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Business Cycle Theory

A Survey of Methods and Concepts

Second, Revised, and Enlarged Edition

With 75 Figures

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To

I.G. and K.L.

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Preface

“Is the business cycle obsolete?” This often cited title of a book edited by Bronfenbrenner with the implicit affirmation of the question reflected the attitude of mainstream macroeconomics in the 1960s regarding the empirical relevance of cyclic motions of an economy. The successful income policies, theoretically grounded in Keynesian macroeconomics, seemed to have eased or even abolished the fluctuations in Western economies which motivated studies of many classical and neoclassical economists for more than 100 years. The reasoning behind the conviction that business cycles would increasingly become irrelevant was rather simple: if an economy fluctuates for whatever reason, then it is almost always possible to neutralize these cyclic motions by means of anticyclic demand policies.

From the 1950s until the mid-1960s business cycle theory had often been considered either as an appendix to growth theory or as an academic exercise in dynamical economics. The common business cycle models were essentially multiplier-accelerator models whose dependence on particular parameter values (in order to exhibit oscillatory motion) suggested a rather improbable occurrence of persistent fluctuations. The obvious success in compensating business cycles in those days prevented intensive concern with the occurrence of cycles. Rather, business cycle theory turned into stabilization theory which investigated theoretical possibilities of stabilizing a fluctuating economy. Many macroeconomic textbooks appeared in the 1960s which consequently identified business cycle theory with inquiries on the possibilities to stabilize economies by means of active fiscal or monetary policies.

The obvious failure of Keynesian demand policies during the 1970s - at least with respect to the postulation of a *general* validity of demand stimulating policies claimed

by orthodox Keynesians - has not only initiated a critical reconsideration of Keynesian macroeconomics and revivals of what has been called "classical" economics, but has also led to a resurrection of business cycle theory. While the term "business cycle" had nearly disappeared from titles of macroeconomic papers for 20 years, the revival of "classical macroeconomics" during the 1970s became inseparably linked with the emphasis on the fluctuating behavior of an economy. However, compared with Keynesian macroeconomics, the causality is usually reversed: the emphasis is not on stabilizing fluctuating economies by means of governmental activities, but rather on the generation of cyclic motions resulting from these activities themselves. The second mainstream of macroeconomic reasoning during the 1970s, namely the rationing or non-Walrasian approach to macroeconomics, has not attempted to contribute much to business cycle theory which is mainly due to the conceptual concentration on short-term, temporary equilibria of an economy.

Although the New Classical Macroeconomics has initiated a renewed interest in business cycles, it has not provided essentially new theoretical insights into the fluctuation of an economy. The assumed mechanisms which allow for the occurrence of cyclic motions are typically the same as those in the multiplier-accelerator models. Yet, there has been some effort in dynamical economics to investigate the relevance of new mathematical techniques in explaining economic fluctuations. The theory of non-linear dynamics (bifurcation theory, catastrophe theory, chaos theory, etc.) has revealed that a large variety of dynamic phenomena emerge if the model at hand is appropriately specified. It has especially become evident that slight modifications of the models are often sufficient to generate cyclic motions. This property particular to some dynamic models suggests to reflect about a classification of business cycle models in the following way.

A text that reviews the current state of the art of static macroeconomics must certainly distinguish between the two mainstreams of macroeconomic thinking, namely the New Classical Macroeconomics (or Rational Expectations literature) and the New Keynesian (or non-Walrasian) economics. Both trends have amounted to paradigms which do not seem to be compatible, even with considerable concessions on both sides. However, a text on business cycle theory following this classification would be characterized by two basic properties: first, abstracting from the underlying qualitative economic reasoning, the text would be full of repetitions as far as the dynamic oscillatory forces are concerned. Second, the text would be very short if it concentrated only on the dynamical aspects of both mainstream macroeconomics and would definitely be incomplete, as it would neglect many interesting approaches to business cycle theory which cannot be subsumed under the two mainstream categories.

Whether or not a dynamic model of an economy is a business cycle model, *i.e.*, a model which allows for fluctuations in major economic variables for a considerable amount of time, does not depend on the general economically motivated and paradigm-

matic features of a model, but rather on its mathematical structure. While, for example, the introduction of a certain lag-structure in the production function can certainly not be a distinctive mark from an economic point of view, this structure may be the essential dynamic feature which allows for oscillatory motions of an economy. Therefore, this text will concentrate on those features of dynamic economic models which constitute the essential fluctuation-generating forces.

A purely formal classification according to linearities or non-linearities, time-concepts, and lag-structures, etc., would also be unsatisfactory as it would veil the interesting aspects of economic dynamics with formalism. The theoretical business cycle models presented in this book will rather be distinguished according to the dependence of their cyclic behavior on exogenous shocks. While this importance of exogenous forces for the onset of cyclic motions has been stressed especially by the New Classical Macroeconomics, a classification according to this dependence allows existing business cycle models to be distinguished very easily and categorized in two classes.

This book is thus organized as follows: Chapter 1 deals with the empirical observation of cyclic performances of major economic variables. The chapter provides an overview of distinct cyclical phenomena of an economy on different time scales and lists typical phenomena, *i.e.*, the so-called *stylized facts*, observable in business cycles. Another section is devoted to the measurement of business cycles. Business cycle theory can only have relevance beyond the pure academic concern if there is indeed some empirical evidence of this cyclic performance. Chapter 2 presents an overview of shock-dependent models. It encompasses the traditional multiplier-accelerator models as well as several special non-linear business cycle models. As these models rely heavily on exogenous shocks in order to start as well as to maintain cycles, a special chapter is devoted to these exogenous forces. Chapter 3 includes the theory of political business cycles and concentrates mainly on the Rational Expectations models. Thus, Chapters 2 and 3 should be viewed as a unit. Chapter 4 presents shock-independent models, *i.e.*, models which can generate cycles endogenously, due only to their formal structure. While the models of Chapter 4 already require the introduction of several mathematical techniques which do not belong to common knowledge in economics, those involved in the models of Chapter 5 are certainly uncommon. As the relevance of these mathematical tools and models for future research is not clear yet, they are presented in a separate chapter dealing with chaotic motion and catastrophe theory.

A short book like the present one can of course not claim to be encyclopedically complete, and it would be pointless to list all concepts and single models which are missing in the presentation. Two omissions should at least be mentioned, however: a text on business cycle theory may be considered incomplete as long as it entirely neglects the history of ideas in this field. We have omitted an appropriate chapter primarily because there are several good texts (some of which are today regarded as classics) which deal with this subject. Furthermore, recent developments in business cycle theory have

initiated a revival of some historic ideas (especially Schumpeterian economics) which are discussed in many good separate survey articles and books. Secondly, we have omitted a treatment of the large field dealing with business cycles in the framework of econometrics, as a satisfactory presentation would exceed the scope of this book.

Although no attempt is therefore made to provide a *complete* survey of modern business cycle theory, it cannot be avoided that the book sometimes appears to be rather itemized. The classification according to the more formal aspects of the models necessarily implies that models which are economically quite different are presented under the same entry. The reader is requested to excuse the consequent isolation of some economic approaches for the sake of a consistent presentation of modern business cycle theory.

This textbook is suited for students on the graduate or the upper undergraduate level. In addition to a sound knowledge of advanced macroeconomics, the reader should be familiar with formal reasoning. Although the book attempts to bring together the various mathematical tools of modern business cycle theory and to comment on unfamiliar instruments as much as necessary, the reader is often requested to complete the calculations or to consult the original literature.

This book contains a revised version of the text that appeared as a *Springer Lecture Note in Economics and Mathematical Systems*. The unexpected success of the first edition showed that there is an obvious demand for business cycle texts like ours. The field is dominated by models in the New Classical tradition with an emphasis on linear stochastic approaches, but it seems as if the importance of non-linear business cycle models is steadily increasing. A major step toward the establishment of non-linear dynamical systems in business cycle theory was undertaken in the attempts to derive the necessary nonlinearities from microeconomic foundations. For example, while many non-linear elements in early models of chaotic dynamical economics were introduced by *ad hoc* assumptions, recent general equilibrium models or optimal control models are much less vulnerable to criticism on their basic assumptions.

During recent years, the literature on business cycles has grown enormously. We have tried to credit these recent developments by incorporating the relevant literature. On the other hand, when uncommon topics are mentioned in a textbook in addition to traditional themes, several items have to be dropped in the course of scientific progress as well. While the first edition included a loose collection of some theorems concerning chaotic dynamics, we decided to delete several theorems which turned out to be rather irrelevant to business cycle theory.

The main modifications of the text in this second edition involved a reshuffling of some sections and an expansion of several others:

- The numbering of the chapters has been changed.
- The first chapter has been extended and now includes a short presentation of different cycle types and the stylized facts of business cycles.

- The Hopf bifurcation is by now a standard tool in business cycle theory. Therefore, we have included material on the continuous-time and discrete-time versions in Chapter 4 dealing with standard shock-independent theories.
- Parts of the section on chaotic dynamics have been completely revised because of some imprecise statements in the first edition. This section now also contains a short survey of methods and recent findings in the field of empirical research in chaotic dynamics.

In addition, we had to revise several definitions, descriptions of established mathematical results, and misleading formulations in the rest of the text.

We are grateful to Dieter Bock, Lutz Siegmund, and the GMD-Göttingen for their assistance in preparing the first edition. Marleen Sacks made tremendous efforts to make the English of the first edition more readable (and understandable). Ralph Phillips copy-edited the new parts of the text. Richard Herrmann kindly provided the numerical bifurcation diagram used in Chapter 5. The final manuscript was typeset in PCT_EX.

It is a pleasure for us to acknowledge the many critical comments made by our colleagues and students who provided many suggestions for improving the text. We hope that the reader will benefit from these modifications.

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