

This PDF is a selection from a published volume from the National Bureau of Economic Research

Volume Title: Annals of Economic and Social Measurement, Volume 5, number 3

Volume Author/Editor: Sanford V. Berg, editor

Volume Publisher: NBER

ISSN: 0044-832X

Volume URL: <http://www.nber.org/books/aesm76-3>

Publication Date: July 1976

Chapter Title: Front matter, Annals of Economic and Social Measurement

Chapter Authors: NBER

Chapter URL: <http://www.nber.org/chapters/c10478>

Chapter pages in book: (0 - iv)

Annals of
**Economic and Social
Measurement**

**journal of computers, information retrieval,
and research methodology**

volume 5

number 3

summer 1976



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The *Annals of Economic and Social Measurement* is published quarterly (Winter, Spring, Summer and Fall) at 71 Winterstoke Road, Bristol, England by the National Bureau of Economic Research, 261 Madison Avenue, New York, N.Y. 10016. The *Annals* has been exempted from the rules governing submission of manuscripts to, and critical review by, the Directors of the National Bureau. Each issue, however, is reviewed and accepted for publication by the members of the Editorial Board, all of whom are affiliated with the NBER.

Communications on editorial matters should be addressed to the Managing Editor, Dr. Sanford V. Berg, Department of Economics, University of Florida, Gainesville, Florida 32601. Applications for permission to quote from this journal should be addressed to Ms. Sydney Shulman, at the publisher's address, and will be freely granted. Reproduction of articles requires written permission from the Assistant Editor and the author. Communications on subscriptions, single copy requests and claims for missing issues should be addressed to Subscription Department, *Annals of Economic and Social Measurement*, at the publisher's address.

Institutional Subscription price: \$15.00 per year; \$16.00 outside U.S.A.

Individual Subscription price: \$10.00 per year; \$11.00 outside U.S.A.

Single and back issues: \$5.00

A perforated subscription form appears opposite the back cover.

Airfreighted to and mailed in the U.S.A. by Publications Expediting, Inc., 200 Meacham Ave., Elmont, N.Y. 11003.

Second-class postage paid at Jamaica, N.Y.

Printed in Bristol, England by J. W. Arrowsmith Ltd.

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US ISSN 0044-832X

CODEN: AESMCM

CONTROL THEORY APPLICATIONS ... MICROECONOMICS AND METHODOLOGY

BY DAVID KENDRICK AND EDISON TSE

The Fourth Stochastic Control Conference was held in Cambridge, Mass. on May 21–23, 1975. The meeting was sponsored by the Conference on the Computer in Economic and Social Research of the NBER with funds provided to the NBER by the National Science Foundation.

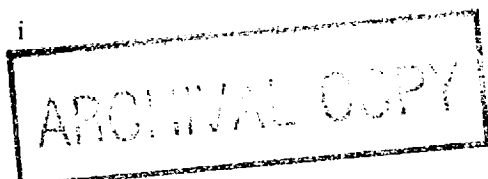
Most of the papers were submitted in response to an announcement we circulated in January 1975. The program for the conference is included as an appendix to this introductory note. Twenty-eight papers were given on applications and methods in control theory. Among the persons who contributed significantly to running the conference were Peggy Mills, of the Project on Control in Economics at the Department of Economics of the University of Texas at Austin, and Anna Tremblay, of the NBER in Cambridge. Also Gregory Chow and Mike Athans who had been the originators of these conferences, and who had run the first three, were very helpful to us in providing guidance on this conference.

This volume and the one preceding it, contains about half the papers which were presented at the conference. The articles are grouped under the topics of: macroeconomics, microeconomics, and methodology, and the individual articles are on deterministic, stochastic, adaptive, and decentralization and conflict models and on estimation.

Two papers on microeconomics are included in this issue, those on stochastic models of price adjustment by Steven Barta and Pravin Varaiya, and on the arms race by Dragoslav Siljak. The paper by Barta and Varaiya discusses the adjustment process of each individual economic agent in disequilibrium using the recursive stochastic approximation models. In particular the authors discuss several price adjustment models for firms. Under certain conditions, it is proved that each firm will reach its equilibrium price. The model does not concentrate on the optimality of each individual but builds in it the interaction of the price adjustment processes of all the firms in the market.

The paper by Siljak treats the problem of arms race. The model assumed is nonlinear. Several reasonable conditions are imposed on the system which are equivalent, in the mathematical sense, to gross substitution and "positive" homogeneity of degree zero in the general competitive analysis. Under these conditions, Siljak shows positivity and stability of the armament equilibrium. He also employed stability theory to show connective stability under structural perturbations.

The volume includes five papers on methodology: one on stochastic control, two on adaptive control, and two on estimation. The stochastic control paper by Gregory Chow is on the development of a method of doing stochastic control with a nonlinear model. This is followed by Fred Norman's paper which discusses a first



order variant of the Tse and Bar-Shalom algorithm for dual control. Fred finds that this first order algorithm performs better on some problems than the second order method. Yaakov Bar-Shalom and Edison Tse report on a comparison of several dual control algorithms including those of Elizabeth Chase MacRae and Gregory Chow as well as their own. They discovered that there is not a clear ranking of the algorithms when Monte Carlo runs are performed on a small problem solved earlier by MacRae.

John Taylor reports on methods of efficient parameter estimation in control problems and Arnold Faden and Gordon Rausser discuss a post-Bayesian approach to econometric model construction.

Below is a list of authors and papers included in the preceding issue on Control Theory Applications.

Macroeconomics:

David A. Kendrick: "Applications of Control Theory to Macroeconomics"
Roger Craine, Arthur Havenner and Peter Tinsley: "Optimal Macroeconomics Control Policies"

B. A. Oudet: "Use of the Linear Quadratic Approach to Study the Dynamic Policy Responses of a Nonlinear Model of the French Economy"

Peter Walsh and J. B. Cruz, Jr.: "Neighboring Stochastic Control of an Econometric Model"

Benjamin Friedman: Comment, "A Note on Uncertainties in Control Applications"

Franklin R. Shupp: "Uncertainty and Optimal Policy Intensity in Fiscal and Income Policies"

Robert S. Pindyck: "The Cost of Conflicting Objectives in Policy Formulation"

Finn Kydland: "Decentralized Stabilization Policies: Optimization and the Assignment Problem"

APPENDIX

PROGRAM OF STOCHASTIC CONTROL
CONFERENCE

Sponsored by
NBER Conference on the Computer in Economic and Social Research

Cambridge, Mass., May 21–23, 1975

Wednesday, May 21

2:00–3:30 Macroeconomics I

Chairman: Ray C. Fair (Yale)

1. Roger Craine, Arthur Havenner and Peter Tinsley (FRB) "An Open-Loop Optimal Control Algorithm for Large Nonlinear Models"
2. Carl J. Palash (FRB, N.Y.) "Preliminary Results in Stabilization Policy Using Optimal Control Procedures with the MPS Model"
3. B. A. Oudet (Mathématiques appliquées, Université Scientifique et Médicale de Grenoble, France) "Use of the Linear Quadratic Approach as a Tool for Analysing the Dynamic Behavior of a Model of the French Economy"
4. Ruey-wen Liu and L. C. Suen (Notre Dame) "The MDR Method and a Comparative Study of the OMB Model"

4:00–5:30 Estimation and Identification

Chairman: Edison Tse (Stanford)

1. John Taylor (Columbia) "Methods of Efficient Parameter Estimation in Control Problems"
2. Kent Wall (NBER) and Thomas F. Cooley (NBER—Tufts University) "On the Identification of Time-varying Structures"
3. Turgay Ozkan and Michael Athans (MIT) "Application of Kalman Filter to Parameter Estimation of Macroeconomic Models"

Thursday, May 22

9:00–10:30 Microeconomics I

Chairman: Masanao Aoki (University of Illinois, Urbana)

1. D. D. Siljak (University of Santa Clara, Cal.) "Competitive Analysis of the Arms Race"
2. James Thurber and Andrew Whinston (Purdue) "Stochastic Control of a Stochastically Described Economic System"
3. Jong K. You (Rutgers College) "A Sensitivity Analysis of Optimal Stochastic Control Policies"
4. Nicholas Hope (Monash University, Australia) "Development Planning in South Korea"

11:00-12:30 Macroeconomics II

Chairman: James Pierce (FRB)

1. Franklin R. Shupp (University of Illinois, Urbana) "Uncertainty and Optimal Wage-Price Controls"
2. David Luenberger (Stanford) "Singular Dynamics in Economic Systems"
3. James McCabe (Yale) and David Sibley (Bell Labs) "Optimal Foreign Borrowing with Export Uncertainty"
4. J. B. Cruz, Jr. and Peter Walsh (University of Illinois, Urbana) "Neighboring Stochastic Control of an Econometric Model"

2:00-3:30 Open discussion of problems in the application of control theory to economics and of work in progress.

Chairmen: Michael Athans (MIT) and Gregory Chow (Princeton)

4:00-5:30 Microeconomics II

Chairman: Stanley Fischer (MIT)

1. S. Barta and Pravin Varaiya (MIT) "Models of Stochastic Price Adjustment"
2. Alex Levits (Systems Control) "A Dynamic Simulation of U.S. Food Production"

Friday, May 23

9:00-10:30 Adaptive Control I

Chairman: David Kendrick (Texas)

1. Gregory C. Chow (Princeton) "On the Control of Nonlinear Econometric Systems with Unknown Parameters"
2. Alfred L. Norman (Texas) "Alternative Control and Estimation Strategies"
3. Dov Pekelman (University of Pennsylvania) and Edison Tse (Stanford) "Adaptive Control in Advertising"
4. Carole Aldrich and David W. Peterson (Duke) "On Learning in Stochastic Linear Quadratic Models"

11:00-12:30 Adaptive Control II and Decomposition

Chairman: Y. C. Ho (Harvard)

1. Yaakov Bar-Shalom (Systems Control) and Edison Tse (Stanford) "Probing and Caution in the Control of Uncertain Systems"
2. Gordon Rausser and Arnold Faden (Iowa State) "Econometrics Policy Model Construction: The Post-Bayesian Approach"
3. Finn Kydland (Norwegian School of Economics) "Decentralized Stabilization Policies: Optimization and the Assignment Problem"
4. Robert Pindyck (MIT) "The Cost of Conflicting Objectives in Optimal Policy Formulations"