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**BOOK REVIEW:
An Introduction to
Computational Macroeconomics,
by Anelí Bongers, Trinidad Gómez
and José L. Torres
Willmington, DE: Vernon Press 2020.**

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JEL CLASSIFICATION: Y30

1. INTRODUCTION

Although computational macroeconomics is a relatively new economic discipline, it is one of the fastest-developing. In recent times the field of macroeconomics has been extended in many directions. One direction is making macroeconomics compatible with a broad array of IT development paths. Computational macroeconomics is now at the core of high-quality graduate courses in macroeconomics. There are many reasons for this, but only the two most important will be mentioned here. First, macroeconomic models, both theoretical and applicative, can hardly be solved without using computational tools. Their complexity requires using software packages, and sometimes even that is not enough to solve the model quickly, especially when it incorporates many state variables. Second, the possibilities of using computational tools for macroeconomic analysis are extensive, in a way that was unthinkable in the past.

An Introduction to Computational Macroeconomics deals with core macroeconomic problems from a computational perspective, which is the most important angle; and therefore it represents a significant contribution to the presentation of macroeconomic models to academics, the scientific community, and the general public. The book consists of three parts and an appendix. In

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the first section, dedicated to Basic Dynamic Systems, the authors analyse topics such as the dynamic IS-LM model and the exchange rate overshooting model. The second section analyses Macroeconomic Dynamic General Equilibrium, and readers are introduced to the consumption–savings decision, the role of fiscal policy in firms' investment decisions, and the basic dynamic general equilibrium model. The third section focuses on Economic Growth, paying special attention to the neoclassical growth model and Ramsey's optimal growth model. In the appendix the authors provide replication codes for the exercises in the main part of the book, written in MATLAB and/or DYNARE.

2. INTRODUCTION TO BASIC DYNAMIC SYSTEMS

The first chapter of the book introduces dynamic systems through exercises based on a general model that consists of difference equations. The authors make readers familiar with basic dynamic modelling concepts, in particular steady state and impulse response functions. Special attention is paid to stability analysis. In macroeconomics not all trajectories lead to equilibrium, i.e., global stability. The common situation is the presence of a saddle point when only a few routes lead to a steady state, while the others do not. Of course, global instability of the economic system is also a possibility.

The second chapter is dedicated to the IS-LM model, one of the greatest tools of macroeconomic analysis. The model has been modified, and the authors analyse the dynamic version. One of the crucial assumptions of the static IS-LM model is constant prices. In a dynamic environment this assumption has to be relaxed. The authors assume that prices evolve over time but that there is some degree of price rigidity, which has consequences for the monetary neutrality proposition, which holds in the long run. After solving the baseline model, the authors additionally perform shock analysis (increase in money supply) and sensitivity analysis (change in the elasticity of money demand with respect to output).

The third chapter of the first section describes the exchange rate overshooting model. This well-known model by Dornbusch explains the response of small open economies to different shocks through exchange rate adjustment. The model consists of two equations, one describing the evolution of the nominal exchange rate, and the other the inflation path.

3. INTRODUCTION TO GENERAL EQUILIBRIUM

The first chapter of the second part of the book deals with households' optimal consumption–savings choice, which is one of the fundamental problems in macroeconomics. The assumption of the representative agent is common in this area of macroeconomics. The authors explain the basis of the problem, starting with the maximization of the utility function subject to budget constraint. They present a detailed numerical solution to the problem. As in the previous cases, additional sensitivity and shock analyses are performed.

The following chapter extends the previous one by introducing the consumption–leisure choice by which households determine their optimal labour supply. It should be emphasised that in the analysis, labour supply is a static decision (Bongers, Gómez, and Torres, 2020, p. 95).

One chapter in this part of the book analyses the role of government and the implications of fiscal policy. Various aspects of fiscal policy are analysed, such as the implications of income tax in the framework of the household optimization problem, the effect of changes in tax rates, and the difference between distortionary and non-distortionary taxes.

Firms and investment decisions are analysed in a separate chapter in this part of the book. This is important, since households and firms are the two main agents that influence the economy through their behaviour, i.e. the economy is micro-founded, and firms maximize their profit function subject to the production function.

Finally, a chapter is dedicated to the basic general equilibrium model. A crucial proposition of dynamic general equilibrium models is that they are micro-founded (Bongers, Gómez, and Torres, 2020, p. 163). This is especially important, as nowadays they usually form the basis for all modelling.

4. ECONOMIC GROWTH

The last part of the book analyses an important topic in macroeconomics: economic growth. It is very important to develop macroeconomic models that are related to the long-run stance of the economy, and dynamic general equilibrium models can be used to describe both the short-run and the long-run dynamics of the economy.

The first chapter of this part of the book deals with the neoclassical growth model. Growth is treated as exogenous. The authors use the neoclassical growth model in discrete time and simulate the Solow-Swan model.

The second chapter is dedicated to Ramsey's optimal growth model. The assumptions used are discrete time and infinite lived households. After the numerical solution of the model, shock analysis is performed in order to investigate the effects of permanent change in total factor productivity. Sensitivity analysis is then conducted to analyse the effects of changes in the discount rate.

5. THE SCIENTIFIC CONTRIBUTION OF THE BOOK AND CONCLUDING REMARKS

In the authors' view of macroeconomics, the central problem is finding new and simple ways to solve models using computational tools. This is important, since computational macroeconomics constitute a new framework for macroeconomic analysis and introduce a necessary change in the way students are familiarised with contemporary macroeconomic problems. The authors provide scientific validity by relying on well-structured macroeconomic theory and rigorous mathematical derivations of the models' solutions.

The key features of this book are simple solutions, even for complex macroeconomic models, based on spreadsheets and codes. The authors have developed an easy way to solve macroeconomic models using Microsoft Excel and/or MATLAB and DYNARE, which is a unique way to present models' solutions. This provides a good basis for the further development of macroeconomic models. Exercises are provided at the end of the each chapter to help readers deepen their knowledge of the particular models.

The possible modifications of the models in the future are certain, but as Galí (2015) concludes it is certain that quantitative macro modeling will be present in the process of the economic policymaking, and therefore this book is an excellent starting point for computational macroeconomic analysis. Bearing all this in mind, this review aims to bring this valuable book to the attention of potential interested readers.

I would encourage all researchers in this area to read this book because of its contribution to economic theory. Its synthesis of concepts from economic theory,

economic policy and mathematical economics will awake the interest of readers for this extraordinary publication among economic literature.

A more specific motive for reviewing this book is that it will be key reading material on the newly established *Applied Macroeconomics* course at the University of Belgrade's Faculty of Economics. It will be used to show that seemingly complex problems can have relatively simple solutions.

6. BIBLIOGRAPHY

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