Modeling Monetary Economies

Third Edition

Bruce Champ
Scott Freeman
Joseph Haslag

Modeling Monetary Economies

Third Edition

BRUCE CHAMP
Federal Reserve Bank of Cleveland

SCOTT FREEMAN

JOSEPH HASLAG
University of Missouri, Columbia

CAMBRIDGE
UNIVERSITY PRESS

CAMBRIDGE UNIVERSITY PRESS
Cambridge, New York, Melbourne, Madrid, Cape Town,
Singapore, São Paulo, Delhi, Tokyo, Mexico City

Cambridge University Press
32 Avenue of the Americas, New York, NY 10013-2473, USA

www.cambridge.org
Information on this title: www.cambridge.org/9780521177009

First published 1994
Second edition published 2001
Third edition published 2011

Printed in the United States of America

A catalog record for this publication is available from the British Library.

Library of Congress Cataloging in Publication data

Champ, Bruce.
Modeling monetary economies / Bruce Champ, Scott Freeman, Joseph Haslag. – 3rd ed.
p. cm.
Includes bibliographical references and index.
ISBN 978-1-107-00349-1 (hardback) – ISBN 978-0-521-17700-9 (paperback) 1. Money –
Mathematical models. I. Freeman, Scott. II. Haslag, Joseph H. III. Title.
HG221.C447 2011
332.401′5118–dc22 2010048090

ISBN 978-1-107-00349-1 Hardback
ISBN 978-0-521-17700-9 Paperback

Modeling Monetary Economies

Third Edition

This textbook is designed to be used in an advanced undergraduate course. The approach of this text is to teach monetary economics using the classical paradigm of rational agents in a market setting. Too often, monetary economics has been taught as a collection of facts about existing institutions for students to memorize. By teaching from first principles instead, the authors aim to instruct students not only in the monetary policies and institutions that exist today in the United States and Canada but also in what policies and institutions may or should exist tomorrow and elsewhere. The text builds on a simple clear monetary model and applies this framework consistently to a wide variety of monetary questions. The authors have added in this third edition new material on money as a means of replacing imperfect social record keeping, the role of currency in banking panics, and a description of the policies implemented to deal with the banking crisis that began in 2007.

Bruce Champ is Senior Research Economist at the Federal Reserve Bank of Cleveland. Previously, he taught at Virginia Polytechnic Institute, the Universities of Iowa and Western Ontario, and Fordham University. Dr. Champ's research interests focus on monetary economics, and his articles have appeared in the *American Economic Review*; *Journal of Monetary Economics*; *Canadian Journal of Economics*; and *Journal of Money, Credit, and Banking*, among other leading academic publications. He co-authored the first and second editions of *Modeling Monetary Economies* with the late Scott Freeman.

Scott Freeman (1954–2004) was a Professor of Economics at the University of Texas, Austin. He taught previously at Boston College and the University of California, Santa Barbara. Professor Freeman died in 2004 after struggling with amyotrophic lateral sclerosis for several years. Professor Freeman specialized in monetary theory, and his articles appeared in the *Journal of Political Economy*; *American Economic Review*; *Journal of Monetary Economics*; and *Journal of Money, Credit, and Banking*, among other eminent academic journals.

Joseph Haslag is Professor and Kenneth Lay Chair in Economics at the University of Missouri, Columbia. He previously worked as an economist at the Federal Reserve Bank of Dallas. He also taught at Southern Methodist University and Michigan State University. Professor Haslag has focused on monetary economics, and his articles have appeared in the *Review of Economics and Statistics*, *Journal of Monetary Economics*, *Review of Economic Dynamics*, and *International Economic Review*, among other leading academic journals.

We dedicate this edition to Scott Freeman, a good friend and a brilliant economist. Unfortunately, Scott lost his long battle with ALS. He is missed by everyone who had the pleasure of knowing him, and especially by those of us who had the opportunity to work with him. We are writing this edition to honor Scott's contributions to the field of economics and to continue his legacy.

Preface

We offer this text as an undergraduate-level exposition about lessons of monetary economics gleaned from overlapping generations models. Assembling recent advances in monetary theory for the instruction of undergraduates is not a quixotic goal; these models are well within the reach of undergraduates at the intermediate and advanced levels. These elegantly simple models strengthen our fundamental understanding of the most basic questions in monetary economics. How does money promote exchange? What should serve as money? What causes inflation? What are the costs of inflation?

This approach to teaching monetary economics follows the profession's general recognition of the need to start building the microeconomic foundations. More directly, our observation is that economists explain aggregate economic phenomena as the implications of the choices of rational people who seek to improve their welfare within their limited means. The use of microeconomic foundations makes macroeconomics easier to understand because the performance of such abstract economic processes as gross domestic product and inflation is linked to something understood by all-rational individual behavior. It also brings powerful tools such as indifference curves and budget lines to bear on questions of interest. Finally, the joining of micro- and macroeconomics introduces a level of consistency across undergraduate studies. Certainly, students will be puzzled if taught that people are rational and prices clear markets when studied by microeconomists but not when studied by macroeconomists.

Inertia and tradition, however, have mired the teaching of monetary economies to a swamp of institutional details, as if monetary economics was only an unchanging set of facts to be memorized. The rapid pace of change in the financial world belies this view. Undergraduates need a way to analyze a wide variety of monetary events and institutional arrangements because the events and institutions of the future will not be the same as those the students learned in the classroom. The teaching of analysis, the heart of a liberal education, is best accomplished by

having students learn clear, explicit, and internally consistent models. In this way, students may uncover the links between the assumptions underlying the models and the performance of the model economies and thus apply their lessons to new events or changes in government priorities or policies.

This book implements our goals by starting with the simplest model—the basic overlapping generations model—which we analyze for insights into the most basic questions of monetary economics, including the puzzling demand for intrinsically worthless pieces of paper and the costs of inflation. Of course, such a simple model will not be able to discuss all of the issues of monetary economics. Therefore, we proceed in successive chapters by asking which features of actual economics the simple model does not address. We then introduce those neglected features into the model to enable us to discuss the more advanced topics. We believe this gradual approach allows us to build, step by step, an integrated model of the monetary economy without overwhelming the students.

The book is organized into three parts of increasing complexity. Part I examines money in isolation. Here, we take the questions of the demand for fiat money, a comparison of fiat and commodity money, inflation, and exchange rates. In Part II, we add capital to study money's interaction with other assets, banking, the intermediation of these assets into fiat money, and alternative arrangement of central banking. In Part III, we look at money's effects on saving, investment, output, and nonmonetary government debt.

This book is written for undergraduates. Its requirements are no more advanced than the understanding of basic graphs and algebra; calculus is not required. (Those who want to use calculus can find an exposition of this approach in the appendix to Chapter 1.) Although the book may prove useful to graduate students as a primer in monetary theory, the main text is pitched to the undergraduate level. This has kept us from a few demanding topics, such as nonstationary equilibria; we hope the reader will be satisfied by the wide range of topics we have been able to discuss within a single simple framework. Material that is difficult but within the grasp of undergraduates is set apart in appendices and can be easily skipped or inserted. The appendices also have many extensions, such as the model of credit, which instructors may wish to use but are not essential to the main topics.

The references display the most tension between the undergraduates and the technical base in which this approach originated. Whenever possible, we reference material written for undergraduates or general audiences; these references are marked by asterisks. Finally, where undergraduate references were not available, we supply references to a few academic articles and surveys to offer graduate and advanced undergraduates some places to start with more advanced work. This is not intended as a full survey of the advanced literature.

The choice of topics to be covered also was difficult. We make no claim to encyclopedic coverage of every topic or opinion related to monetary economics. We limited coverage to the topics most directly linked to money, covering banking (but

not finance in general) and government debt (but not macroeconomics in general). We insisted on models with rational agents operating in explicitly specified environments. We also selected topics that could be addressed in the basic framework of the overlapping generations model. In our view, the selected topics are tractably teachable, promoting unity and consistency. We also selected what we best know and understand. We hope that instructors can build on our foundations to fill in any gaps.

To reduce these gaps, we added in the second edition new material on speculative attacks, the not-very-monetary topic of social security, currency boards, central banking alternatives, the payments system, and the Lucas model of price surprises. We have greatly expanded our presentations of data and have added new exercises.

In this third edition, we have updated many of the graphs. We added a chapter, introducing a model of random relocation. This chapter provides an excellent framework for understanding the role that intermediaries play in solving problems that arise when deciding how to allocate portfolios between liquid and illiquid types of assets. This chapter extends the liquid liability and illiquid asset mismatch that intermediaries face. The model economy developed in this chapter links monetary factors to bank panics in a way that illuminates previous financial crises. We have also added a section to Chapter 11 on the payments system that seeks to account for monetary policy in the biggest financial crisis in the United States since the Great Depression.

Many have contributed to the development of this book. We owe Neil Wallace a tremendous intellectual debt for impressing upon us the importance of microeconomic theory in monetary economics. Many others have provided helpful suggestions, criticisms, encouragement, and other help during the writing of this book. These include David Andolfatto, Leonardo Auernheimer, Robin Bade, Valerie Bencivenga, Joydeep Bhattacharya, Mike Bryan, John Bryant, Douglas Dacy, Siverio Foresi, Christian Gilles, Paul Gomme, Paula Hernandez-Verme, Greg Hess, Dennis Jansen, Finn Kydland, David Laidler, Kam Liu, Mike Loewy, Antoine Martin, Helen O'Keefe, John O'Keefe, Michael Parkin, Dan Peled, Steve Russell, Tom Sargent, Pierre Siklos, Bruce Smith, Ken Stewart, Dick Tresch, Francois Velde, Warren Weber, and Steve Williamson. We would like to thank the large number of students at Boston College, the University of California at Santa Barbara, the University of Western Ontario, Fordham University, the University of Texas at Austin, and the University of Missouri, Columbia, who have persevered through the development of this book.

The views stated herein are those of the authors and are not necessarily those of the Federal Reserve Bank of Cleveland or of the Board of Governors of the Federal Reserve System.

Contents

Part I

Money