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## Multi-Stage Modelling of Nonlinear Economic Processes



### IZA Seminar

**Place:** Schaumburg-Lippe-Str. 9, 53113 Bonn

**Date:** 07.07.2009, 12:00 - 13:30

**Presentation by** [Gustav Feichtinger](#) (Vienna University of Technology)

### Abstract:

While 'standard' optimal control theory deals with systems evolving smoothly through time, in many cases there occur discontinuities that fundamentally change the system dynamics and/or the objective of the decision maker at particular points in time. Recently, there has been a growing interest in 'multi-stage modeling' (MSM) tailored on switching between different regimes. MSM is illustrated by three different examples: Firms in recession, optimal retirement policies, and counter-terror strategies. - In parallel with the stock market turmoil, demand for fancy hotel rooms has plummeted. The New York Times spoke on 'Dim Days for Luxury Hotels Feeling the Economy's Pinch'. Facing a recession period in which the demand for conspicuous consumption goods is reduced, the sales manager is pushed for aggressive discounting. Lower prices, however, reduce brand image and thus long-term demand. If capital markets do not function, how should a firm react to a recession period of uncertain duration and intensity to avoid bankruptcy? - Moreover, we propose a multi-stage optimal control life-cycle model that focuses on both optimal health expenditure and retirement age. When the individual retires, wage payments are replaced by a pension payment over the remaining lifespan. The pension payment depends on the length of the working period and the discounted average remaining life expectancy. We derive explicit expressions for the time paths of consumption and health expenditures and an implicit one for the optimal retirement age. All of them have interesting economic interpretations. Numerically we are able to compare various scenarios. - Finally, a massive attack of a terror organization may trigger a qualitatively different phase of counter-terror operations. September 11th changed the conflict between international terrorism and possible target countries from a low-intensity 'police investigation' to essentially a war. One might ask under what circumstances it is optimal to respond to a terrorist attack very aggressively from the outset and when it is advantageous to pursue some preparatory phase. While 'water strategies' play the rules in the eyes of the general population, 'fire strategies' harming innocent parties stimulate the recruitment rates of terrorists.

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