixed duopoly, privatization and the shadow cost of public funds
Carlo CAPUANO and Giuseppe DE FEO

The purpose of this paper is to investigate the effect of privatization in a mixed duopoly, where a private firm competes in quantities with a welfare-maximizing public firm. We consider two inefficiencies of the public sector: a possible cost inefficiency, and an allocative inefficiency due to the distortionary effect of taxation (shadow cost of public funds). Furthermore, we analyze the effect of privatization on the timing of competition by endogenizing the determination of simultaneous (Nash-Cournot) versus sequential (Stackelberg) games using the model developed by Hamilton and Slutsky (1990). The latter is especially relevant for the analysis of privatization, given that results and policy prescription emerged in the literature crucially rely on the type of competition *assumed*. We show that privatization has generally the effect of shifting from Stackelberg to Cournot equilibrium and that, absent efficiency gains privatization never increases welfare. Moreover, even when large efficiency gains are realized, an inefficient public firm may be preferred.
JEL Classification: H2, H42, L13, L32, L33
Keywords: mixed oligopoly, privatization, endogenous timing, distortionary taxes.

2008/20 Forced saving, redistribution and nonlinear social security schemes
Helmuth CREMER, Philippe DE DONDER, Dario MALDONADO and Pierre PESTIEAU

This paper studies the design of a nonlinear social security scheme in a society where individuals differ in two respects: productivity and degree of myopia. Myopic individuals

may not save "enough" for their retirement because their "myopic self" emerges when labor supply and savings decisions are made. The social welfare function is paternalistic: the rate of time preference of the far-sighted (which corresponds to the "true" preferences of the myopics) is used for both types. We show that the paternalistic solution does not necessarily imply forced savings for the myopics. This is because paternalistic considerations are mitigated or even outweighed by incentive effects. Our numerical results suggest that as the number of myopic individuals increases, there is less redistribution and more forced saving. Furthermore, as the number of myopic increases, the desirability of social security (measured by the difference between social welfare with and without social security) increases.
JEL Classification: H55, D91
Keywords: social security, myopia, dual-self model.

2008/21 Approximating multiple class queueing models with loss models
Philippe CHEVALIER and Jean-Christophe VAN DEN SCHRIECK

Multiple class queueing models arise in situations where some flexibility is sought through pooling of demands for different services. Earlier research has shown that most of the benefits of flexibility can be obtained with only a small proportion of cross-trained operators. Predicting the performance of a system with different types of demands and operator pools with different skills is very difficult. We present an approximation method that is based on equivalent loss systems. We successively develop approximations for the waiting probability, the average waiting time and the service level. Our approximations are validated using a series of simulations. Along the way we present some interesting insights into some similarities between queueing systems and equivalent loss systems that have to our knowledge never been reported in the literature.

2008/22 Interaction of defined benefit pension plans and social security
Pierre PESTIEAU and Uri M. POSSEN

This paper explores the shift from defined benefit to defined contribution pension plans when the payout rate from social security is set optimally. This paper shows that when employees are receiving more of their private pensions from defined contribution plans one should be raising the payout rate from traditional social security rather than trying to privatize part of it.
JEL Classification: H55, J26
Keywords: social security, defined benefit, defined contribution.

2008/23 Optimal ownership in joint ventures with contributions of asymmetric partners
Marco MARINUCCI

This paper faces two questions concerning Joint Ventures (JV) agreements. First, we study how the partners contribution affect the creation and the profit sharing of a JV when partners' effort is not observable. Then, we see whether such agreements are easier to enforce when the decision on JV profit sharing among partners is either delegated to the independent JV management (Management Sharing) or jointly taken by partners (Coordinated Sharing). We find that the firm whose effort has a higher impact on the JV's

profits should have a larger profit shares. Moreover, a Management sharing ensures, at least in some cases, a wider range of self-enforceable JV agreements.
JEL Classification: D43, L13, L14, L22
Keywords: joint ventures, strategic alliances, ownership structure, asymmetries.

2008/24 Optimal firm behavior under environmental constraints
Raouf BOUCEKKINE, Natali HRITONENKO and Yuri YATSENKO

The paper examines the Porter and induced-innovation hypotheses in a firm model where: (i) the firm has a vintage capital technology with two complementary factors, energy and capital ; (ii) scrapping is endogenous; (iii) technological progress is energy-saving and endogenous through purposive R&D investment; (iv) the innovation rate increases with R&D investment and decreases with complexity; (v) the firm is subject to emission quotas which put an upper bound on its energy consumption at any date; (vi) energy and capital prices are exogenous. Balanced growth paths are first characterized, and a comparative static analysis is performed to study a kind of long-term Porter and induced-innovation hypotheses. In particular, it is shown that tighter emission quotas do not prevent firms to grow in the long-run, thanks to endogenous innovation, but they have an inverse effect on the growth rate of profits. Some short-term dynamics are also produced, particularly, to analyze the role of initial conditions and energy prices in optimal firm behavior subject to environmental regulation. Among numerous results, we show that (i) firms which are historically "small" polluters find it optimal to massively pollute in the short run: during the transition, new and clean machines will co-exist with old and dirty machines in the productive sectors, implying an unambiguously dirty transition; (ii) higher energy prices induce a shorter lifetime for capital goods but they depress investment in both new capital and R&D, featuring a kind of reverse Hicksian mechanism.
JEL Classification: C71, C78
Keywords: matching problem, von Neumann-Morgenstern stable sets, farsighted stability.

2008/25 Market integration in network industries
Ana MAULEON, Vincent VANNETELBOSCH and Cecilia VERGARI

What is the effect of product market integration on the market equilibrium in the presence of international network externalities in consumption? To address this question, we set up a spatial two-country model and we find that the economic forces at work may have an ambiguous effect on prices.
JEL Classification: L13, L15
Keywords: compatibility, horizontal differentiation, network effect.

2008/26 Decentralization of the core through Nash equilibrium
Leonidas C. KOUTSOUGERAS and Nicholas ZIROS

We show that in large finite economies, core allocations can be approximately decentralized as Nash (rather than Walras) equilibrium. We argue that this excrcise is an essential complement to asymptotic core equivalence results, because it implies that in some approximate sense individual attempts to manipulate the decentralizing prices cannot be beneficial, which fits precisely the interpretation of asymptotic core

convergence, namely the emergence of price taking.
JEL Classification: D43, D50, C72
Keywords: core, Nash equilibrium, asymptotic proximity, decentralization.

2008/27 To acquire, or to compete? An entry dilemma
Jean J. GABSZEWICZ, Didier LAUSSEL and Ornella TAROLA

In this paper we address the following question: is it more profitable, for an entrant in a differentiated market, to acquire an existing firm than to compete? We illustrate the answer by considering competition in the banking sector.
JEL Classification: G34, L13, L22
Keywords: Vertical differentiation, entry, banking competition.

2008/28 Probability masses fitting in the analysis of manufacturing flow lines
Jean-Sébastien TANCREZ, Philippe CHEVALIER and Pierre SEMAL

A new alternative in the analysis of manufacturing systems with finite buffers is presented. We propose and study a new approach in order to build tractable phase-type distributions, which are required by state-of-the-art analytical models. Called "probability masses fitting" (PMF), the approach is quite simple: the probability masses on regular intervals are computed and aggregated on a single value in the corresponding interval, leading to a discrete distribution. PMF shows some interesting properties: it is bounding, monotonic and it conserves the shape of the distribution. After PMF, from the discrete phase-type distributions, state-of-the-art analytical models can be applied. Here, we choose the exactly model the evolution of the system by a Markov chain, and we focus on flow lines. The properties of the global modelling method can be discovered by extending the PMF properties, mainly leading to bounds on the throughput. Finally, the method is shown, by numerical experiments, to compute accurate estimations of the throughput and of various performance measures, reaching accuracy levels of a few tenths of percent.
Keywords: stochastic modelling, flow lines, probability masses fitting, discretization, bounds, performance measures, distributions.

2008/29 Endogenous differential mortality, non monitored effort and optimal non linear taxation
Marie-Louise LEROUX

This paper studies the normative problem of redistribution among individuals who can influence their longevity through a non-monetary effort but have different taste for effort. As benchmarks, we first present the laissez-faire and the first best. In the first best, the level of effort is always lower than in the laissez-faire as the social planner takes into account the consequences of higher survival on the budget constraint. However, since we suppose that effort is private and non-monetary (like exercising), it is reasonable to think that the social planner has no control over it. Thus, we modify our framework and assume for the rest of the paper that effort is determined by the individual while the social planner only allocates consumptions. Under full information with non monitored effort, early consumption is preferred to future consumption and the high-survival individual obtains higher future consumption. Under asymmetric information, the distortion is identical for the low-survival individual while the direction of the distortion for the high-survival

individual is ambiguous. We finally show how to decentralize these allocations through a perfect annuity market and (positive or negative) taxes on annuities.
JEL Classification: H21, H23, H55, I12
Keywords: annuities, effort, differential mortality, non linear taxation.

2008/30 Two row mixed integer cuts via lifting
Santanu S. DEY and Laurence A. WOLSEY

Recently, Andersen et al. [1], Borozan and Cornuéjols [6] and Cornuéjols and Margot [9] characterized extreme inequalities of a system of two rows with two free integer variables and nonnegative continuous variables. These inequalities are either split cuts or intersection cuts derived using maximal lattice-free convex sets. In order to use these inequalities to obtain cuts from two rows of a general simplex tableau, one approach is to extend the system to include all possible nonnegative integer variables (giving the two-row mixed integer infinite-group problem), and to develop lifting functions giving the coefficients of the integer variables in the corresponding inequalities. In this paper, we study the characteristics of these lifting functions.

We begin by observing that functions giving valid coefficients for the nonnegative integer variables can be constructed by lifting a subset of the integer variables and then applying the fill-in procedure presented in Johnson [23]. We present conditions for these 'general fill-in functions" to be extreme for the two-row mixed integer infinite-group problem. We then show that there exists a unique 'trivial' lifting function that yields extreme inequalities when starting from a maximal lattice-free triangle with multiple integer points in the relative interior of one of its sides, or a maximal lattice-free triangle with integral vertices and one integer point in the relative interior of each side. In all other cases (maximal lattice-free triangle with one integer point in the relative interior of each side and non-integral vertices, and maximal lattice-free quadrilaterals), non-unique lifting functions may yield distinct extreme inequalities. For the case of a triangle with one integer point in the relative interior of each side and non-integral vertices, we present sufficient conditions to yield an extreme inequality for the two-row mixed integer infinite-group problem.

2008/31 Taxing sin goods and subsidizing health care
Helmuth CREMER, Philippe DE DONDER, Dario MALDONADO and Pierre PESTIEAU

We consider a two-period model. In the first period, individuals consume two goods: one is sinful and the other is not. The sin good brings pleasure but has a detrimental effect on second period health and individuals tend to underestimate this effect. In the second period, individuals can devote part of their saving to improve their health status and thus compensate for the damage caused by their sinful consumption. We consider two alternative specifications concerning this second period health care decision: either individuals acknowledge that they have made a mistake in the first period out of myopia or ignorance, or they persist in ignoring the detrimental effect of their sinful consumption. We study the optimal linear taxes on sin good consumption, saving and health care expenditures for a paternalistic social planner. We compare those taxes in the two specifications. We show under which circumstances the first best outcome can be

decentralized and we study the second best taxes when saving is unobservable.
JEL Classification: H21, I18
Keywords: paternalism, behavioral, economics, dual self v single self.

2008/32 The TV news scheduling game when the newscaster's face matters
Jean J. GABSZEWICZ, Didier LAUSSEL and Nathalie SONNAC

The present note first provides an alternative formulation of the Cancian, Bills and Bergström (1995)-problem which discards the non-existence difficulty and consequently allows to consider some extensions of the TV-newscast scheduling game. The extension we consider consists in assuming that viewers'preferences between the competing channels do not depend only on the timing of their broadcast, but also on some other characteristics, like the content of the show or the identity of the newscaster. Then we identify a sufficient condition on the dispersion of these preferences over the viewers'population guaranteeing the existence of a unique Nash equilibrium. It turns out that, at this equilibrium, both networks broadcast their news at the same instant.
JEL Classification: L150, L820
Keywords: advertising, newspapers quality.

2008/33 Does the absence of competition *in* the market foster competition *for* the market? A dynamic approach to aftermarkets
Didier LAUSSEL and Joana RESENDE

In this paper, we investigate dynamic price competition when firms strategically interact in two distinct but interrelated markets: a primary market and an aftermarket, where indirect network effects arise. We set up a differential game of two-dimensional price competition and we conclude that the absence of price competition in the aftermarket (competition *in* the market) fosters dynamic price competition in the primary market (competition *for* the market). We also investigate the impact of network sizes on firms' prices in the primary market concluding that, in equilibrium, larger firms have incentives to compete more fiercely for new "uncolonized" consumers.
JEL Classification: C61, L11, L13
Keywords: dynamic competition, differential games, Linear Markov Perfect Equilibrium, aftermarkets, network effects.

2008/34 Polynomial-time computation of the joint spectral radius for some sets of nonnegative matrices
Vincent D. BLONDEL and Yurii NESTEROV

We propose two simple upper bounds for the joint spectral radius of sets of nonnegative matrices. These bounds, the *joint column radius* and the *joint row radius*, can be computed in polynomial time as solutions of convex optimization problems. We show that for general matrices these bounds are within a factor $1/n$ of the exact value, where n is the size of the matrices. Moreover, for sets of matrices with independent column uncertainties of with independent row uncertainties, the corresponding bounds coincide with the joint spectral radius. In these cases, the joint spectral radius is also given by the largest spectral radius of the matrices in the set. As a byproduct of these results, we

propose a polynomial-time technique for solving Boolean optimization problems related to the spectral radius. We also consider economics and engineering applications of our results which were never considered practice due to their intrinsic computational complexity.
Keywords: joint spectral radius, joint column radius, joint row radius, nonnegative matrices, asynchronous systems, convex optimization, Leontief model.

2008/35 Democracy, rule of law, corruption incentives and growth
David DE LA CROIX and Clara DELAVALLADE

We bridge the gap between the standard theory of growth and the mostly static theory of corruption. Some public investment can be diverted from its purpose by corrupt individuals. Voters determine the level of public investment subject to an incentive constraint equalizing the returns from productive and corrupt activities. We concentrate on two exogenous institutional parameters: the "technology of corruption" is the ease with which rent-seekers can capture a proportion of public spending. The "concentration of political power" is the extent to which rent-seekers have more political influence than other people. One theoretical prediction is that the effects of the two institutional parameters on income growth and equilibrium corruption are different according to the constraints that are binding at equilibrium. In particular, the effect of judicial quality on growth should be stronger when political power is concentrated. We estimate a system of equations where both corruption and income growth are determined simultaneously and show that income growth is more affected by our proxies for legal and political institutions in countries where political rights and judicial institutions respectively are limited.
JEL Classification: O41, H50, D73
Keywords: economic growth, corruption, rule of law, incentive constraint, political power.

2008/36 Uncertain quality, product variety and price competition
Jean J. GABSZEWICZ and Joana RESENDE

This paper analyses price competition under product differentiation when goods are defined in a two dimensional characteristic space, and consumers do not know which firm sells which quality. Equilibrium prices consist of two additive terms, which balance consumers' relative valuation of goods' expected quality and consumers' preferences for variety. However the relative importance of these terms differ under vertical and horizontal dominance.
JEL Classification: D43, D80, L15
Keywords: product differentiation, variety, quality, uncertainty.

2008/37 On investment decisions in liberalized electricity markets: the impact of price caps at the spot market
Gregor ZOETTL

We analyze the impact of a uniform price cap at electricity spot markets on firms investment decisions and on welfare. Since investment decisions for those markets are taken in the long

run, fluctuating demand at the spot market eventually gives rise to high price spikes in case of binding capacities. Those price spikes are considered to send accurate signals for investment in generation capacities, limiting those spikes by price caps is thought to reduce firms' investment incentives.

We are able to show that this is not true for the case of strategic investment behavior. More specifically we analyze a market game where firms choose capacities prior to a spot market which is subject to fluctuating or uncertain demand. We derive, that appropriately chosen price caps do always increase firms investment incentives under imperfect competition. We furthermore characterize the optimal price cap. Based on the theoretical framework, we empirically analyze the impact of uniform price caps on the German electricity market.

JEL Classification: D43, L13, D41, D42, D81
Keywords: Investment incentives, price caps, fluctuating demand, electricity markets.

2008/38 Habit formation and labor supply

Helmuth CREMER, Philippe DE DONDER, Dario MALDONADO and Pierre PESTIEAU

This paper shows that the combination of habit formation – present consumption creating additional consumption needs in the future – and myopia may explain why some retirees are forced to "unretire", i.e., unexpectedly return to work. It also shows that when myopia about habit formation leads to unretirement there is a case for government's intervention. In a first-best setting the optimal solution can be decentralized by a simple "Pigouvian" (paternalistic) consumption tax (along with suitable lump-sum taxes). In a second-best setting, when personalized lump-sum transfers are not available, consumption taxes may have conflicting paternalistic and redistributive effects. We study the design of consumption taxes in such a setting when myopic individuals differ in productivity.

JEL Classification: D91, H21, H55
Keywords: habit formation, myopia, unretiring.

2008/39 Optimal tax policy and expected longevity: a mean and variance approach

Marie-Louise LEROUX and Grégory PONTHIERE

This paper studies the normative problem of redistribution between agents who can influence their survival probability through private health spending, but who differ in their attitude towards the risks involved in the lotteries of life to be chosen. For that purpose, we develop a two-period model where agents's preferences on lotteries of life can be represented by a mean and variance utility function allowing, unlike the expected utility form, some – agent-specific – sensitivity to what Allais (1953) calls the 'dispersion of psychological values'. It is shown that if agents ignore the impact of their health expenditures on the return of their savings, the decentralization of the first-best optimum requires not only intergroup lump-sum transfers, but, also, group-specific taxes on health spending. Under asymmetric information, we find that a subsidy on savings is optimal, whereas group-specific taxes on health spending are of ambiguous signs.

JEL Classification: D81, H21, I12, I18, J18
Keywords: longevity, risk, lotteries of life, expected utility theory, health spending.

2008/40 Transportation, freight rates, and economic geography
Kristian BEHRENS and Pierre M. PICARD

We investigate the role of the transport sector in structuring the location of economic activity within two-region economic geography models of the footloose capital and core-periphery types. In our setting, competitive carriers offer transport services for shipping manufactured goods across regions and freight rates are determined endogenously to clear transport markets. Each carrier commits to the maximum capacity for a round-trip and thus faces a simple logistic problem: there are costs associated with 'returning empty', and those costs increase the freight rates charged to manufacturing firms. Since demand for transport services depends on the spatial distribution of economic activity, agglomeration in one region raises freight rates to serve foreign markets, thus generating an additional dispersion force. We show that a more equal equilibrium distribution of firms prevails when freight rates are endogenously determined than when they are exogenous and that multiple equilibria (including partial agglomeration) usually coexist.
JEL Classification: F12, R12
Keywords: transport sector, freight rates, economic geography, trade.

2008/41 Investment decisions in liberalized electricity markets: a framework of peak load pricing with strategic firms
Gregor ZOETTL

In this article we analyze firms investment incentives in liberalized electricity markets. Since electricity is economically non storable, it is optimal for firms to invest in a differentiated portfolio of technologies in order to serve strongly fluctuating demand. Prior to the Liberalization of electricity markets, for regulated monopolists, optimal investment and pricing strategies haven been analyzed in the peak load pricing literature (compare Crew and Kleindorder (1986)). In restructured electricity markets regulated monopolistic generators have often been replaced by competing and potentially strategic firms.

This article aims to respond to the changed reality and model investment decisions of strategic firms in those markets. We derive equilibrium investment for strategic firms and compare to the benchmark cases of perfect competition and monopoly outcomes. We find that strategic firms have an incentive to overinvest in base-load technologies but choose total capacities too low from a welfare point of view. By fitting the framework to a specific electricity market (Germany) we are able to empirically analyze Investment choices of strategic firms, and quantify the potential for market power and its impact on generation portfolios in restructured electricity markets in the long run.
Keywords: Investment decisions, technology choice, restructured electricity markets, peak load pricing, strategic firms.

2008/42 How do epidemics induce behavioral changes?
Raouf BOUCEKKINE, Rodolphe DESBORDES and Hélène LATZER

This paper develops a theory of optimal fertility behavior under mortality shocks. In a 3-periods OLG model, young adults determine their optimal fertility, labor supply and life-cycle consumption with both exogenous child and adult mortality risks. For fixed prices (real wages and interest rate), it is shown that both child and adult one-period mortality shocks raise fertility due to insurance and life-cycle mechanisms respectively. In general

equilibrium, adult mortality shocks give rise to price effects (notably through rising wages) lowering fertility, in contrast to child mortality shocks. We complement our theory with an empirical analysis on a sample of 39 Sub-Saharan African countries over the 1980-2004 period, checking for the overall effects of the adult and child mortality channels on optimal fertility behavior. We find child mortality to exert a robust, positive impact on fertility, whereas the reverse is true for adult mortality. We further find this negative effect on fertility of a rise in adult mortality to *dominate* in the long-term the positive effect on demand for children resulting from an increase in child mortality.
JEL Classification: J13, J22, O41
Keywords: fertility, mortality, epidemics, HIV.

2008/43 Would empowering women initiate the demographic transition in least-developed countries?
David DE LA CROIX and Marie VANDER DONCKT

We examine the pathways by which gender inequality affects fertility and hampers growth. We introduce several dimensions of gender inequality into a 2-sex OLG model with a non-unitary representation of household decision-making. We characterize a Malthusian corner regime which is characterized by strong gender inequality in education and high fertility. We find both in theory and in the data that reducing the social and institutional gender gap does not help to escape from this regime while reducing the wage gender gap lowers fertility only in countries which have already escaped from it. The key policies to ease out the countries in the Malthusian regime are to promote mother's longevity and to curb infant mortality. In the interior regime, parents consider the impact of their children education on the expected intra-household bargaining position in their future couple. Education could thus compensate against the institutional and social gender gap that still exists in developed countries.
JEL Classification: J13, O11, O40
Keywords: gender gap, fertility, education, household bargaining.

2008/44 Space-time patterns of urban sprawl, a 1D cellular automata and microeconomic approach
Geoffrey CARUSO, Dominique PEETERS, Jean CAVAILHES and Mark ROUNSEVELL

We present a theoretical model of residential growth that emphasizes the path-dependent nature of urban sprawl patterns. The model is founded on the monocentric urban economic model and uses a cellular automata (CA) approach to introduce endogenous neighbourhood effects. Households are assumed to both like and dislike the density of their neighbourhood, and trade-off this density with housing space consumption and commuting costs. Discontinuous spatial patterns emerge from that trade-off, with the size of suburban clusters varying with time and distance to the centre. We use space-time diagrams inspired from 1D elementary CA to visualize changes in spatial patterns through time and space, and undertake sensitivity analyses to show how the pattern and timing of sprawl are affected by neighbourhood preferences, income level, commuting costs or by imposing a green belt.
JEL Classification: C61, C63, D62, R14, R21

Keywords: urban sprawl, open space, neighbourhood externalities, cellular automata, residential dynamics.

2008/45 Asymptotic properties of the Bernstein density copula for dependent data
Taoufik BOUEZMARNI, Jeroen V.K. ROMBOUTS and Abderrahim TAAMOUTI

Copulas are extensively used for dependence modeling. In many cases the data does not reveal how the dependence can be modeled using a particular parametric copula. Nonparametric copulas do not share this problem since they are entirely data based. This paper proposes nonparametric estimation of the density copula for α-mixing data using Bernstein polynomials. We study the asymptotic properties of the Bernstein density copula, i.e., we provide the exact asymptotic bias and variance, we establish the uniform strong consistency and the asymptotic normality.
JEL Classification: C13, C14
Keywords: nonparametric estimation, copula, Bernstein polynomial, α-mixing, asymptotic properties, boundary bias.

2008/46 On the impact of labor market matching on regional disparities
Joe THARAKAN and Jean-Philippe TROPEANO

We propose a model where imperfect matching between firms and workers on local labor markets leads to incentives for spatial agglomeration. We show that the occurrence of spatial agglomeration depends on initial size differences in terms of both number of workers and firms. Allowing for dynamics of workers' and firms' location choices, we show that the spatial outcome depends crucially on different dimensions of agents' mobility. The effect of a higher level of human capital on regional disparities depends on whether it makes workers more mobile or more specialized on the labor market.
JEL Classification: J61, J42, R12
Keywords: economic geography, local labor market, regional disparities, human capital.

2008/47 An easy test for two stationary long processes being uncorrelated via AR approximations
Shin-Huei WANG and Cheng HSIAO

This paper proposes an easy test for two stationary autoregressive fractionally integrated moving average (ARFIMA) processes being uncorrelated via AR approximations. We prove that an ARFIMA process can be approximated well by an autoregressive (AR) model and establish the theoretical foundation of Haugh's (1976) statistics to test two ARFIMA processes being uncorrelated. Using AIC or Mallow's C_p criterion as a guide, we demonstrate through Monte Carlo studies that a lower order AR(k) model is sufficient to prewhiten an ARFIMA process and the Haugh test statistics perform very well in finite sample. We illustrate the methodology by investigating the independence between the volatility of two daily nominal dollar exchange rates-Euro and Japanese Yen and find that there exists "strongly simultaneous correlation" between the volatilities of Euro and Yen within 25 days.
JEL Classification: C22, C53
Keywords: forecasting, long memory process, structural break.

2008/48 Adult longevity and economic take-off: from Malthus to Ben-Porath
David DE LA CROIX

We propose four arguments favoring the idea that medical effectiveness, adult longevity and height started to increase in Europe before the industrial revolution. This may have prompted households to increase their investment in human skills as a response to longer lives and initiated the transition from stagnation to growth.
JEL Classification: J11, I12, N30, I20, J24
Keywords: life expectancy, height, industrial revolution, human capital, adult mortality.

2008/49 On the Golden Rule of capital accumulation under endogenous longevity
David DE LA CROIX and Grégory PONTHIERE

This note derives the Golden Rule of capital accumulation in a Chakraborty-type economy, i.e. a two-period OLG economy where longevity is endogenous. It is shown that the capital per worker maximizing steady-state consumption per head is inferior to the Golden Rule capital level prevailing under exogenous longevity. We characterize also the Lifetime Golden Rule, that is, the capital per worker maximizing steady-state expected lifetime consumption per head, and show that this tends to exceed the standard Golden Rule capital level.
JEL Classification: E13, E21, E22, I12
Keywords: Golden Rule, longevity, OLG models.

2008/50 Successive oligopolies and decreasing returns
Jean J. GABSZEWICZ and Skerdilajda ZANAJ

In this paper, we propose an example of successive oligopolies where the downstream firms share the same decreasing returns technology of the Cobb-Douglas type. We stress the differences between the conclusions obtained under this assumption and those resulting from the traditional example considered in the literature, namely, a constant returns technology.
JEL Classification: D43, L1, L22, L42
Keywords: successive oligopolies, vertical integration, technology.

2008/51 Optimal linear taxation under endogenous longevity
Marie-Louise LEROUX, Pierre PESTIEAU and Grégory PONTHIERE

This paper studies the optimal linear tax-transfer policy in an economy where agents differ in productivity and in genetic background, and where longevity depends on health spending and genes. It is shown that, if agents internalize imperfectly the impact of genes and health spending on longevity, the utilitarian social optimum can be decentralized with type-specific redistributive lump sum transfers and Pigouvian taxes correcting for agents's myopia (leading to undersaving and underinvestment in health), and for their incapacity to perceive the effect of health spending on the resource constraint of the economy (causing overinvestment in health). The second-best problem is also examined under

linear taxation instruments. Our main result is that it may be optimal to tax health spending, in particular under a complementarity of genes and health spending in the production of longevity.
JEL Classification: H21, H51, H55, I12, I18
Keywords: longevity, myopia, genetic background, social security, paternalism.

2008/52 Estimating the dynamics of R&D-based growth models
Yuri YATSENKO Raouf BOUCEKKINE and Natali HRITONENKO

Several R&D-based models of endogenous economic growth are investigated under the Solow-like assumption of fixed allocation of resources across activities. We identify model parameters that lead to explosive dynamics and analyze various economic techniques to avoid it. The techniques include adding stricter constraints on model trajectories and limiting factors in technology equation. In particular, we demonstrate that our vintage version of the well-known R&D-based model of economic growth (Jones, 1995) exhibits the same balanced dynamics as the original model.
JEL Classification: E20, O40, C60
Keywords: vintage capital models, endogenous technological change, R&D investment, explosive dynamics, nonlinear Volterra integral equations.

2008/53 Voting for redistribution under desert-sensitive altruism
Roland Iwan LUTTENS and Marie-Anne VALFORT

We endow individuals that differ in skill levels and tastes for working with altruistic preferences for redistribution in a voting model where a unidimensional redistributive parameter is chosen by majority voting in a direct democracy. When altruistic preferences are desert-sensitive, i.e. when there is a reluctance to redistribute from the hard-working to the lazy, we show that lower levels of redistribution emerge in political equilibrium. We provide empirical evidence, based on the ISSP 1992 dataset, that preferences for redistribution are not purely selfish and that desert-sensitive motivations play a significant role. We estimate that preferences for redistribution are significantly more desert-sensitive in the US than in Europe. We believe that differences in desert-sensitive preferences for redistribution help explain the different social contracts that prevail in both continents.
JEL Classification: D31, D63, D64, D72
Keywords: altruism, voting, redistribution, desert, responsibility, compensation.

2008/54 Budget deficits and inflation feedback
Sergei PEKARSKI

This paper contributes to the literature on budget deficits and inflation in high inflation economies. The main finding is that recurrent outbursts of extreme inflation in these economies can be explained by a certain hysteresis effect associated with public finance. This interpretation meets the evidence that dramatic shifts between regimes of moderately high and extremely high (hyper-) inflation often occur without visible deterioration in public finance or abrupt shifts in fiscal or monetary policies. The existence of this hysteresis effect is explicitly explained by the action of two mechanisms: the arithmetic

associated with the wrong side of the inflation tax Laffer curve and the Patinkin effect (the reverse of the much oftener cited Olivera-Tanzi effect). It is also shown that the division of the operational budget deficit into the part that is subject to negative inflation feedback and the part that is inflation-proof, has implications for both the discussion of the inflationary consequences of budget deficits and the proper design of stabilization policy.

JEL Classification: E41, E52, E61, E63
Keywords: budget deficit, high inflation, the Patinkin effect.

2008/55 Towards an understanding of tradeoffs between regional wealth, tightness of a common environmental constraint and the sharing rules

Raouf BOUCEKKINE, Jacek B. KRAWCZYK and Thomas VALLEE

Consider a country with two regions that have developed differently so that their current levels of energy efficiency differ. Each region's production involves the emission of pollutants, on which a regulator might impose restrictions. The restrictions can be related to pollution standards that the regulator perceives as binding the whole country (e.g., enforced by international agreements like the Kyoto Protocol). We observe that the pollution standards define a common constraint upon the *joint* strategy space of the regions. We propose a game theoretic model with a coupled constraints equilibrium as a solution to the regulator's problem of avoiding excessive pollution. The regulator can direct the regions to implement the solution by using a political pressure, or compel them to employ it by using the coupled constraints' Lagrange multipliers as taxation coefficients. We specify a stylised model that possesses those characteristics, of the Belgian regions of Flanders and Wallonia. We analytically and numerically analyse the equilibrium regional production levels as a function of the pollution standards and of the sharing rules for the satisfaction of the constraint. For the computational results, we use NIRA, which is a piece of software designed to min-maximise the associated Nikaido-Isoda function.

JEL Classification: C6, C7, D7
Keywords: coupled constraints, generalised Nash equilibrium, Nikaido-Isoda function, regional economics, environmental regulations.

2008/56 A note on the split rank of intersection cuts

Santanu S. DEY

In this note, we present a simple geometric argument to determine a lower bound on the split rank of intersection cuts. As a first step of this argument, a polyhedral subset of the lattice-free convex set that is used to generate the intersection cut is constructed. We call this subset the *restricted lattice-free set*. It is then shown that $\lceil \log_2(l) \rceil$ is a lower bound on the split rank of the intersection cut, where l is the number of integer points lying on the boundary of the restricted lattice-free set satisfying the condition that no two points lie on the same facet of the restricted lattice-free set. The use of this result is illustrated to obtain a lower bound of $\lceil \log_2(n+1) \rceil$ on the split rank of n-row mixing inequalities.

Keywords: mixed integer programming, split rank, intersection cuts.

2008/57 Primal-dual interior-point methods with asymmetric barriers

Yu. NESTEROV

In this paper we develop several polynomial-time interior-point methods (IPM) for solving nonlinear primal-dual conic optimization problem. We assume that the barriers for the primal and the dual cone are not conjugate. This broken symmetry does not allow to apply the standard primal-dual IPM. However, we show that in this situation it is also possible to develop very efficient optimization methods, which satisfy all desired qualities, including the infeasible-start features. Our technique is based on asymmetric primal-dual barrier augmented by squared residual of the primal-dual linear system.
Keywords: conic optimization, self-concordant barriers, polynomial-time methods, interior-point methods, path-following methods, potential-reduction methods, infeasible start.

2008/58 Should we subsidize longevity?
Marie-Louise LEROUX, Pierre PESTIEAU and Grégory PONTHIERE

This paper studies the design of the optimal non linear taxation in an economy where longevity varies across agents, and depends on three factors: longevity genes, health investment and farsightedness. Provided earnings, farsightedness and genes are correlated, governmental intervention can be justified on two grounds: correction for a lack of farsightedness and redistribution across both earnings and genetic dimensions. Whether longevity-enhancing spending should be subsidized or taxed is shown to depend on the combined effects of myopia, self-selection and free-riding on the annuity returns. Our policy conclusions depend also on how productivity and genes are correlated, on the complementarity of genes and efforts in the survival function, and on how the government weights the welfare of heterogeneous agents. All in all, it might be desirable to tax longevity-enhancing spending.
JEL Classification: H21, I10
Keywords: optimal taxation, longevity, genetic background, heterogeneity, myopia.

2008/59 The role of Skorokhod space in the development of the econometric analysis of time series
J. Roderick McCRORIE

This paper discusses the fundamental role played by Skorokhod space, through its underpinning of functional central limit theory, in the development of the paradigm of unit roots and co-integration. This paradigm has fundamentally affected the way economists approach economic time series as was recognized by the award of the Nobel Memorial Prize in Economic Sciences to Robert F. Engle and Clive W.J. Granger in 2003. Here, we focus on how P.C.B. Phillips and others used the Skorokhod topology to establish a limiting distribution theory that underpinned and facilitated the development of methods of estimation and testing of single equations and systems of equations with possibly integrated regressors. This approach has spawned a large body of work that can be traced back to Skorokhod's conception of fifty years ago. Much of this work is surprisingly confined to the econometrics literature.
AMS subject classification: 60F7, 60G50, 60J15, 60J55, 60J65, 62M10, 62P20
Keywords: Skorokhod space, functional central limit theorems, non-stationary time

series, unit roots and co-integration, Wiener functionals, econometrics.

2008/60 Barrier subgradient method
Yu. NESTEROV

In this paper we develop a new primal-dual subgradient method for nonsmooth convex optimization problems. This scheme is based on a self-concordant barrier for the basic feasible set. It is suitable for finding approximate solutions with certain *relative accuracy*. We discuss some applications of this technique including fractional covering problem, maximal concurrent flow problem, semidefinite relaxations and nonlinear online optimization.
Keywords: convex optimization, subgradient methods, non-smooth optimization, minimax problems, saddle points, variational inequalities, stochastic optimization, black-box methods, lower complexity bounds.

2008/61 The impact of the unilateral EU commitment on the stability of international climate agreements
Thierry BRECHET, Johan EYCKMANS, François GERARD, Philippe MARBAIX, Henry TULKENS and Jean-Pascal VAN YPERSELE

In this paper we analyze the negotiation strategy of the European Union regarding the formation of an international climate agreement for the post-2012 era. We use game theoretical stability concepts to explore incentives for key players in the climate policy game to join future climate agreements. We compare a minus 20 percent unilateral commitment strategy by the EU with a unilateral minus 30 percent emission reduction strategy for all Annex-B countries. Using a numerical integrated assessment climate-economy simulation model, we find that carbon leakage effects are negligible. The EU strategy to reduce emissions by 30% (compared to 1990 levels) by 2020 if other Annex-B countries follow does not induce participation of the USA with a similar 30% reduction commitment. However, the model shows that an appropriate initial allocation of emission allowances may stabilize a larger and more ambitious climate coalition than the Kyoto Protocol in its first commitment period.
JEL Classification: C6, C7, H4, Q5
Keywords: climate change, coalition theory, integrated assessment model, Kyoto protocol.

2008/62 Average power contracts can mitigate carbon leakage
Giorgia OGGIONI and Yves SMEERS

The progressive relocation of part of the Energy Intensive Industries (EIIs) out of Europe is one of the possible consequences of the combination of emission charges and higher electricity prices entailed by the EU-Emission Trading Scheme (EU-ETS). In order to mitigate this effect, EIIs have asked for special power contracts whereby they would be supplied from dedicated power capacities at average (capacity, fuel, transmission and emission allowance) costs. We model this situation on a prototype power system calibrated on four countries of Central Western Europe. In order to capture the main feature of EIIs' demand, we separate the consumer market in two segments: EIIs and the

rest. EIIs buy electricity at average cost price while the rest pays marginal cost. We consider two different types of EIIs' contractual arrangements: a single region wide and zonal average cost prices. We also analyze the cases where generators only rely on existing capacities or can invest in new ones. We find that these average cost contracts can indeed partially mitigate the incentive to relocate activities but with quite diverse regional impacts depending on different national power policies. Models are formulated as a non-monotone complementarity problems with endogenous energy, transmission and allowance prices and are implemented in GAMS.
Keywords: average cost based contracts, carbon leakage, complementarity conditions, EU-ETS.

2008/63 A tight bound on the throughput of queueing networks with blocking
Jean-Sébastien TANCREZ, Philippe CHEVALIER and Pierre SEMAL

In this paper, we present a bounding methodology that allows to compute a tight lower bound on the cycle time of fork--join queueing networks with blocking and with general service time distributions. The methodology relies on two ideas. First, probability masses fitting (PMF) discretizes the service time distributions so that the evolution of the modified network can be modelled by a Markov chain. The PMF discretization is simple: the probability masses on regular intervals are computed and aggregated on a single value in the corresponding interval. Second, we take advantage of the concept of critical path, i.e. the sequence of jobs that covers a sample run. We show that the critical path can be computed with the discretized distributions and that the same sequence of jobs offers a lower bound on the original cycle time. The tightness of the bound is shown on computational experiments. Finally, we discuss the extension to split--and--merge networks and approximate estimations of the cycle time.
Keywords: queueing networks, blocking, throughput, bound, probability masses fitting, critical path.

2008/64 Nonnegative factorization and the maximum edge biclique problem
Nicolas GILLIS and François GLINEUR

Nonnegative Matrix Factorization (NMF) is a data analysis technique which allows compression and interpretation of nonnegative data. NMF became widely studied after the publication of the seminal paper by Lee and Seung (Learning the Parts of Objects by Nonnegative Matrix Factorization, Nature, 1999, vol. 401, pp. 788--791), which introduced an algorithm based on Multiplicative Updates (MU). More recently, another class of methods called Hierarchical Alternating Least Squares (HALS) was introduced that seems to be much more efficient in practice.

In this paper, we consider the problem of approximating a not necessarily nonnegative matrix with the product of two nonnegative matrices, which we refer to as Nonnegative Factorization~(NF)~; this is the subproblem that HALS methods implicitly try to solve at each iteration. We prove that NF is NP-hard for any fixed factorization rank, using a reduction to the maximum edge biclique problem.

We also generalize the multiplicative updates to NF, which allows us to shed some light on the differences between the MU and HALS algorithms for NMF and give an explanation for the better performance of HALS. Finally, we link stationary points of NF with feasible solutions of the biclique problem to obtain a new type of biclique finding

algorithm (based on MU) whose iterations have an algorithmic complexity proportional to the number of edges in the graph, and show that it performs better than comparable existing methods.
Keywords: nonnegative matrix factorization, nonnegative factorization, complexity, multiplicative updates, hierarchical alternating least squares, maximum edge biclique.

2008/65 Generalized time-invariant overtaking
Geir B. ASHEIM, Claude D'ASPREMONT and Kuntal BANERJEE

We present a new version of the overtaking criterion, which we call *generalized time-invariant overtaking*. The generalized time-invariant overtaking criterion (on the space of infinite utility streams) is defined by extending proliferating sequences of complete and transitive binary relations defined on finite dimensional spaces. The paper presents a general approach that can be specialized to at least two, extensively researched examples, the utilitarian and the leximin orderings on a finite dimensional Euclidean space.
JEL Classification: D63, D71
Keywords: intergenerational justice, utilitarianism, leximin.

2008/66 Contractually stable networks
Jean-François GAUTIER, Ana MAULEON and Vincent VANNETELBOSCH

We develop a theoretical framework that allows us to study which bilateral links and coalition structures are going to emerge at equilibrium. We define the notion of *coalitional network* to represent a network and a coalition structure, where the network specifies the nature of the relationship each individual has with his coalition members and with individuals outside his coalition. To predict the coalitional networks that are going to emerge at equilibrium we propose the concept of contractual stability which requires that any change made to the coalitional network needs the consent of both the deviating players and their original coalition partners. We show that there always exists a contractually stable coalitional network under the simple majority decision rule and the component-wise egalitarian or majoritarian allocation rules. Moreover, requiring the consent of group members may help to reconcile stability and efficiency.
JEL Classification: A14, C70
Keywords: networks, coalition structures, contractual stability, allocation rules.

2008/67 On Gale and Shapley 'College Admissions and Stability of Marriage'
Jean J. GABSZEWICZ, Filomena GARCIA, Joana PAIS and Joana RESENDE

In this note, we start to claim that established marriages can be heavily destabilized when the population of existing couples is enriched by the arrival of new candidates to marriage. Afterwards, we discuss briefly how stability concepts can be extended to account for entry and exit phenomena affecting the composition of the marriage market.
JEL Classification: C78, D00
Keywords: matching, stability, marriage model, divorce cascades.

2008/68 Contract renewal as an incentive device. An application to the French urban public

transport sector
Axel GAUTIER and Anne YVRANDE-BILLON

In the French urban public transport industry, services are often delegated to a private firm by the mean of a fixed-term regulatory contract. This contract specifies the duties of the firm and a financial compensation. When it expires, a new contract is awarded, possibly to a different operator. Cost-plus and fixed-price (gross cost or net cost) contracts are commonly used to regulate the operators in the transport industry. In this paper, we analyse the incentives for the operator to reduce its cost. These incentives come from both the profit maximization during the current contract and the perspective of contract renewal. In our model, the amount of cost-reducing effort depends on the contract type and the time remaining till contract expiration. We use a sample of 124 French urban public transport networks covering the period 1995-2002 to test our predictions. Our proxy for the cost reducing effort is technical efficiency. The data largely confirm the importance of contract type on performances and the incentive effect of contract renewal.
JEL Classification: L33, L51, L92
Keywords: incentive regulation, urban transport, stochastic frontier analysis.

2008/69 Discrete-continuous analysis of optimal equipment replacement
Yuri YATSENKO and Natali HRITONENKO

In Operations Research, the equipment replacement process is usually modeled in discrete time. The optimal replacement strategies are found from discrete (or integer) programming problems, well known for their analytic and computational complexity. An alternative approach is represented by continuous-time vintage capital models that explicitly involve the equipment lifetime and are described by nonlinear integral equations. Then the optimal replacement is determined via the optimal control of such equations. These two alternative techniques describe essentially the same controlled dynamic process. We introduce and analyze a model that unites both approaches. The obtained results allow us to explore such important effects in optimal asset replacement as the transition and long-term dynamics, clustering and splitting of replaced assets, and the impact of improving technology and discounting. In particular, we demonstrate that the cluster splitting is possible in our replacement model with given demand in the case of an increasing asset lifetime. Theoretical findings are illustrated with numeric examples.
JEL Classification: E20, O40, C60
Keywords: vintage capital models, optimization, equipment lifetime, discrete-continuous models.

2008/70 Generalized power method for sparse principal component analysis
Michel JOURNÉE, Yurii NESTEROV, Peter RICHTÁRIK and Rodolphe SEPULCHRE

In this paper we develop a new approach to sparse principal component analysis (sparse PCA). We propose two single-unit and two block optimization formulations of the sparse PCA problem, aimed at extracting a single sparse dominant principal component of a data matrix, or more components at once, respectively. While the initial formulations involve nonconvex functions, and are therefore computationally intractable, we rewrite them into

the form of an optimization program involving maximization of a convex function on a compact set. The dimension of the search space is decreased enormously if the data matrix has many more columns (variables) than rows. We then propose and analyze a simple gradient method suited for the task. It appears that our algorithm has best convergence properties in the case when either the objective function or the feasible set are strongly convex, which is the case with our single-unit formulations and can be enforced in the block case. Finally, we demonstrate numerically on a set of random and gene expression test problems that our approach outperforms existing algorithms both in quality of the obtained solution and in computational speed.
Keywords: sparse PCA, power method, gradient ascent, strongly convex sets, block algorithms.

2008/71 Firm's location under taste and demand heterogeneity
Toshihiro OKUBO and Pierre M. PICARD

In this paper we build a quality-augmented version of an economic geography model where consumers have heterogenous tastes for a set of manufacturing varieties. We discuss a footloose capital model and a footloose entrepreneur model. We show that firms selling the goods with higher values select the region hosting the largest number of consumers. Larger countries thus get better access to the higher quality products. We also show that the effect of spatial selection on firms' spatial distribution crucially depends on the properties of the taste distribution across varieties. Finally, we show that taste heterogeneity smooths the agglomeration patterns but that it should be considered neither as a dispersion force nor as an agglomeration force. Indeed, the introduction of taste heterogeneity makes an initially dispersed economy less dispersed and an initially agglomerated economy less agglomerated.
JEL Classification: F12, F15, R11, R12
Keywords: heterogeneous taste and quality, spatial selection, economic geography, agglomeration, home market effect.

2008/72 Style rotation and performance persistence of mutual funds
Iwan MEIER and Jeroen V.K. ROMBOUTS

Most academic studies on performance persistence in monthly mutual fund returns do not find evidence for timing skills of fund managers. Furthermore, realized returns are undoubtedly driven by the investment style of a fund. We propose a new holdings-based measure of style rotation to investigate the relation between performance persistence and changes in style. For a large sample of U.S. domestic equity mutual funds we find that top and bottom performing decile portfolios, sorted on past one-year returns and risk-adjusted excess performance from a 4-factor model, are subject to a higher degree of style rotation than middle deciles. Style inconsistent funds with high values for the style rotation measure in turn exhibit less persistence in decile rankings over subsequent years than style consistent funds. Hence, it is important for delegated portfolio management to consider style rotation when selecting managers based on past performance.
JEL Classification: G11, G20
Keywords: mutual fund, performance persistence, style rotation.

2008/73 Estimating autocorrelations in the presence of deterministic trends
Shin-Huei WANG and Christian M. HAFNER

This paper considers the impact of ordinary least squares (OLS) detrending and the first difference (FD) detrending on autocorrelation estimation in the presence of long memory and deterministic trends. We show that the FD detrending results in inconsistent autocorrelation estimates when the error term is stationary. Thus, the FD detrending should not be employed for autocorrelation estimation of the detrended series when constructing e.g. portmanteau-type tests. In an empirical application of volume in Dow Jones stocks, we show that for some stocks, OLS and FD detrending result in substantial differences in ACF estimates.
JEL Classification: C22
Keywords: autocorrelations, OLS, first difference detrending, long memory.

2008/74 Technological breakthroughs and asset replacement
Yuri YATSENKO and Natali HRITONENKO

The authors analyze the optimal replacement of assets under continuous and discontinuous technological change. They investigate the variable lifetime of assets in an infinite-horizon replacement problem. Due to deterioration, the maintenance cost increases when the asset becomes older. Because of technological change, both maintenance and new capital costs decrease for a fixed asset age. The dynamics of the optimal lifetime is investigated analytically and numerically under technological change in the cases of one and several technological breakthroughs. It is shown that the breakthroughs cause irregularities (anticipation echoes) in the asset lifetime before the breakthrough time.
JEL Classification: C61, L23, O14, O33
Keywords: asset replacement, technological change, optimal lifetime, anticipation echoes.

2008/75 The taxation of capital returns in overlapping generations economies without financial assets
Julio DÁVILA

I show in this paper that in an overlapping generations economy with production à la Diamond (1970) in which the agents can only save in terms of capital (i.e. with no asset bubbles à la Tirole (1985) or public debt as in Diamond (1965)), there is a period-by-period balanced fiscal policy supporting a steady state allocation that Pareto-improves upon the laissez-faire competitive equilibrium steady state (without having to resort to intergenerational transfers) if there is no first generation or the economy starts there. A transition from the competitive equilibrium steady state to this other allocation is also Pareto-improving if the former is dynamically inefficient, but even in the dynamically efficient case if the elasticity of output to capital is high enough. This intervention allows every subsequent generation to attain, as a competitive equilibrium outcome, the highest utility attainable at a steady state through the existing markets for the consumption good and the production factors. The active fiscal policy consists of taxing (or subsidizing, in the dynamically efficient case) linearly the returns to capital, while balancing the budget

period by period through a lump-sum transfer (or tax, respectively) on second period income. This policy does not finance any public spending, since there is none in the model. The only purpose of the intervention is to decentralize as a competitive equilibrium the steady state allocation that maximizes the utility of the representative agent among all steady state allocations attainable through the existing markets.
JEL Classification: E62, E21, E22, H21
Keywords: taxation of capital, overlapping generations.

2008/76 Equilibrium models for the carbon leakage problem
Giorgia OGGIONI and Yves SMEERS

Carbon leakage in this pape ris the phenomenon whereby Electricity Intensive Industries subject to harsh environmental standards move their activity or part of it to more environmentally lenient regions. Carbon leakage has been mentioned as a possible outcome of the EU Emission Trading Scheme. Different studies are underway to assess the reality of the phenomenon and to devise policies to mitigate its possible impact. One remedy, proposed by the Energy Intensive Industries is to combine free emission allowances with a pricing of electricity whereby energy émissions and transmission costs are bundled and sold on an average cost basis. The paper attempts to model this proposal.

We cast the problem in a spatial model of the power sector where generators can develop new capacities, the transmission system is organized on a flowgate basis, emission allowances are auctioned, except possibly for industries, and traded. The consumer market is decomposed in two segments. Industries purchase electricity according to some form of average cost price, the rest of the market is supplied at marginal cost. These equilibrium models are non convex. We present the models and discuss their properties. Companion papers report policy implications.
JEL Classification: C61, L23, O14, O33
Keywords: carbon leakage, emission trading scheme, electricity, energy policies, equilibrum, complementarity.

2008/77 Intergenerational equity and the discount rate for cost-benefit analysis
Jean-François MERTENS and Anna RUBINCHIK

For two independent principles of intergenerational equity, the implied discount rate equals the growth rate of real per-capita income, say 2%, thus falling right into the range suggested by the U.S. Office of Management and Budget. To prove this, we develop a simple tool to evaluate small policy changes affecting several generations, by reducing the dynamic problem to a static one. A necessary condition is time-invariance, which is satisfied by any common solution concept in an overlapping generations model with exogenous growth. This tool is applied to derive the discount rate for cost-benefit analysis under two different utilitarian welfare functions: classical and relative. It is only with relative utilitarianism that the discount rate is well-defined for a heterogeneous society, is corroborated by an independent principle equating values of human lives, and equals the growth rate of real per-capita income.
JEL Classification: D31, D61, D63, E60, H43
Keywords: social welfare function, social welfare functional, overlapping generations, exogenous growth, policy reform, intergenerational equity, intergenerational fairness, cost-benefit analysis, discount rate, social discount rate, utilitarianism, relative utilitarianism, welfarism.

2008/78 Does public housing occupancy increase unemployment?
Claire DUJARDIN AND Florence GOFFETTE-NAGOT

In order to test for the effect of public housing occupancy on unemployment, we estimate a simultaneous probit model of unemployment and public housing. On a first sample, we instrument public housing with the gender composition of children. On a second sample, the instrument is the share of public housing at the city level. We also perform a robustness check that consists in measuring the correlation between unobservables that could explain the effect of public housing on unemployment. As the corresponding level of correlation is low, this check reinforces our result of no effect of public housing on unemployment.
JEL Classification: R2, J64
Keywords: public housing, unemployment, simultaneous probit models, instrumental variables.

2008/79 Financial constraints in China: firm-level evidence
Sandra PONCET, Walter STEINGRESS and Hylke VANDENBUSSCHE

This paper uses a unique micro-level data-set on Chinese firms to test for the existence of a "political-pecking order" in the allocation of credit. Our findings are threefold. Firstly, private Chinese firms are credit constrained while State-owned firms and foreign-owned firms in China are not; Secondly, the geographical and sectoral presence of foreign capital alleviates credit constraints faced by private Chinese firms. Thirdly, geographical and sectoral presence of state firms aggravates financial constraints for private Chinese firms (“crowding out”). Therefore it seems that ongoing restructuring of the state-owned sector and further liberalization of foreign capital inflows in China can help to circumvent financial constraints and can boost the investment of private firms.
JEL Classification: E22, G32
Keywords: investment-cashflow sensitivity, China, firm level data, foreign direct investment.

2008/80 Public goods' attractiveness and migrations
Jean J. GABSZEWICZ, Salome GVETADZE, Didier LAUSSEL and Patrice PIERETTI

The aim of this paper is to develop a dynamic model of migrations, in which migration is driven by size asymmetries between countries and by the relative preferences of consumers between private consumption and consumption of public goods. The dynamic tra jectories heavily depend on the degree of attractiveness for public goods We show that monotone migrations require sufficiently strong preferences for public goods, and can only be sustained from the small to the large countries. We identify the threshold value of the public goods’ intensity of preferences guaranteeing the survival of the small country. For weaker preference intensities, oscillating migrations may arise, but they finally converge to situation where both countries are of equal size.
JEL Classification: H
Keywords: migration, public goods, income tax.

2008/81 Are your firm's taxes set in Warsaw? Spatial tax competition in Europe
Karen CRABBE and Hylke VANDENBUSSCHE

Tax competition within the EU is fiercer than in the rest of the OECD with tax rates falling rapidly. This paper analyzes tax responses of EU-15 countries to corporate tax changes in the EU-10 new member states as a function of their proximity to these new member states. The average corporate tax rate in the new member states has always been considerably lower than the average in the EU-15 countries. Their entry into the EU eliminated capital barriers, allowing firms to locate in one of the new EU-10 with full access to the European Market. Our results indicate that EU-15 countries geographically closer to the new member states respond stronger to corporate tax changes in these new member states. We use a theoretical and a spatial regression framework to test the hypothesis that distance to a low tax region intensifies countries' tax reaction functions.
JEL Classification: H25, H77, H39
Keywords: spatial tax competition, corporate taxes, fiscal reaction function.

2008/82 How stochasticity and emergencies disrupt the surgical schedule
Jean-Sébastien TANCREZ, Benoît ROLAND, Jean-Philippe CORDIER and Fouad RIANE

In health care system, the operating theatre is recognized as having an important role, notably in terms of generated income and cost. Its management, and in particular its scheduling, is thus a critical activity, and has been the sub ject of many studies. However, the stochasticity of the operating theatre environment is rarely considered while it has considerable effect on the actual working of a surgical unit. In practice, the planners keep a safety margin, let's say 15% of the capacity, in order to absorb the effect of unpredictable events. However, this safety margin is most often chosen sub jectively, from experience. In this paper, our goal is to rationalize this process. We want to give insights to managers in order to deal with the stochasticity of their environment, at a tactical–strategic decision level. For this, we propose an analytical approach that takes account of the stochastic operating times as well as the disruptions caused by emergency arrivals. From our model, various performance measures can be computed: the emergency disruption rate, the waiting time for an emergency, the distribution of the working time, the probability of overtime, the average overtime, etc. In particular, our tool is able to tell how many operations can be scheduled per day in order to keep the overtime limited.
Keywords: health care, surgical schedule, emergencies, Markov chain.

2008/83 Approximate level method
Peter RICHTARIK

In this paper we propose and analyze a variant of the *level method* [4], which is an algorithm for minimizing nonsmooth convex functions. The main work per iteration is spent on 1) minimizing a piecewise-linear model of the objective function and on 2) projecting onto the intersection of the feasible region and a polyhedron arising as a level set of the model. We show that by replacing exact computations in both cases by *approximate computations*, in *relative scale*, the theoretical iteration complexity increases

only by the factor of four. This means that while spending less work on the subproblems, we are able to retain the good theoretical properties of the level method.
Keywords: level method, approximate projections in relative scale, nonsmooth convex optimization, sensitivity analysis, large-scale optimization.

2008/84 Characterizations of Pareto-efficient, fair, and strategy-proof allocation rules in queueing problems
Cagatay KANI and Eve RAMAEKERS

A set of agents with possibly different waiting costs have to receive the same service one after the other. Efficiency requires to maximize total welfare. Equity requires to at least treat equal agents equally. One must form a queue, set up monetary transfers to compensate agents having to wait, and not a priori arbitrarily exclude agents from positions. As one may not know agents' waiting costs, they may have no incentive to reveal them. We identify the only rule satisfying Pareto-efficiency, a weak equity axiom as equal treatment of equals in welfare or symmetry, and strategy-proofness. It satisfies stronger axioms, as no-envy and anonymity. Further, its desirability extends to related problems. To obtain these results, we prove that even non-single-valued rules satisfy Pareto-efficiency of queues and strategy-proofness if and only if they select Pareto-efficient queues and set transfers in the spirit of Groves (1973). This holds in other problems, provided the domain of quasi-linear preferences is rich enough.
JEL Classification: D63, C72
Keywords: queueing problems, efficiency, fairness, strategy-proofness..