

## Recursive Methods In Economic Dynamics

Jean-Paul Fitoussi needs no introduction as one of the world's foremost Macroeconomists of his generation. This celebration of his work includes contributions from Nobel Prize - winning economists Robert W. Clower and Robert Solow as well as Olivier Blanchard and leading economic theorist, Edmond Malinvaud.

Renowned trade theorist Koji Shimomura passed away in February 2007 at the age of 54. He published nearly 100 articles in international academic journals. The loss of this extremely productive economist has been an enormous shock to the economic profession. This volume has emerged from the great desire on the part of the profession to honor his contributions to economic research. Contributors include authoritative figures in trade theory such as Murray Kemp, Ronald Jones, Henry Wan, and Wilfred Ethier, world-renowned macroeconomists such as Stephen Turnovski and Costas Azariadis, and leading Japanese economists such as Kazuo Nishimura, Makoto Yano, Ryuzo Sato, and Koichi Hamada. This broad range of contributors reflects Koji Shimomura's many connections as well as the respect he earned in the economic profession. This volume offers the reader a rare opportunity to learn the views of so many renowned economists from different schools of thought.

This book is a companion volume to *Dynamic Macroeconomic Theory* by Thomas J. Sargent. It provides scrimmages in dynamic macroeconomic

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theory--precisely the kind of drills that people will need in order to learn the techniques of dynamic programming and its applications to economics. By doing these exercises, the reader can acquire the ability to put the theory to work in a variety of new situations, build technical skill, gain experience in fruitful ways of setting up problems, and learn to distinguish cases in which problems are well posed from cases in which they are not. The basic framework provided by variants of a dynamic general equilibrium model is used to analyze problems in macroeconomics and monetary economics. An equilibrium model provides a mapping from parameters of preferences, technologies, endowments, and rules of the game to a probability model for time series. The rigor of the logical connections between theory and observations that the mapping provides is an attractive feature of dynamic equilibrium, or rational expectations, models. This book gives repeated and varied practice in constructing and interpreting this mapping.

This rigorous but brilliantly lucid book presents a self-contained treatment of modern economic dynamics. Stokey, Lucas, and Prescott develop the basic methods of recursive analysis and illustrate the many areas where they can usefully be applied.

This two-volume work functions both as a textbook for graduates and as a reference for economic scholars. Assuming only the minimal mathematics background required of every second-year graduate, the two volumes provide a self-contained and careful development of mathematics through locally convex topological vector

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spaces, and fixed-point, separation, and selection theorems in such spaces. Volume One covers basic set theory, sequences and series, continuous and semi-continuous functions, an introduction to general linear spaces, basic convexity theory, and applications to economics.

Recursive Methods in Economic Dynamics Harvard University Press

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An overview of the causes and consequences of speculative attacks on domestic currency and international financial turmoil. It provides a comprehensive treatment of the existing theories of exchange rate crises and of financial market runs. A unified and comprehensive introduction to the analytical and numerical tools for solving dynamic economic problems; substantially revised for the second edition. This book offers a unified, comprehensive, and up-to-date treatment of analytical and numerical tools for solving dynamic economic problems. The focus is on introducing recursive methods—an important part of every economist's set of tools—and readers will learn to apply recursive methods to a variety of dynamic economic problems. The book is notable for its combination of theoretical foundations and numerical methods. Each topic is first described in theoretical terms, with explicit definitions and rigorous proofs; numerical methods and computer codes to implement these methods follow. Drawing on the latest research, the book covers such cutting-edge topics as asset price bubbles, recursive

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utility, robust control, policy analysis in dynamic New Keynesian models with the zero lower bound on interest rates, and Bayesian estimation of dynamic stochastic general equilibrium (DSGE) models. This second edition has been substantially updated. Responding to renewed interest in modeling with multiple equilibria, it incorporates new material on this topic throughout. It offers an entirely new chapter on deterministic nonlinear systems, and provides new material on such topics as linear planar systems, chaos, bifurcations, indeterminacy and sunspot solutions, pruning nonlinear solutions, the bandit problem, rational inattention models, bequests, self-fulfilling prophecies, the cyclical behavior of unemployment and vacancies, and the long-run risk model. The exposition of each chapter has been revised and improved, and many new figures, Matlab codes, and exercises have been added. A student solutions manual can be purchased separately.

This solutions manual is a companion volume to the classic textbook *Recursive Methods in Economic Dynamics* by Nancy L. Stokey and Robert E. Lucas. Efficient and lucid in approach, this manual will greatly enhance the value of *Recursive Methods* as a text for self-study.

*Financial Economics, Risk and Information* presents the fundamentals of finance in static and dynamic frameworks with focus on risk and information. The objective of this book is to introduce undergraduate and first-year graduate students to the methods and solutions of the main problems in finance theory relating to the economics of uncertainty and information. The main goal

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of the second edition is to make the materials more accessible to a wider audience of students and finance professionals. The focus is on developing a core body of theory that will provide the student with a solid intellectual foundation for more advanced topics and methods. The new edition has streamlined chapters and topics, with new sections on portfolio choice under alternative information structures. The starting point is the traditional mean-variance approach, followed by portfolio choice from first principles. The topics are extended to alternative market structures, alternative contractual arrangements and agency, dynamic stochastic general equilibrium in discrete and continuous time, attitudes towards risk and towards inter-temporal substitution in discrete and continuous time; and option pricing. In general, the book presents a balanced introduction to the use of stochastic methods in discrete and continuous time in the field of financial economics. This is a thoroughly updated edition of *Dynamic Asset Pricing Theory*, the standard text for doctoral students and researchers on the theory of asset pricing and portfolio selection in multiperiod settings under uncertainty. The asset pricing results are based on the three increasingly restrictive assumptions: absence of arbitrage, single-agent optimality, and equilibrium. These results are unified with two key concepts, state prices and martingales. Technicalities are given relatively little emphasis, so as to draw connections between these concepts and to make plain the similarities between discrete and continuous-time models. Readers will be particularly intrigued by this latest edition's most

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significant new feature: a chapter on corporate securities that offers alternative approaches to the valuation of corporate debt. Also, while much of the continuous-time portion of the theory is based on Brownian motion, this third edition introduces jumps--for example, those associated with Poisson arrivals--in order to accommodate surprise events such as bond defaults. Applications include term-structure models, derivative valuation, and hedging methods. Numerical methods covered include Monte Carlo simulation and finite-difference solutions for partial differential equations. Each chapter provides extensive problem exercises and notes to the literature. A system of appendixes reviews the necessary mathematical concepts. And references have been updated throughout. With this new edition, Dynamic Asset Pricing Theory remains at the head of the field.

Concise yet rigorous, this textbook provides a clear and systematic introduction to the theory and application of dynamic economic models.

"This is the ideal book for those who want to study, understand, and work with linear-quadratic dynamic economies. Providing a thorough, authoritative, yet accessible treatment, it contains a superb analysis of the connections between various linear-quadratic dynamic programming problems, the general equilibrium properties of these economies, the type of aggregation applicable to them, and the time-series implications for quantities and prices. A great book by two giants of the field."--Fernando Alvarez, University of Chicago "In this tour-de-force of modern macroeconomics, Hansen and

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Sargent have written the definitive text on linear-quadratic economies that illustrate the connection between preferences and technology and the appropriate time-series representation. This gem of a book not only provides a thorough review of mathematical methods and related computational issues, but also includes cutting-edge economic models. It will be the required reference for anybody who works in modern dynamic macroeconomic problems."--Rodolfo E. Manuelli, Washington University in St. Louis "Modern macroeconomics relies on dynamic equilibrium modeling and the statistical analysis of time-series data. This superb book teaches both techniques hands-on. It guides readers towards mastering a library of computer programs that work for many practical problems, a library that readers will then build on in their own macroeconomic research."--Martin Schneider, Stanford University "It is nearly impossible to think of a better set of coauthors for this subject. I read their superior book with great pleasure and learned much from it."--Jesus Fernandez-Villaverde, University of Pennsylvania "Drawing strong connections between mathematics and economic intuition, this rigorous and insightful book contains an extremely broad set of applications, treated from the same consistent framework. The exposition of the benchmark model is outstanding and unique."--John Stachurski, Australian National University

This textbook provides a one-semester introduction to mathematical economics for first year graduate and senior undergraduate students. Intended to fill the gap between typical liberal arts curriculum and the rigorous

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mathematical modeling of graduate study in economics, this text provides a concise introduction to the mathematics needed for core microeconomics, macroeconomics, and econometrics courses. Chapters 1 through 5 builds students' skills in formal proof, axiomatic treatment of linear algebra, and elementary vector differentiation. Chapters 6 and 7 present the basic tools needed for microeconomic analysis. Chapter 8 provides a quick introduction to (or review of) probability theory. Chapter 9 introduces dynamic modeling, applicable in advanced macroeconomics courses. The materials assume prerequisites in undergraduate calculus and linear algebra. Each chapter includes in-text exercises and a solutions manual, making this text ideal for self-study.

A substantially revised new edition of a widely used text, offering both an introduction to recursive methods and advanced material. Recursive methods offer a powerful approach for characterizing and solving complicated problems in dynamic macroeconomics. Recursive Macroeconomic Theory provides both an introduction to recursive methods and advanced material, mixing tools and sample applications. Only experience in solving practical problems fully conveys the power of the recursive approach, and the book provides many applications. This third edition offers substantial new material, with three entirely new chapters and significant revisions to others. The new content reflects recent developments in the field, further illustrating the power and pervasiveness of recursive methods. New chapters cover asset pricing empirics with possible resolutions to

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puzzles; analysis of credible government policy that entails state variables other than reputation; and foundations of aggregate labor supply with time averaging replacing employment lotteries. Other new material includes a multi-country analysis of taxation in a growth model, elaborations of the fiscal theory of the price level, and age externalities in a matching model. The book is suitable for both first- and second-year graduate courses in macroeconomics and monetary economics. Most chapters conclude with exercises. Many exercises and examples use Matlab programs, which are cited in a special index at the end of the book. Dynamic Programming in Economics is an outgrowth of a course intended for students in the first year PhD program and for researchers in Macroeconomics Dynamics. It can be used by students and researchers in Mathematics as well as in Economics. The purpose of Dynamic Programming in Economics is twofold: (a) to provide a rigorous, but not too complicated, treatment of optimal growth models in infinite discrete time horizon, (b) to train the reader to the use of optimal growth models and hence to help him to go further in his research. We are convinced that there is a place for a book which stays somewhere between the "minimum tool kit" and specialized monographs leading to the frontiers of research on optimal growth.

Optimal growth theory studies the problem of efficient resource allocation over time, a fundamental

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concern of economic research. Since the 1970s, the techniques of nonlinear dynamical systems have become a vital tool in optimal growth theory, illuminating dynamics and demonstrating the possibility of endogenous economic fluctuations. Kazuo Nishimura's seminal contributions on business cycles, chaotic equilibria and indeterminacy have been central to this development, transforming our understanding of economic growth, cycles, and the relationship between them. The subjects of Kazuo's analysis remain of fundamental importance to modern economic theory. This book collects his major contributions in a single volume. Kazuo Nishimura has been recognized for his contributions to economic theory on many occasions, being elected fellow of the Econometric Society and serving as an editor of several major journals. Chapter "Introduction" is available open access under a Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International License via [link.springer.com](http://link.springer.com).

This volume constitutes the Proceedings of the "Nonlinear Dynamics in Economics and Social Sciences" Meeting held at the Certosa di Pontignano, Siena, on May 27-30, 1991. The Meeting was organized by the National Group "Modelli Nonlineari in Economia e Dinamiche Complesse" of the Italian Ministry of University and Scientific Research, M.U.R.S.T. The aim of the

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Conference, which followed a previous analogous initiative taking place in the very same Certosa, on January 1988\*, was the one of offering a come together opportunity to economists interested in a new mathematical approach to the modelling of economical processes, through the use of more advanced analytical techniques, and mathematicians acting in the field of global dynamical systems theory and applications. A basic underlying idea drove the organizers: the necessity of focusing on the use that recent methods and results, as those commonly referred to the overpopularized label of "Chaotic Dynamics", did find in the social sciences domain; and thus to check their actual relevance in the research program of modelling economic phenomena, in order to individuate and stress promising perspectives, as well as to curb excessive hopes and criticize not infrequent cases where research reduces to mechanical, ad hoc, applications of "a la mode" techniques. In a word we felt the need of looking about the state of the arts in non-linear systems theory applications to economics and social processes: hence the title of the workshop and the volume.

This two-volume work functions both as a textbook for graduates and as a reference for economic scholars. Assuming only the minimal mathematics background required of every second-year graduate in economics, the two volumes provide a self-



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monetarist models of the 1960s have induced macroeconomists to begin applying general equilibrium models. This book describes some general equilibrium models that are dynamic, that have been built to help interpret time-series of observations of economic aggregates and to predict the consequences of alternative government interventions. The first part of the book describes dynamic programming, search theory, and real dynamic capital pricing models. Among the applications are stochastic optimal growth models, matching models, arbitrage pricing theories, and theories of interest rates, stock prices, and options. The remaining parts of the book are devoted to issues in monetary theory; currency-in-utility-function models, cash-in-advance models, Townsend turnpike models, and overlapping generations models are all used to study a set of common issues. By putting these models to work on concrete problems in exercises offered throughout the text, Sargent provides insights into the strengths and weaknesses of these models of money. An appendix on functional analysis shows the unity that underlies the mathematics used in disparate areas of rational expectations economics. This book on dynamic equilibrium macroeconomics is suitable for graduate-level courses; a companion book, *Exercises in Dynamic Macroeconomic Theory*, provides answers to the exercises and is also available from Harvard

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University Press.

A common set of mathematical tools underlies dynamic optimization, dynamic estimation, and filtering. In *Recursive Models of Dynamic Linear Economies*, Lars Peter Hansen and Thomas Sargent use these tools to create a class of econometrically tractable models of prices and quantities. They present examples from microeconomics, macroeconomics, and asset pricing. The models are cast in terms of a representative consumer. While Hansen and Sargent demonstrate the analytical benefits acquired when an analysis with a representative consumer is possible, they also characterize the restrictiveness of assumptions under which a representative household justifies a purely aggregative analysis. Hansen and Sargent unite economic theory with a workable econometrics while going beyond and beneath demand and supply curves for dynamic economies. They construct and apply competitive equilibria for a class of linear-quadratic-Gaussian dynamic economies with complete markets. Their book, based on the 2012 Gorman lectures, stresses heterogeneity, aggregation, and how a common structure unites what superficially appear to be diverse applications. An appendix describes MATLAB programs that apply to the book's calculations.

To harness the full power of computer technology, economists need to use a broad range of mathematical

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techniques. In this book, Kenneth Judd presents techniques from the numerical analysis and applied mathematics literatures and shows how to use them in economic analyses. The book is divided into five parts. Part I provides a general introduction. Part II presents basics from numerical analysis on  $\mathbb{R}^n$ , including linear equations, iterative methods, optimization, nonlinear equations, approximation methods, numerical integration and differentiation, and Monte Carlo methods. Part III covers methods for dynamic problems, including finite difference methods, projection methods, and numerical dynamic programming. Part IV covers perturbation and asymptotic solution methods. Finally, Part V covers applications to dynamic equilibrium analysis, including solution methods for perfect foresight models and rational expectation models. A website contains supplementary material including programs and answers to exercises.

A rigorous and example-driven introduction to topics in economic dynamics, with an emphasis on mathematical and computational techniques for modeling dynamic systems. This text provides an introduction to the modern theory of economic dynamics, with emphasis on mathematical and computational techniques for modeling dynamic systems. Written to be both rigorous and engaging, the book shows how sound understanding of the underlying theory leads to effective algorithms for solving real world problems. The material makes extensive use of programming examples to illustrate ideas. These programs help bring to life the abstract concepts in the text. Background in computing and

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analysis is offered for readers without programming experience or upper-level mathematics. Topics covered in detail include nonlinear dynamic systems, finite-state Markov chains, stochastic dynamic programming, stochastic stability and computation of equilibria. The models are predominantly nonlinear, and the emphasis is on studying nonlinear systems in their original form, rather than by means of rudimentary approximation methods such as linearization. Much of the material is new to economics and improves on existing techniques. For graduate students and those already working in the field, *Economic Dynamics* will serve as an essential resource.

The standard rationality hypothesis implies that behaviour can be represented as the maximization of a suitably restricted utility function. This hypothesis lies at the heart of a large body of recent work in economics, of course, but also in political science, ethics, and other major branches of social sciences. Though the utility maximization hypothesis is venerable, it remains an area of active research. Moreover, some fundamental conceptual problems remain unresolved, or at best have resolutions that are too recent to have achieved widespread understanding among social scientists. The main purpose of the *Handbook of Utility Theory* is to make recent developments in the area more accessible. The editors selected a number of specific topics, and invited contributions from researchers whose work had come to their attention. Therefore, the list of topics and contributions is largely the editors' responsibility. Each contributor's chapter has been refereed, and revised



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and discusses applications to price setting, investment, and durable goods purchases."--Pub. desc.

An integrated approach to the empirical application of dynamic optimization programming models, for students and researchers. This book is an effective, concise text for students and researchers that combines the tools of dynamic programming with numerical techniques and simulation-based econometric methods. Doing so, it bridges the traditional gap between theoretical and empirical research and offers an integrated framework for studying applied problems in macroeconomics and microeconomics. In part I the authors first review the formal theory of dynamic optimization; they then present the numerical tools and econometric techniques necessary to evaluate the theoretical models. In language accessible to a reader with a limited background in econometrics, they explain most of the methods used in applied dynamic research today, from the estimation of probability in a coin flip to a complicated nonlinear stochastic structural model. These econometric techniques provide the final link between the dynamic programming problem and data. Part II is devoted to the application of dynamic programming to specific areas of applied economics, including the study of business cycles, consumption, and investment behavior. In each instance the authors present the specific optimization problem as a dynamic programming problem, characterize the optimal policy functions, estimate the parameters, and use models for policy evaluation. The original contribution of *Dynamic Economics: Quantitative Methods and Applications* lies in the integrated approach

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to the empirical application of dynamic optimization programming models. This integration shows that empirical applications actually complement the underlying theory of optimization, while dynamic programming problems provide needed structure for estimation and policy evaluation.

For decades, the market, asset, and income approaches to business valuation have taken center stage in the assessment of the firm. This book brings to light an expanded valuation toolkit, consisting of nine well-defined valuation principles hailing from the fields of economics, finance, accounting, taxation, and management. It ultimately argues that the "value functional" approach to business valuation avoids most of the shortcomings of its competitors, and more correctly matches the actual motivations and information set held by stakeholders. Much of what we know about corporate finance and mathematical finance derives from a narrow subset of firms: publicly traded corporations. The value functional approach can be readily applied to both large firms and companies that do not issue publicly traded stocks and bonds, cannot borrow without constraints, and often rely upon entrepreneurs to both finance and manage their operations. With historical side notes from an international set of sources and real-world exemplars that run throughout the text, this book is a future-facing resource for scholars in economics and finance, as well as the academically minded valuation practitioner.

This is an insightful survey of approaches to computational analysis of economics and finance.

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This book explains how changing technology and economizing behaviour induce vast changes in productivity, resource allocation, labour utilization, and patterns of living. Economic growth is seen as a process by which businesses, regimes, countries, and the whole world pass through distinct epochs, each one emerging from its predecessor, each one creating the conditions for its successor. Viewed from a long-run perspective, growth must be characterized as an explosive process, marked by turbulent transitions in social and political life as societies adapt to new opportunities, the demise of old ways of living, and to the vast increase and redistribution of human populations. The book is based on a synthesis of classical economics and contemporary concepts of adaptation and economic evolution. Although it is based on analytical methods, the text has been stripped of all equations and with few exceptions is devoid of technical jargon.

Richard H. Day was one of the first economists to recognize the importance of complex dynamics, or chaos theory, to economics. He can justly be described as one of the originators of the now extensive economic literature on chaos. The two volumes of *Complex Economic Dynamics* show that, far from being a passing trend in economic research, complex dynamics belongs at the heart of the subject. Although they can be read independently,

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the volumes follow a logical sequence. Volume 1 contained nontechnical introductions to the basics of economic change and to the mathematical and theoretical tools used to describe them. Volume 2, which is concerned with macroeconomic dynamics, looks at the economy as a whole. Topics include business cycles, economic growth, economic development, and dynamical economic science and policy. The book concludes with the author's reflections on the implications of complex dynamics for economic theory, quantitative research, and government policy.

This book reflects the state of the art on nonlinear economic dynamics, financial market modelling and quantitative finance. It contains eighteen papers with topics ranging from disequilibrium macroeconomics, monetary dynamics, monopoly, financial market and limit order market models with boundedly rational heterogeneous agents to estimation, time series modelling and empirical analysis and from risk management of interest-rate products, futures price volatility and American option pricing with stochastic volatility to evaluation of risk and derivatives of electricity market. The book illustrates some of the most recent research tools in these areas and will be of interest to economists working in economic dynamics and financial market modelling, to mathematicians who are interested in applying complexity theory to economics and finance and to

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market practitioners and researchers in quantitative finance interested in limit order, futures and electricity market modelling, derivative pricing and risk management.

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