# Preface

The main challenges for macroeconomic theory are to explain the long-term economic growth and the short-term business fluctuations observed in the real world. This book offers an introduction to advanced economic analysis of these issues. In the following we will explain the philosophy underlying the book, its key features and target readership, and how it may be used for teaching purposes.

### The main distinguishing feature of the book and the target readership

Our book seeks to bridge the gap between the typical intermediate macroeconomics text and the more advanced texts used at the graduate level. As examples of the typical intermediate level text, we have in mind well-known books such as those by N. Gregory Mankiw, Olivier Blanchard, J. Bradford DeLong, Rudiger Dornbusch and Stanley Fischer or Michael Burda and Charles Wyplosz, to mention but a few. Examples in the advanced category are the textbooks by David Romer, Ben J. Heijdra and Frederick van der Ploeg, Olivier Blanchard and Stanley Fischer, or a more specialized book like the one on open economy macroeconomics by Maurice Obstfeld and Kenneth Rogoff.

With respect to the level of abstraction and analytical sophistication and the technical skills required, we think that the gap between the typical intermediate and the typical advanced text is very wide, and for many students too wide to overcome in one step. One of our intentions is that a course based on this book (coming after an intermediate level course) should prepare well for the advanced texts. We think there are not many other textbooks aimed at this purpose, if any at all, and we believe there is a great need for such a book.

At many universities there are indeed macro courses between the intermediate and advanced level. This could, for instance, be a third-year undergraduate course where the second-year course was based on an intermediate level text. Personally we have had difficulties finding a well-suited coherent textbook for such a course. From conversations we have learned that colleagues in other countries have experienced similar difficulties. This book is intended to fit exactly such a course.

Other universities and business schools do not have courses between the two levels just described. Rather, their study programmes require graduate students to go directly from a typical intermediate text used in the final macro course at the undergraduate level to an advanced text used at the graduate level. Because of the gap we have described, we think that such a programme may be suboptimal for many students and that this book can be helpful also as a starter at the graduate level.

Thus, depending on the specific background of students, we imagine that the book may be studied during the one or two last years of undergraduate studies, or during the first year at the master's level, and a main intention of the book is that it should give students a strong background for pursuing further studies in macroeconomics at the graduate level.

Another intention is that the book should also be well-suited for a final-year course for bachelor students who plan to leave the university with an undergraduate specialization in economics. In particular we think that the focus of the book on relatively few fundamental topics makes it appropriate for such a purpose.

### What we expect from students

To give students a feel for the methodology of modern macroeconomics, the book uses formal mathematical analysis throughout, supplemented by graphical illustrations. However, the mathematics used are simple, and students are only required to have some training in basic calculus and some familiarity with first-order difference equations and with the concept of a stochastic variable. All steps in the mathematical derivations are carefully explained, and all results derived are given an intuitive explanation, so no student should feel that the models presented have the character of a 'black box'. In some empirical exercises we ask students to undertake Ordinary Least Squares regression analysis. A brief technical appendix provides the untrained student with the minimum knowledge needed to carry out OLS regressions.

Intuitive economic reasoning is important and indeed indispensable for understanding and interpreting the results of formal economic analysis. But in a complex world intuition can sometimes lead the analyst astray if it is not backed up by a mathematical analysis ensuring consistency. With this book we hope to demonstrate to students that even very simple mathematics can take them a long way towards understanding numerous key economic relationships and mechanisms.

### Essential features of the text

*1. Focus on fundamental and elementary models*

Rather than offering a superficial coverage of a wide range of topics and different model types, we have chosen to provide an in-depth treatment of a limited number of basic workhorse macro models. We focus on models which are both fundamental and relatively elementary. The models are elementary in the sense that analysing them does not require mathematical skills which are out of line with a second-year or third-year undergraduate course. The models are fundamental in the sense that they have provided basic and lasting insights.

*2. Finishing the job*

Because the models in the text are basic, we can analyse them in depth without overburdening students with mathematical technicalities, but at the same time without sacrificing rigour, and we can use all models to their full potential. Hence the student can put some of the most important models in macroeconomics 'on the shelf' after having studied this text: he or she will not have to start over again studying, say, the Solow growth model at a more technical or general level in a later course. Instead, the student can move right on to more advanced models such as the Ramsey growth model, say.

*3. Systematic confrontation of theory with data and continued emphasis on policy relevance*

To justify the relevance of the models and the theoretical problems analysed, each part of the book starts by reviewing the stylized facts that we want our models to explain, and

each chapter systematically confronts the model predictions with empirical data. Throughout the book we highlight how our models help to illuminate important economic policy problems, and we discuss what the models imply for economic policy.

*4. Coherence and internal consistency*

To help the student appreciate the big picture, the book is careful to point out how the models in different parts of the book are linked. For example, we illustrate how the aggregate supply curve in our short-run business cycle model may be derived from our models of long-run structural unemployment by introducing expectational errors and short-run nominal rigidities. As another example, we point out the link between our workhorse model of economic growth and the theory of real business cycles. In this way students do not have to move into entirely new 'model worlds' as they move from one chapter to another. In particular, we have chosen to specify all models in discrete time, including the growth models of Book One. This means that students do not have to go through the technicalities of the transition from discrete to continuous time. We do acknowledge that continuous time formulations of growth models can be very convenient and serve as a preparation for further studies. Throughout the growth chapters of Book One we have therefore included (heavily-guided) exercises allowing more advanced students to become familiar with the parallel growth models in continuous time.

*5. Respect for rigour, but avoidance of unnecessary technicalities*

The combination of text and exercises will teach the student how to set up simple macroeconomic models, and how to derive the model implications through simple mathematics. In this way the student will learn the importance of being precise in stating one's assumptions, and he or she will learn to appreciate the importance of different assumptions. However, unnecessary technicalities are avoided, and a balance between formal and graphical analysis is maintained.

*6. Complementarity between main text and exercises*

We think that an unusual feature of this book is the extent of the system of exercises and the degree to which the exercises go hand-in-hand with the text. While solving the exercises systematically is in no way required for a fruitful reading, working through exercises should be very helpful for obtaining a deeper insight and an improved capacity for analysing macroeconomic problems independently. Our book is therefore very well suited for the type of course where lectures focused on theory are combined with smaller classes focused on solving problems.

## Novelties

This book contains several features which we believe to be novel in a textbook context.

For example, Chapter 4 extends the Solow growth model to the open economy to allow an analysis of the long-run effects of international capital mobility. This model may serve as a basis for discussing some of the current issues in the ongoing debate on globalization. Moreover, in Chapter 7 we present a simple Solow model with scarce natural resources which may illuminate some of the issues in the debate on the environmental limits to growth.

In dealing with the macro economy in the short run, we apply and extend the modern AS-AD framework where the nominal variable is the rate of inflation rather than the price level, and where monetary policy is specified as a rule for setting the short-term interest rate. This set-up is gradually superseding the traditional IS-LM and AS-AD analysis and makes it easier to relate the model to real-world policy discussions. However, Chapter 17 on aggregate demand is careful to point out the link between our specification of monetary policy and the more traditional analysis of the money market, so students trained in IS-LM analysis should find it easy to make the transition to our modern AS-AD framework.

In Book Two we also illustrate the methodology of modern business cycle analysis by calibrating and simulating a simple stochastic AS-AD model to reproduce the most important stylized statistical facts of the business cycle. Furthermore, we present a detailed extension of the modern AS-AD framework to the open economy and introduce students to the problems of inflation targeting under flexible exchange rates.

### The hard choices made

In our treatment of economic growth we have resisted the strong temptation to include fundamental workhorse models like the Ramsey model of economic growth and the Diamond model of overlapping generations. A thorough treatment and full understanding of these models require mathematical techniques that go beyond those used in the present text. Furthermore, the Ramsey and Diamond models are typically core subjects in the advanced texts that this book prepares for. By devoting space to the Solow model and its various extensions, we can show in depth how successful this simple and elegant framework actually is in accounting for the stylized facts of economic growth and at the same time give a good preparation for the study of the more advanced models.

One cost of leaving out the Ramsey and Diamond models is that our analysis of public debt has to be kept rather brief. Chapter 16 does introduce the intertemporal government budget constraint in a two-period setting as a basis for discussing Ricardian equivalence, but we chose to leave an extensive treatment of government debt for a more advanced course which covers the OLG model.

Dealing with short-run fluctuations is even more difficult than presenting the theory of economic growth, since there is less consensus on the best way to model business cycles. Here we have also chosen to go carefully through our basic workhorse AS-AD model and its extensions to illustrate how far it can take us towards an understanding of business cycles. Thus we do not present an array of different short-run models, but we do show how a Solow model with stochastic productivity growth can generate real business cycles. In this way we confront our preferred AS-AD framework with real business cycle theory to give students a flavour of some of the controversies in the theory of short-run fluctuations.

### Overview of contents

The text is divided into two 'Books'. Book One deals with the economy in the long run, covering economic growth and structural unemployment. Part I presents basic Solow

growth models of capital and wealth accumulation for closed and open economies. Part II brings technological progress into the picture, first presenting the Solow model with exogenous technical progress, and then extending this model with human capital and with scarce natural resources.

Part III covers endogenous growth, starting with models based on the idea of productive externalities and increasing returns at the aggregate level, then moving on to Romer-type models with endogenous R&D, first in a simple macro setting, subsequently in a more complex micro-founded model.

In Part IV the focus shifts to long-run structural unemployment. After some preliminary theorizing about frictional unemployment, we go through the efficiency wage theory and the trade union model of the labour market.

Book Two contains the analysis of short-run fluctuations. In Part V we develop the building blocks for our workhorse short-run model. While keeping the mathematics simple, we start by going through the life cycle-permanent income theory of consumption and Tobin's q-theory of investment, stressing the role of the stock market in the economy. The chapter on aggregate demand builds on the theories of consumption and investment and introduces monetary policy to derive the aggregate demand curve. This is followed by a chapter on aggregate supply which derives a micro-founded expectations-augmented Phillips curve and an aggregate supply curve from labour market theories consistent with those presented in Part IV.

Part VI puts the pieces together to assemble our basic dynamic AS-AD model for the closed economy. This model (with various amendments) is used to analyse short run fluctuations and optimal stabilization policy with backward-looking as well as forward-looking expectations. The analysis ends by highlighting credibility issues and the problems raised by time lags and uncertainty for stabilization policies.

Finally Part VII extends the AS-AD model to the open economy, developing model variants to study the effects of shocks and the scope for macroeconomic policy under fixed as well as flexible exchange rates. On this basis the last chapter discusses the choice of exchange rate regime, ending with a survey of optimum currency area theory.

### How teachers may use the book

Although the book is written as a basis for a two- or three-semester course (or a sequence of courses) covering growth as well as business cycles, the structure of the book leaves a high degree of flexibility for teachers. First of all, the two 'Books' can serve as a basis for separate courses in Economic Growth and in Business Cycles, and teachers can choose to start with the short run before moving to the long run.

For the purpose of shorter courses, it is possible to skip some chapters without serious loss of continuity. For example, a relatively short course on Economic Growth should, we think, include Chapters 2, 3 and 5. The teacher can choose to include or exclude any one, two or three of Chapter 4 (on the open economy), Chapter 6 (on human capital), and Chapter 7 (on scarce natural resources). Likewise, Part III on endogenous growth can be skipped altogether if preferred, or one can skip Chapter 10 alone (the micro-founded Romer model), Chapter 9 (the macro model of endogenous R&D) as well as Chapter 10, or just Chapter 8 (on endogenous growth based on productive externalities). The remaining chapters would still constitute a coherent sequence on growth theory. Among the

chapters on structural unemployment, Chapter 12 (on efficiency wages) can be read independently of Chapter 13 (on trade unions) and vice versa.

A short course on business cycles which does not intend to go deeply into the micro foundations for the aggregate demand curve could skip Chapters 15 and 16 on investment and consumption and start directly with Chapters 17 and 18 on aggregate demand and supply. It is even possible to start directly with Chapter 19 setting up our short-run model of aggregate supply and aggregate demand, provided the teacher spends a little time explaining the specification of the AD and AS curves. Moreover, a course which only seeks to cover the more basic points on stabilization policy treated in Chapter 20 could skip Chapter 22, or both of Chapters 21 and 22 which contain more advanced points. Finally, a course that does not have the ambition to cover both exchange rate regimes could skip Chapter 26 and either one of Chapters 24 and 25.

As another example of the flexibility offered by the book, a course on business cycles which digs deeper into the theory of unemployment could combine chapters from Book Two with one or more of the chapters on structural unemployment in Book One.

Although not absolutely necessary, we believe that students would benefit from starting out with Chapter 1, whether they follow a course on the long run or on the short run. In Chapter 1 we explain the different types of assumptions and modelling strategies used in long-run theory and short-run theory. Our experience is that such an introduction helps students to see how the various models fit into the 'big picture' of macroeconomic theory.

### Special facilities

Each chapter ends with an extended summary highlighting the main points to be learned from that chapter. Moreover, each chapter is followed by a number of exercises intended to deepen the student's understanding of the material covered. Some of these exercises have the purpose of increasing the student's familiarity with the basic model encountered in the chapter text, while others invite the student to explore various extensions and modifications of the basic model version. Several exercises are empirical, asking students to undertake simple statistical analysis, typically running an OLS regression. The technical appendix to the book should provide students without prior statistical training with the minimum knowledge needed to solve these exercises (and serve as a useful brush-up for those students who already have some training). Book One also includes Table A reproducing growth relevant country data from various databases, most importantly from the Penn World Table 6.1.

One category of exercises asks students to implement and simulate simple dynamic macro models on the computer. This may be done by means of easily accessible software such as Excel. It is our experience that the process of implementing a simulation model increases the student's understanding of the model (and his/her motivation for model analysis). Because of this, we deliberately chose to ask students to program the models themselves rather than making the simulation models directly available on the internet.

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