10th Viennese Workshop on Optimal Control, Dynamic Games and Nonlinear Dynamical Systems

(Retirement of Gustav Feichtinger)

Preliminary Program

Thursday, May 8, 2008

Location: TU, 1040 Vienna, Gußhausstraße 25-29, Contact Room, 6th floor

9:15 **Opening by D. Dorninger, Dean of the Faculty of Mathematics & Geoinformation**

9:30 – 11:00 **G. Leitmann:** An Equivalent Problem Approach to Optimization

J.P. Caulkins: How the Mix of Drug Control Strategies Should Vary Over a Drug Epidemic

11:00 – 11:30 **Break**

11:30 – 12:15 **G. Sorger:** Heterogeneous Time-Preference and the Long-Run Distribution of Wealth: Attempts to Address the Ramsey Conjecture

12:15 – 13:45 **Lunch**

13:45 – 15:15 **H. Dawid:** Innovation Strategies in Oligopolistic Markets

G. Zaccour: Time Consistency in Cooperative Differential Games: A Tutorial

15:15 – 15:45 **Break**

15:45 – 16:30 **R.F. Hartl/P.M. Kort**: Innovation and Capital Accumulation

17:00 **Reception by the Rector of the Vienna University of Technology**
Location: TU, 1040 Vienna, Karlsplatz 13, Festsaal, 1th floor

Friday, May 9, 2008

Location: TU, 1040 Vienna, Resselgasse 5, Library, 5th floor

10:30 – 11:15 **F.O.O. Wagener:** The Fruits of the First CeNDEF Decade

11:15 – 11:45 **Break**

11:45 – 12:30 **E.J. Dockner:** Equilibrium Investment and Risk Dynamics in Oligopolistic Industries

12:30 – 13:45 **Lunch**

-- End of the meeting --

Jonathan P. Caulkins

How the Mix of Drug Control Strategies Should Vary Over a Drug Epidemic

How the Mix of Drug Control Strategies Should Vary Over A Drug Epidemic Drug problems plague countries around the world, so there has long been interest in understanding the relative cost-effectiveness of different control strategies (treatment vs. prevention vs. enforcement etc.). Complicating matters, drug problems vary dramatically over time, often following an "epidemic" cycle, so the effectiveness of various interventions likewise varies over time. Hence, the fundamental resource allocation problem in drug control (how much to spend on each intervention) is a dynamic optimization problem with state constraints reflecting the epidemic dynamics. This talk reviews how dynamic optimization has affected thinking about drug control policy, a domain that has not otherwise been particularly sophisticated or quantitative in its decision making.

Bio: Jonathan P. Caulkins is Professor of Operations Research and Public Policy at Carnegie Mellon University's Heinz School of Public Policy. Dr. Caulkins specializes in mathematical modeling and systems analysis of social policy problems. He is a past co-director of RAND's Drug Policy Research Center (1994 - 1996) and founding Director of RAND's Pittsburgh office (1999 – 2001). He has done seminal work on systems analysis of issues pertaining to drugs, crime, and violence. Dr. Caulkins also publishes on airline operations, sulfur dioxide pollution trading markets, internet-based advertising, flexible manufacturing systems, and personnel performance evaluation, among other topics.

Dr. Caulkins received a B.S., and M.S. in Systems Science from Washington University, an S.M. in Electrical Engineering and Computer Science and Ph.D., in Operations Research both from M.I.T.

Herbert Dawid

Innovation Strategies in Oligopolistic Markets

This talk addresses the optimal design of innovation strategies in the presence of dynamic effects and (strategic) market interaction. First a short review of the existing literature on innovation incentives in oligopolies, which is mainly based on static models, is given. In the main part of the talk several own papers on this topic with a dynamic focus are discussed, where two main themes are disintuished. On the one hand, in a series of studies multi-stage game models are used to analyze the question what kind of strategic interactions arise in an oligopolistic market if it is explicitly taken into account that innovation projects typically are multi-stage projects and might be terminated mid-stream. Hence, competitors may react to the initiation of an innovation project and thereby influence the later decisions about completion or termination of the project. On the other hand, the interplay of several key parameters of innovation strategies, like the desired level of product diversification or the selection of market regions to be targeted, are examined in dynamic models of industry evolution. A main question in this respect is for which aspects of the innovation strategies it is profitable for the individual firm to deviate from the characteristics of its competitors. Implications for evolving long-run properties of the industry and for welfare are discussed.

Engelbert Dockner

Equilibrium Investment and Risk Dynamics in Oligopolistic Industries
We formulate an industry model in which two firms strategically compete in a duopolistic product market. Firms produce a homogenous product and face stochastic industry demand. Demand is specified either as being linear or iso-elastic. Each firm has two options to expand capacity, and hence output. In this setup we analyze the risk characteristics of this industry and explore the role of industry demand on asset prices dynamics for the two firms. We focus on sequential exercise of options. We find that strategic competition in the product market is risk reducing, irrespective of the demand function. This is the consequence of a simple hedging argument. Moreover, we find that own firm and rival firm characteristics have opposite risk implications.

Richard F. Hartl and Peter Kort

Innovation and Capital Accumulation
Innovation led to the extraordinary productivity gains seen in the 1990's. In current business practice it is felt that the heat is on and that firms must innovate faster just to stand still. Therefore, technological progress is a crucial input for firms in taking their investment decisions. This talk reviews some recent developments regarding dynamic modeling of investment and innovation. Among other things, we will show how disruptive innovations lead to Skiba curves and why the development of multi-stage modeling methods can be crucial for understanding the optimal timing of technology adoption. Concerning the latter topic, an important research aim is to establish the length of the time interval a firm produces using a particular technology.

George Leitmann

An Equivalent Problem Approach to Optimization
Classical sufficiency conditions for absolute extrema are derived by employing an equivalent problem approach based on a coordinate transformation. To illustrate the method only the simplest problem of the Calculus of Variations will be considered. However, various classes of optimal control and dynamic games applications will also be addressed. This approach allows for simple, direct and succinct proofs leading to constructive sufficiency conditions. Indeed, no proof exceeds on page in length and most are but a few sentences long.

Gerhard Sorger

Heterogeneous time-preference and the long-run distribution of wealth: Attempts to address the Ramsey conjecture

Frank P. Ramsey's "Mathematical Theory of Saving", published in 1928, describes the fundamental tradeoff between consumption and saving that is at the core of many intertemporal economic decision problems. Ramsey recognized in particular that in a population that is heterogeneous with respect to time-preference, a degenerate distribution of wealth emerges over time that features "a division of society into two classes, the thrifty enjoying bliss and the improvident at the subsistence level." During the 80 years that have passed since Ramsey's writings, various attempts have been made to modify the basic consumption/saving problem in order to bring its predictions about the long-run distribution of wealth in line with empirical observations. In this talk I will survey some of these attempts with a focus on a number of recent papers that apply methods from dynamic game theory to capture imperfect competition on capital markets.

Florian Wagener

The Fruits of the First CeNDEF Decade

The Center for Nonlinear Dynamics in Economics and Finance (CeNDEF) has been established at the University of Amsterdam in 1998. It is a interdisciplinary research environment, which under the direction of prof.dr. Cars Hommes has grown into one of the focal points of research in nonlinear economic dynamics. This research is conducted theoretically, empirically, as well as experimentally in cooperation of the CREED laboratory in experimental economics. This talk will present some of this research, mainly focussing on the theoretical contributions.

Georges Zaccour

Time Consistency in Cooperative Differential Games: A Tutorial

How a cooperative agreement made at the start of a dynamic game can be sustained over time? Early work has avoided this question by supposing that the players sign binding agreements. This assumption is hard to accept from a theoretical perspective, and a practical one as well. Conceptually, there is no reason to believe that rational players would stick to an agreement if they can achieve a better outcome by walking away of it, no matter what they have announced before. At an empirical level, it suffices to look at the number of disputes (between spouses, business partners, countries, etc.) before the courts to convince our selves that binding agreements are not so binding. Scholars in dynamic games have followed different lines of thoughts to answer the raised question. This tutorial reviews one of them, namely time consistency, a concept which has also be termed dynamic individual rationality, sustainability, dynamic stability, agreeability, or acceptability, etc.