General introduction

In this book we shall be concerned with the foundations of integrated macromodels of monetary growth dynamics in disequilibrium as they have been laid out (to some extent) in the sixties and the seventies. These foundations are reconsidered and reformulated as well as extended into a uniform and systematic body of macrodynamic models of closed economies with five markets and three agents. The stress here lies on disequilibrium models as we believe that there is an urgent need for progress in this neglected, but nevertheless very relevant, area of macrodynamics. We do not believe that the numerous equilibrium models of monetary growth that have been developed over the last two decades[1] will realize their potential for policy analysis if they are not supplemented and confronted with disequilibrium analyses that try to portray, with more and more descriptive exactness and analytical rigor, the macroeconomy and the policy scenarios to be investigated.

On the one hand completeness of such models is necessary when one wants to provide a systematic and comparative study of them (and their pros and cons) which can then be used as a framework and as a foundation for the further systematic development of this area of macroeconomics. Such a systematic development is almost nonexistent in the literature on disequilibrium monetary growth dynamics. Partial models may of course be of great interest if, as is generally the case, more specialized questions are considered. Yet, it should in principle always be possible to trace back what type of model has been specialized in such a study and what the general model may look like.

On the other hand completeness of monetary growth models with respect to agents and sectoral behavioral descriptions including budget restrictions and with respect to markets and their type of adjustment process is nowadays a compelling prerequisite for a broader acceptance of

[1] See the survey by Orphanides and Solow (1990) for example.

so-called macro ad-hoc (or descriptive) macromodels, to be distinguished from micro ad-hoc macromodels (where ad-hoc refers to the empirical relevance of the micro assumptions that are made). The advantage of such approaches to macro theory indeed lies in the fact that these models can more easily be made complete, and thereby tested with respect to the degree of consistency that is achieved by them, than the many micro ad-hoc models that are now the fashion. These latter models are generally partial in nature because of the restrictions that are caused by the technical complexity of the dynamic intertemporal optimization framework that they employ. Furthermore, the dynamics of such models is by technical necessity generally limited to a study of linearized systems around steady states. Such approaches automatically exclude the type of complex behavior which the models in this book can display.

Complete or integrated macrodynamic models therefore may provide a macro foundation for micro perspectives and be further developed in the light of the achievements obtained from such micro perspectives. Complete disequilibrium macrodynamic models of monetary growth therefore mainly serve the purpose of providing right from the outset a full picture of the economy in states of disequilibrium by means of more or less traditional tools or modules. These modules may subsequently be updated step by step as better descriptions of their micro foundations become available.

As we shall see in this book, there exists now a hierarchically structured class of such models which build upon each other in a step-by-step improvement of the modules they contain. Yet, even though at the end of this book we will be higher up in the hierarchy of our models, there will remain some module formulations that are obviously problematic and which therefore call for significant further improvement. There is thus the need to extend much further the project begun here. Yet, it should have become obvious to the reader by this stage that such a task can be accomplished by continuing to proceed in the manner we have developed in this book. This will indeed give rise to a structured body of theories of monetary growth in disequilibrium, up to the most recent developments of disequilibrium macrodynamics, where insights of earlier achievements are preserved and where a pathway of systematic progress to more convincing and realistic model types becomes visible. This is the main advantage of a method which provides a class of monetary disequilibrium growth macromodels that all attempt to be complete and thereby clearly show the path to their further improvement and the next required step to be taken in their further development.

The resulting prototypes of such models in this book are descriptive in the sense that they generally use traditional macro tools to describe the behavior of the various sectors of their economies. These tools may never-

theless simplify the considered behavior significantly with respect to its descriptive content in order to allow us to proceed from simple building blocks to more elaborate ones in a systematic fashion, thereby filling their descriptive or ad-hoc macro assumptions with more realism step by step. Descriptive components of such macromodels can therefore at first be fairly abstract and stylized in their "descriptive" content, due in particular to the tradition that has been established in the formulation of such components of macromodels. The basic justification for the use of such (sometimes radically simplified) building blocks is that also in this area of macroeconomics one has to start from known model structures and to go from the simple (and abstract) to the more complex (and concrete) by means of a stepwise improvement in the formulation and the analysis of intentionally complete models of monetary growth.

We shall make no attempt here to base the descriptive components of our models on micro assumptions surrounding the concept of representative agents as is now the fashion in macroeconomics,[2] since our central aim is a complete presentation and analysis of the interaction of the three sectors of our economies. This interaction will be made more refined as the book proceeds, leaving a systematic improvement of the behavior of sectors to later studies of these models (where also refinements by means of modern microfounded approaches may be taken into consideration).

The intention of this book on descriptive macrodynamic models thus is to start from the traditional roots of a more or less orthodox formulation of such monetary growth dynamics (in particular Tobin and Keynes–Wicksell models of monetary growth) in order to obtain from them and their detailed presentation and discussion (from the beginning of chapter 4 of the book) a description of a general prototype model which may properly be regarded as a Keynesian one. Such a model, which allows (as should be the case in a Keynesian model) for the investigation of unemployed labor as well as underutilized capital, has rarely been considered in the literature, and certainly not in the fully specified dynamic framework which we shall employ throughout this book.

Instead, a so-called neoclassical production function, and the marginal productivity postulate for the employment of labor, have generally been included in the existing analyses of monetary growth in such a way that only labor is considered as experiencing unemployment (due to nominal wage rigidities).[3] In chapter 5 we shall also allow for neoclassical smooth

[2] Note, however, that most of the (traditional) behavioral relationships we employ have received some micro foundations in the course of their use in macroeconomics.

[3] The exception to this is provided by models of the so-called neo-Keynesian or non-Walrasian type which, however, are seldom as complete as our development and presentation of the working model of Keynesian monetary growth.

factor substitution and then demonstrate that this does not prevent the analysis of underutilized capital in a Keynesian setup. In general, however, we will stick to the simpler assumption of fixed proportions in production, since this makes the Keynesian analysis of underutilized resources much more transparent.

After providing some numerical investigations of the considered models of Tobin, Keynes–Wicksell and Keynes(ian) type with or without smooth factor substitution we shall finally consider two further important extensions of the Keynesian prototype introduced here: a Metzlerian extension of this prototype when IS-disequilibrium is allowed for and a "Marxian" extension of it which avoids the use of "natural" economic magnitudes as much as possible. The final chapter will also point to a variety of omissions in the modeling framework presented here which must be addressed in order to properly make the analysis a Keynesian one, particularly since the behavior of wealth owners is still much too passively modeled in the approaches to monetary growth dynamics presented in this book. Also, investment behavior is still presented far too simply to portray accurately the trade cycle vision of Keynes' *General Theory*. All of these extensions, however, must be left for future research.

We shall consider throughout this book only macroeconomic models which fit into the standard and basic framework of a closed three-sector economy (households, firms, and government), where there exist five distinct markets (for labor, goods, money, bonds [savings deposits], and equities [perfect substitutes of bonds]).[4] Money market transactions are, of course, a mirror image of transactions on the remaining four markets and are to be related to these activities by means of budget restrictions for the three sectors assumed. In table I.1 we use the index d to denote "quantities demanded" and no index in the case of "quantities supplied." Furthermore, since we will use continuous-time models throughout this book we have to distinguish between flow and stock demand and supply since we here follow the macroeconomic tradition which distinguishes between stock and flow constraints in such a setup; see Turnovsky (1977a) and Sargent (1987) for details. This said, the symbols in table I.1 should be clear as to

[4] We restrict ourselves to this standard, basic framework due to our intention to stay, at least initially, very close to orthodox foundations of neoclassical and Keynesian dynamics. The following modeling framework is therefore chosen, initially, as identical to the one that is employed in such a conventional textbook of macroeconomics as that of Sargent (1987); see also Turnovsky (1977a) for a related framework. In this book we shall revise only some of the assumptions (but nevertheless very important ones) that underlie the Sargent approach to complete, or integrated, macroeconomic models. In some respects the contents of this book may thus be characterized as providing simply improved and dynamic counterparts of the three model prototypes that are at the core of Sargent's (1987, part I) mainly static analysis of them.

Table I.1. *Basic structure of closed economies*

	Labor market	Goods market	Money market	Bonds market	Equities market
Households	L	C	$M^d, \dot{M}^d$	$B^d, \dot{B}^d$	$E^d, \dot{E}^d$
Firms:	L^d	$Y, I + \delta K$	—	—	$E, \dot{E}$
Government	—	G	$M, \dot{M}$	$B, \dot{B}$	—

their economic meaning (a detailed list of the notation employed is provided at the front of this book).[5]

Table I.1 shows the basic structure of the closed economies that are considered throughout this book and it is of the same type as the one in Sargent (1987, chs. 1–5) as will become apparent from its further description in chapter 1.

We will model the behavior of our three economic agents in the usual fashion by staying close to behavioral assumptions which are firmly rooted in the tradition of descriptive macroeconomics. This guarantees that the models considered in chapters 2–7 will not depart too much from the established formulations of (textbook) macrodynamic models, though they will be generalized considerably with respect to their degree of integration. As in Turnovsky (1977a), our main aim is to develop and analyze such integrated (or complete) models of monetary growth (of closed economies) in a systematic way. In this respect it is of particular importance that the budget restrictions (BR) of all three sectors, households, firms, government (to be denoted by HBR, FBR, and GBR, respectively), are always fully specified. The behavior of the agents that is assumed to take place within these budget restrictions may, due to the traditional roots of our modeling framework, still not be too convincing. Yet, improved assumptions or derivations for the assumed behavioral relationship can easily be inserted into the complete models employed in this book, thereby changing the description of one or more sectors of the model, but not the overall formulation of the interaction of these sectors. Our conjecture is that such improvements may change details in the models' behavior but not the general finding of this book that the considered models of monetary growth do exhibit a high potential for generating undamped and, if appropriate nonlinearities are assumed, also viable patterns of cyclical growth.

[5] Planned aggregate demand Y^d is, as usual, given by $C + I + \delta K + G$. Note also that table I.1 suggests (again as is customary) that money holdings of firms are considered as unimportant and thus ignored and that there is no bond supply on the side of firms, but only equity financing if necessary.

We start with the most orthodox model of monetary growth that is available in descriptive macroeconomics: the Tobin (1965) extension of the neoclassical growth model which introduces money as a further asset into this otherwise purely real framework. This model will be introduced in chapter 2 in a form that is convenient both with respect to our general assumption of fixed proportions in production as well as from the point of view of the historical development of capitalistic economies. Our particular reformulation of this basic Tobin model will be extended in various directions in chapter 2 leading eventually to a very general formulation of it that serves as a basis for our subsequent introduction of a general model of Keynes–Wicksell type (chapter 3) and later of proper Keynesian type (chapter 4).

The general Tobin model is, however, problematic in its assumption of money-market disequilibrium and the price-adjustment equation that is built upon it. Furthermore its view of the behavior of the firm sector is extremely limited, since it allows only for production decisions in this substructure of the economy. All these weaknesses are overcome (in chapter 3) by our next prototype, the Keynes–Wicksell approach to monetary growth dynamics. Here investment decisions of firms and their financing by means of equities are considered explicitly and made consistent with the other sectors of the economy. Price adjustment is also put on a firmer basis in this model type and gives rise to the famous growth cycle mechanism of Goodwin and Rose as part of this extended framework of analysis and its dynamical implications. The inclusion of these Classical growth cycle mechanisms, by way of an improved wage–price module of the model, in a relatively pure form, is the main contribution that we will obtain from this variation of the Tobin monetary growth model.

Having improved the presentation of asset markets (in particular by assuming money market equilibrium throughout), the goods market remains a problem, since the added description of the investment behavior of firms generally now gives rise to a disequilibrium situation which is not present in the Tobin approach due to its dependence on Say's Law on the market for goods. The further development of the model (in chapter 4) to a basically Keynesian one therefore now adds IS-equilibrium. Following from this latter assumption (and the assumed wage/price adjustment behavior) the degree of utilization of the capital stock becomes the variable which will always adjust appropriately in order to make possible the assumed goods market equilibrium. In contrast to the fashionable full equilibrium version of the Tobin models we thereby arrive at the basic Keynesian prototype structure that will underlie all following generalizations of models of monetary growth exhibiting IS–LM-equilibrium and disequilibrium on the labor market and within firms. These disequilibria

are then used as the basis for wage and price adjustments and the investment decision of firms.

This latter Keynesian prototype will be extended in various directions in chapters 4–7 to allow for factor substitution, technological change, wage taxation, p-star expectations, delayed quantity adjustments, endogenous natural rates and insider–outsider effects in the labor market. By the end of these extensions the Keynesian prototype will have become what we label a working Keynesian model. It will also be demonstrated to the reader that this working model still represents only a starting point (though already a fairly elaborate and consistent one) to a thorough consideration of many further extensions. Indeed section 7.7 provides a survey of such, necessary, extensions.

The way in which the basic "proper" Keynesian prototype, and then the working Keynesian model of monetary growth, is established here will in addition show that this model type overcomes important weaknesses of the predecessor models of Tobin and Keynes–Wicksell type by a systematic variation of them. Nevertheless, each of these two predecessor models is also of importance in its own right, due to the specific topics that have been considered important within these earlier prototypes. The Tobin model, for example, distinguishes between actual and perceived disposable income of households and allows consideration of a number of interesting effects that flow from this distinction, including the fact that it will represent a nonlinear model (again due to this distinction) even if all of its structural equations are linear. The consequences of distinguishing between actual and perceived disposable income will only be considered in chapter 2, while later chapters will again identify perceived with actual disposable income, leaving this specificity of the Tobin approach for the later investigations of our other models.

In our presentation of the various model types we shall mostly employ linear economic behavioral relationships. Thus nonlinearities that appear in the dynamic laws will be naturally occurring in that they are brought about by product terms such as the wage bill, state variable quotients such as the rate of employment, and some formulations being in terms of rates of growth. This serves the purpose of investigating the dynamical systems that are implied at first only in a "naturally" or "intrinsic" nonlinear setup in order to see how much "dynamical complexity" is already involved on this most basic level of the study of integrated economic systems. Occasionally we introduce, however, specific nonlinear behavioral relationships, in particular in investment functions and Phillips curves, in order to maintain economic viability of the dynamics being analyzed. However, we leave for future research a systematic study of the introduction into our general modeling framework of these and other nonlinear economic behav-

ioral relationships which have been proposed in the literature on macroeconomic fluctuations.

Throughout this book we model expectations as a weighted sum of "backward looking" and "forward looking" components. We endow our agents with neither the information of the model structure in which they play out their economic roles, nor the computational ability that they would need to form expectations in a way that is currently referred to as "rational" in a large body of literature. Our reasons for adopting this approach are detailed in section 1.6. In essence these reasons revolve around a critique of the so-called jump-variable technique which the adoption of a "rational" expectations approach would necessitate as well as a growing body of empirical evidence which suggests that our approach to expectations modeling may be more appropriate. However here we stress that the future research agenda to which we have already referred will need to incorporate the effects of heterogeneity of expectations and of learning on the part of the various economic agents of our models.

This concludes the description of the basic line of reasoning that we will employ in the development of our model structure. Since there is a clear progression from model to model in this book we will generally explain the model equations only when they appear for the first time. Before we now proceed to such a systematic step-by-step development of prototype models of monetary growth we will briefly consider in chapter 1 certain roots of these approaches in the literature.

The material presented in chapters 1 to 7 of this book is neither of direct textbook type nor written in the way of a handbook on monetary growth. There is now a variety of advanced textbooks on macroeconomics available, ranging from traditional Keynesian analysis of extended IS–LM type to analysis that claim to go "beyond IS–LM," see in particular Blanchard and Fischer (1989), Carlin and Soskice (1990), Karakitsos (1992), Leslie (1993), Turnovsky (1995), and Romer (1996). On the one hand, we add to these presentations a new hierarchically structured set of theories and models of monetary growth that can be used for classroom teaching. On the other hand, we seek to draw to the attention of writers of advanced textbooks and researchers in the field of macrodynamics the fact that traditional analyses of models of monetary growth cannot be viewed as a set of isolated models. Rather they must be considered as a lively body of systematic studies which, when fully integrated, are still poorly understood and where further investigation will provide a firm foundation and a better understanding of existing and future developments in this area.

This book is also not a handbook on aspects of monetary economics or more precisely a survey on the theory of monetary growth, as provided, for example, by Orphanides and Solow (1990). Instead we show that there still

exists a large evolutionary potential in traditional macrodynamics that leads us to integrated macrodynamical models with Keynesian short-run features and Keynesian and monetarist features in the medium run as well as in the long run. These integrated models not only allow us to evaluate the contributions of the two schools of economic thought from this integrated perspective, but also serve to put into perspective more recent contributions to the theory of fluctuations and growth in monetary economies. In this way our book provides a benchmark against which alternative approaches can be judged and be developed further, including the working model of this book, towards a common core of macrodynamics that "we all can believe in."

1 Traditional monetary growth dynamics

1.1 Introduction

We reconsider in this chapter the leftover ruins of traditional monetary growth dynamics[1] which, with respect to the general dynamics they can give rise to, have so far been poorly analyzed and understood in the literature.[2]

We attempt to show to the reader, in section 1.2 in overview, and in detail in chapters 2–5, that these leftover ruins can be arranged and represented in a systematic way so that they form a hierarchical structured class of monetary growth models where each subsequent model type eliminates some of the weaknesses of the preceding model type. We then indicate in section 1.2 two ways in which this methodological approach to macrodynamics can be significantly extended beyond the existing scope of traditional models of monetary growth. Firstly, this way of proceeding in fact leads to the establishment of a proper (still traditional), but much neglected Keynesian model of monetary growth where both labor and capital exhibit fluctuating degrees of utilization independently of the assumptions that are made on "technology." Secondly, our approach leads to a further improvement of this IS–LM growth type of dynamics by allowing for sluggish price, as well as quantity, adjustments (two Phillips-curve mechanisms and a Metzlerian treatment of disappointed sales expectations) and by establishing thereby what we will call the working Keynesian model of this book. Section 1.2 therefore provides a survey of what we call the macro foundations of (disequilibrium) macroeconomics, namely the indication that there is a systematic way of proceeding from less sound and

[1] See Turnovsky (1995, part I) with respect to another reconsideration of integrated macrodynamics of traditional type.

[2] See for example Sargent's (1987, ch. 5) analysis of "Keynesian Dynamics" of AS–AD type and its reconsideration in Flaschel (1993, ch. 6–7) and Franke (1992a), or Stein's (1982) investigation of dynamic models of Keynes–Wicksell type and its reconsideration in Flaschel, Franke, and Semmler (1997, ch. 10).