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Macroeconomic
analysis

Macroeconomic analysis and stabilization policy

STEPHEN J. TURNOVSKY

Australian National University

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PREFACE

This book has evolved from a graduate course in macroeconomics which I have given at the Australian National University over the past five years. Many good books on the subject are now available and the reader may legitimately wonder how this book differs from some of the existing texts in the area.

The main focus of this book is on the construction and analysis of an integrated macroeconomic model. In developing such a model, there are four main aspects which we wish to stress, and which so far have not received adequate attention in existing textbooks.

First, and most important, we emphasize what we call the 'intrinsic dynamics' of the macroeconomic system. This is the dynamics inherent in the system arising from the creation of securities by certain groups in the economy, in order to finance their operations. Typically, the government prints money or issues debt in order to finance its deficit, while firms issue bonds or stocks to finance their investments. These securities are in turn absorbed by households through the process of savings. These relationships necessarily impose a dynamic structure on the macroeconomic system, even if all the underlying behavioural relationships are static. It is the analysis of this dynamic system which forms the central theme of this book and which until now has been conspicuously absent from existing macroeconomic textbooks.

Secondly, a good deal of attention is devoted to developing current ideas in inflation theory – particularly pertaining to the role of inflationary expectations – and incorporating these into a fully integrated macroeconomic model. Thirdly, several chapters are devoted to the international aspects of macroeconomics. These are typically given very brief attention in macroeconomic textbooks, being left to specialist books on international economics. But with increasing international integration, it seems that international macroeconomics should be treated as part of the received body of macroeconomic theory and not just left to specialized books on the subject. Finally, the book discusses in some detail several aspects of stabilization policy, and in particular gives an introduction to optimal stabilization theory.

These four areas reflect the main emphasis of the approach adopted in the present volume and also include what I believe are some of the more important topics neglected by existing books. On the other hand, many books give excellent treatments of the component parts of the macroeconomic system, such as the consumption function, investment function, etc., and these are not discussed in any detail here. Rather, the objective is to

take standard forms of such functions and to introduce them into a complete macroeconomic model. In this respect, the present volume can be regarded as complementary to some of the existing texts, which discuss the theoretical and empirical issues relating to these component functions in great detail.

Some of the material appearing in this volume has been adapted from articles which originally appeared in journal form. In particular, I am grateful to the editors and publishers of the *International Economic Review*, *Australian Economic Papers*, *Economic Journal*, *Canadian Journal of Economics* and the *Journal of International Economics* for their kind permission to include material which was originally published in their journals. The paper that I wrote with David H. Pyle, *The Dynamics of Government Policy in an Inflationary Economy: An 'Intermediate-Run' Analysis*, *Journal of Money, Credit, and Banking*, Vol. VIII, No. 4 (November 1976), copyright ©1976 by the Ohio State University Press, has also been adapted for use in this volume.

In undertaking a project of this size, one necessarily incurs many debts. Many individuals have read parts of the material either in draft form, or in the form of papers which subsequently were revised into chapters. In particular, I would like to express my gratitude to Edwin Burmeister, Geoffrey H. Kingston, Steven W. Kohlhaugen, Thomas Mayer, Robert A. Meyer, Frank Milne, John Pitchford, Michael G. Porter, Alan Preston, David H. Pyle, Edward Sieper, Robert M. Solow, Pravin K. Trivedi and W. Murray Wonham, either for reading various parts of the material or for discussions at earlier stages. Comments by graduate students in macroeconomics at the ANU, who were exposed to the manuscript in draft form, were also useful in clarifying various parts. In particular I would like to thank Geoff Carmody and Ian McKenzie for their helpful comments. I would also like to thank Debbie Stoyles for her superb typing of numerous drafts of the manuscript. Thanks are also due to Isobel Everitt who assisted most ably with the typing of two of the chapters and to Lindy Spence for editorial assistance. Finally, I would like to thank my wife, Michelle, and children, Geoffrey and Jacqueline, for their patience and forbearance throughout this long project.

STEPHEN J. TURNOVSKY

NOTE

Throughout this book, where no ambiguity can arise, we shall adopt the convention of letting primes denote total derivatives and denoting partial derivatives by appropriate subscripts. Time derivatives will be denoted by dots about the variable concerned. Thus we shall let

$$f'(x) \equiv \frac{df}{dx}; \quad f_i(x_1, \dots, x_n) \equiv \frac{\partial f}{\partial x_i} \quad i = 1, \dots, n,$$

$$f_{ij}(x_1, \dots, x_n) \equiv \frac{\partial^2 f}{\partial x_i \partial x_j} \text{ etc.}, \quad \dot{x} \equiv \frac{dx}{dt}$$

The application of a bar to a letter is used to denote either a stationary equilibrium value to a dynamic system, or the fact that the variable to which it is applied is fixed exogenously. The intended meaning should be quite clear from the particular context.

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1

INTRODUCTION AND OVERVIEW

1 Scope of the book

Macroeconomic theory has been a rapidly evolving subject over the past few years. For a long time it was approached in a rather descriptive and non-analytic fashion. While some progress was made in the 1950s at formal macroeconomic model building, the subject was never treated with anything like the rigour with which microeconomics was studied and frequently taught.

This is beginning to change. Much of the recent and current research on the subject has been, and is being, directed at trying to set it in a sounder theoretical framework. In particular, people have become aware of the need for any behavioural relationship embedded in a macroeconomic model to be derivable, at least in principle, from considerations relating to the individual decision-making units within the economy. In other words, the aggregate (macro) system, reflecting the actions of all the individuals (micro units) in the economy, should, in some broad sense, be consistent with their behaviour.

The first area of macroeconomics which economists attempted to derive from underlying microeconomic principles was the analysis of the consumption function. This was the subject of a good deal of theoretical research starting in the late 1940s with the pioneering work of Duesenberry (1948), Modigliani and Brumberg (1954), Friedman (1957), Ando and Modigliani (1963), and Yaari (1964). In this respect, progress in the theory of investment was somewhat slower. It would not be unfair to say that this subject was treated in a rather *ad hoc* manner until well into the 1960s, when the initial appearance of Jorgenson's work (1963, 1965) revolutionized the approach, basing it on the neoclassical micro theory of the firm. Subsequent work by Jorgenson himself, with various co-authors, and more recently by Bischoff (1971), Lucas (1967), Gould (1968), Treadway (1969) and others has continued this development to the point that it has now become the firmly established approach to investment theory. Similar progress has been taking place in the treatment of financial markets in modern macroeconomic theory. For many years, the demand for money was studied in isolation, in

terms of the three Keynesian motives, expressed in terms of the transactions, precautionary, and speculative demands. With the appearance of work by Patinkin (1965), Tobin (1969) and others, the more recent approach has been to consider the demand for money, along with the demands for all other financial assets, in the context of a general equilibrium portfolio framework. Finally, the area of employment theory and labour markets provides a further example in which progress is being made to base modern macroeconomic theory on microeconomic principles. However, this is a much more recent development and is a much less settled issue at this stage; see Phelps (1970).

Despite these developments, we do not mean to suggest that it will be possible to treat macroeconomics with the same theoretical rigour with which micro theory is typically studied. It almost certainly will not. Even if a completely general intertemporal, stochastic, theory of microeconomic behaviour were ultimately developed, there would always remain the inherently intractable aggregation problem, whereby the relationships at the aggregate level are obtained from the underlying individual relationships. The intractability of this problem has long been recognized by economists; see Theil (1954). It stems from the fact that it is only under extremely restrictive conditions that the behavioural relations at the aggregate level will be of the same form as functions of the aggregate variables, as they are at the individual level. But recent work by mathematical economists goes much further than this. It has been argued that the restrictions obtained from utility maximizing behaviour for the microeconomic relations provide almost no information as to the likely properties of the corresponding aggregate functions; see Debreu (1974), Sonnenschein (1972). If this view is taken seriously, it would suggest that the advantages in deriving macroeconomic relationships from microeconomic principles may be overstated.

But in spite of these enormous difficulties it would be fair to say that progress has been made in giving macroeconomic theory a firmer theoretical foundation. Particular attention is being devoted to recognizing the existence of budget constraints, which play such a crucial role in microeconomic theory, and to formulating macroeconomic models consistently within these constraints. To this extent at least, a more consistently formulated macroeconomic theory can be said to be emerging.

In this book we attempt to give a fairly rigorous analysis of macroeconomic theory. Our concern is with developing and analysing a consistent, integrated model, rather than with any detailed discussion of particular expenditure functions. Thus we do not devote any attention to discussing such issues as the consumption functions, the investment function, or the demand for money functions. These have all been discussed at length in many excellent textbooks elsewhere; see e.g. Branson (1972), Evans (1969), Lovell (1975), Wonnacott (1974). Rather, our approach is to take some general form of these functions as given (hopefully having reasonably firm microeconomic underpinnings) and to insert them into a complete macroeconomic

model. Our purpose is to analyse the behaviour of the model as a whole rather than with a detailed construction of its component parts. We should also emphasize that the book represents a theoretical exercise in macroeconomics. Almost no attention is devoted to discussing empirical issues, either pertaining to the empirical estimation of the model, or to the more general empirical literature which has evolved. Again some of this is discussed in other texts; see Evans (1969), Cramer (1971), Kuh and Schmalensee (1973), Bridge (1971). One exception to this is that we do make use of available empirical evidence on certain relevant parameters, insofar as these may be of assistance in determining the likely behaviour of the system, where otherwise no conclusion could be drawn.

Our approach is to develop a succession of models of increasing complexity, beginning with relatively simple extensions of the traditional textbook model (see e.g. Branson). In building these models, the main emphasis of our analysis is on what we shall refer to as the *intrinsic* dynamics of the system. By this we mean the dynamic behaviour stemming from certain logical relationships which constrain the system; specifically the relationships between stocks and flows. For example, the process of saving gives rise to the accumulation of assets and it is this change in the stock of assets which causes the system to evolve over time. It is only relatively recently that this fundamental dynamic economic process has begun to be incorporated into macroeconomic theory, although it was central to the more specialized subject of economic growth; see Burmeister and Dobell (1970). In any event, it provides a cornerstone to the model we shall develop.

With few exceptions (notably Chapters 13 and 14), we shall abstract from lags in the underlying behavioural relationships. In this respect, our approach provides a contrast to what one might regard as the traditional short-run dynamic macroeconomic model, in which the dynamics is often due entirely to the existence of such lags; see Allen (1959, 1967). By abstracting from them, we do not mean to deny their importance, for this is obviously an unquestionable empirical fact. Rather, our reason for neglecting them is that they are not fundamental to the logical consistency of the model in the same way as the intrinsic dynamics clearly are.

2 Outline of the book

The book is divided into three parts. Chapters 2–8 develop and analyse a progression of models for a closed economy; Chapters 9–12 extend these models to allow for international transactions; Chapters 13, 14 deal with problems of stabilization policy.

Our starting point is the traditional textbook static macroeconomic model and in Chapter 2 we begin with a review of the standard *IS–LM* model, together with the various traditional extensions incorporating the labour market. Chapter 3 deals with some of the issues which arise in the formulation of a consistent macroeconomic model. The main point of this chapter is to begin

with the underlying constraints facing the various groups in the economy (households, firms, and the government) and to make sure that the behavioural relationships we shall consider are consistent with them. Since throughout this volume we shall use both discrete-time and continuous-time models as convenient, this question is considered for both types of formulations. On the whole, discrete-time analysis is probably more useful where one is concerned with analysing period-by-period effects of various policies, and in particular their short-run impacts. But discrete-time analysis has its drawbacks and continuous-time formulations are generally more useful in longer-run analyses, where the arbitrary choice of time unit may become more critical. In any event, the procedure whereby the continuous-time model is obtained as the limit of an underlying discrete model raises technical issues which require the derivation to be performed with some care. That is the reason why it is necessary to treat the two systems separately.

The first dynamic model is introduced in Chapter 4. This is accomplished by introducing the government budget constraint into the *IS-LM* fixed-price model of Chapter 2. This idea was introduced into macroeconomic theory at a relatively late stage by Ott and Ott (1965), Christ (1967, 1968). The essential idea is the observation that any government deficit needs to be financed. Assuming that tax rates remain constant, this can be achieved either by issuing more debt, or by issuing more money (or both). To the extent that the short-run equilibrium of the economy (the level of income and the rate of interest in the *IS-LM* context) depends upon the stocks of these assets held by the private sector, as these stocks change, this equilibrium will change and the system will evolve over time.

Chapter 5 introduces the wage-price sector, paying particular attention to the role of inflationary expectations. Along with the dynamics of asset accumulation, the evolution of inflationary expectations over time also plays an important role in the dynamics of the overall model. In the following chapter we present our first integrated model. This is obtained by incorporating the analysis of the wage-price sector of Chapter 5 into the conventional static model summarized in Chapter 2. Attention is focused on the short run, although account is taken of the government budget constraint discussed in Chapter 4. Being short run, this model can treat the expected rate of inflation as a given parameter and particular emphasis is placed on analysing the effects of changes in these exogenous anticipations on the short-run equilibrium of the system. The short-run effects of monetary and fiscal policy in an inflationary context are also discussed.

Chapter 7 extends Chapter 6 to what we call the 'intermediate run'. In doing so it introduces several new features. First, we allow for the accumulation of government debt (money and bonds) just as we did for the fixed-price model of Chapter 4. Secondly, we relax the assumption made in our first dynamic model (Chapter 4), that the capital stock remains fixed, and instead allow it to vary as well. This extension of the Ott and Ott and Christ

Introduction and overview

analysis was first undertaken by Blinder and Solow (1973). correctly, that the earlier literature had made a somewhat contradictory assumption, namely, that although net investment was assumed to be taking place, nevertheless the capital stock was treated as remaining constant. This was in direct contrast to the treatment of government debt, the adjustment of which formed the basis for the dynamics of the system. Moreover, in introducing the dynamics of capital accumulation in an inflationary context, it becomes necessary to distinguish between the physical capital itself and the financial claims on capital issued by firms, which we take to be equity. The final modification pertains to our treatment of expectations. Whereas in the short run these could be taken as given, over time they evolve and are determined endogenously.

The model is 'intermediate run' in the following two senses. First, it makes the traditional Keynesian assumption that although capital is accumulated over time, instantaneously it is fixed. Labour is the only short-run variable factor of production which is adjusted to meet the demand-determined output. It therefore does not allow for the substitution of capital for labour (or vice versa) in response to their relative price movements. The second sense in which it is intermediate run is that, unlike the Blinder–Solow model in which the equilibrium they consider is one with a zero rate of investment, the equilibrium for this model is one in which investment is occurring at a positively, endogenously determined rate. The reason for defining it in this way is discussed in Chapter 7 below.

Our final model of the closed economy is presented in Chapter 8. This is a long-run model in which the full capital deepening effects of investment are introduced. In addition, this chapter seeks to integrate some of the more advanced theoretical issues introduced previously in Chapter 3, but which hitherto were not fully treated. For example, in Chapter 3 we will be discussing the implications of stock and flow constraints in continuous time models and their implications for product market equilibrium. We will also be showing how the introduction of capital gains on financial assets, required for the consistent accounting of the system in real terms, also imposes dynamic behaviour on the system. These problems, which are of a somewhat more technical nature, are included in greater generality in this chapter.

Part II introduces international transactions into the model. But we hasten to emphasize at the outset that we do not intend to give a detailed treatment of international economics. Obviously space limitations preclude this and in any event, there are many excellent references available dealing with this subject; see e.g. Takayama (1972), Stern (1973), Mundell (1968), Caves and Jones (1973). Rather, this part should be viewed as an extension of part I to a small open economy, and in many respects our analysis parallels our discussion in earlier chapters quite closely.

Specifically, Chapter 9 reviews the basic static macroeconomic model of a small country. This is the analogue of the *IS–LM* type models discussed in

Chapter 2. Chapter 10 extends this model to allow for variable prices and in particular provides a framework for analysing the short-run effects of foreign inflation on the domestic economy and the appropriate monetary, fiscal, and exchange rate policies to deal with it. This is still a short-run model and can be viewed as an extension to Chapter 6.

Chapters 11 and 12 deal with the longer-run dynamic models of an open economy, incorporating the dynamics of international capital flows, together with that of asset accumulation. Chapter 11 looks at this question within the context of a fixed price – fixed exchange rate economy. It therefore represents the analogue to Chapter 4. Chapter 12 extends this analysis one stage further by introducing the rate of inflation and considers the longer-run effects of monetary and fiscal policies in the context of an inflationary economy. Moreover, it deals with both fixed and flexible exchange rate regimes. On the other hand it is less general than the corresponding chapters for the closed economy, Chapters 7, 8, in that purely for reasons of analytical tractability, we are forced to assume that physical capital remains fixed.

With few exceptions, the analysis of monetary and fiscal policies throughout Parts I and II deals with them in the sense of considering the effects, over various time horizons, of some *fixed* policy, which is maintained throughout. For example, one standard kind of exercise is to consider the short-run and long-run effects of a *sustained* increase in government expenditure, with the only adjustment in the stock of money or bonds being that required to finance the induced government deficits as they occur. This form of analysis is standard practice in modern macroeconomic theory and undoubtedly provides a lot of insight. However, in reality governments do not maintain fixed policies in this way. On the contrary, they are continually changing their monetary and fiscal instruments in order to try and achieve certain specified objectives. Part III therefore takes up the question of stabilization policy, though treating it at a fairly general level. Chapter 13 deals with some of the more traditional aspects of this topic, while some of the more recent developments in optimal stabilization theory are outlined and applied in the concluding chapter.

3 Methodology

We have already remarked that this book is primarily a theoretical exercise. The basic analytical method used is that of comparative statics. Essentially what this involves is to study the economic system at a given state and to see how it is affected by changes in various factors, which at that point of time can be taken as given. Depending upon what is taken as given determines whether we are dealing with a situation of short-run equilibrium or some kind of longer-run steady-state equilibrium. We also consider the evolution of the system over time and where possible discuss its stability properties. In general our strategy is to proceed from a consideration of short-run (sometimes instantaneous) equilibrium to the steady-state equilibrium, to which a stable system will converge.