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Structural Change in Macroeconomic Models

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Structural Change in Macroeconomic Models
Theory and Estimation

by

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Preface

This book grew out of a 'Doctorat D'Etat' thesis presented at the University of Dijon—Institut Mathematique Economiques (IME). It aims to show that quantity rationing theory provides the means of improving macroeconometric modelling in the study of structural changes. The empirical results presented in the last chapter (concerning Portuguese economy) and in the last Appendix (concerning the French economy), although preliminary, suggested that the effort is rewarding and should be continued.

My debts are many. An important part of the research work was accomplished during my visit to the Institut National de la Statistique et des Etudes Economiques (INSEE, Paris), where I have beneficted from stimulating discussions (particularly with P. Villa) and informatical support. I have also received comments and suggestions from R. Quandt, J.-J. Laffont, P. Kooiman and P.-Y. Henin.

I am specially indebted to P. Balestra for encouraging and valuable discussions, particularly in the field of econometric methods.

My thanks go also to an anonymous referee. His constructive criticism and suggestions resulted in a number of improvements to an earlier version of this book.

I cannot forget my friend A. Costa from BPA (Porto) who has helped me in the preparation of this work.

Last but not least, I would like to thank my wife for her encouragement and patience throughout these years.

Of course, I am the only one responsible for any remaining errors.

Contents

Introduction

Macroeconometric modelling has improved considerably since Jan Tinbergen and Laurence Klein's pionner work in the 1940s. A clear sign of that development is the fact that all industrialised countries have since then built their own macroeconometric models, for the assessment of alternative economic policies.

It comes as no surprise, however, to find that macroeconometric models have not always enjoyed unanimous support. Yet, considerable agreement on their virtues prevailed in the 1960s and early 1970s. Then "they were seen as a skillful combination of several ingredients, namely macroeconomics and econometrics, statistics, numerical calculus and computing, that provided a reasonably accurate representation of the past, and gave plausible results to simple problems. They inspired trust and proved reliable".[1]

Alas, things soon changed with poor predictions and when models failed to explain the recent oscillations in the level of economic activity. Caution prevailed as economists and econometricians reassessed macroeconometric modelling and two new streams of though emerged.

Economists and econometricians in the first group are very much against macroeconometric models. They argue that the low quality of the results does not offset their great complexity. The argument is supported with evidence from cases where highly sophisticated models have been shown to be no better than simple ones.[2] They believe that we should stick to the use of simple and small models, thereby ensuring that discussions about macroeconomic policy are carried out in clear terms, easily understood by all. This was strongly criticised by Malinvaud,[3] who called it the "temptation towards short cuts".[4]

Economists and econometricians in the second group are not against macroeconometric modes; instead, they argue that the art

of macroeconometric modelling is still very crude, so one should not be surprised by the fact that they fail to fit the complex nature of the economic relationships of the real world. This group argues that a considerable research effort is still needed, before macroeconometric models can be relied upon in the design of economic policies.

The way advocated by this second group is the most promising. The present work is intended to be part of that research effort towards better macroeconometric models, free of the critical shortcomings which led to their rejection by some, namely their inability to account for structural changes in the economy as they occur through time.[5]

The shortcoming lies in the traditional approach whereby structural changes can only be imposed exogeneously. That is, their specification is such that any alteration in the behaviour of the economy[6] can only be reflected in the model through an exogenous modification of at least one of the three following elements: (i) the functional form of the equations, (ii) the values of the parameters, and (iii) the properties of stochastic disturbance terms.

This approach has two significant drawbacks.

The first is that it cannot explain structural changes because it fails to make them endogenous to the model. Before the approach can be used, it must be shown that the observed behaviour, for some of the years under study, is significantly different from the modelled behaviour. It only then becomes possible to 'model' these differences through a modification of the model for the concerned years (in general one uses dummy variables, which, as we know, take on a unitary value for the 'abnormal' years and a zero value for the remaining years of the period).

The second drawback is that the model may fit well in the sample period, while being inappropriate for forecasting purposes. The reason is straightforward: we can observe the past but not the future. The introduction of dummy variables may improve the model's degree of fit over the observed years, but it does not help to predict values in the future.

Summing up, the exogenous modification of the structure of a model, in response to a structural change in the economy which the model attempts to represent, is not good enough. The problem is that there is no other alternative for dealing with structural changes in the context of traditional macroeconometric models.[7]

As we said above, the present work aims to solve this difficulty. In particular, a new approach for model specification is put forward, which provides macroeconometric models with the facility to interpret endogenously any structural changes that may occur in the economy, however strong they may be and regardless of their nature. We will refer to these models as 'models for the study of structural changes'.

An obvious idea lies at the root of our approach. A macroeconomic model is able to explain the behaviour of an economy if its specification can be such as to describe the working of the economy for every kind of state or regime in which the economy may find itself. It would then be up to the estimation of the model to identify which regimes the economy had followed thoughout the observed years, as well as the change from one regime to another.[8] This means that the specification of a model for the study of structural changes must follow a different path from that used by traditional macroeconometric models. The latter are single regime models, i.e. they represent a single state of the economy. The former are multi-regime models, i.e. the states on which the economy finds itself are endogenous to the model; the estimation of the model will then identify which regime best suits each one of the states of the economy.

Our research on macroeconometric models for the study of structural changes is organised in four stages.

First, we examine the underlying theoretical framework. It should provide a clear typology for the regimes, i.e. it should be able to identify the states of the economy as well as what is involved in a change in regime.

Second, with the help of the theoretical framework, we look into the important question of how to specify such models.

Third, we develop the econometric techniques to be used in the estimation of the parameters of the model under study. These techniques should not be too complex, so that they can be easily applied to large models.

Finally, the usefulness of the approach is illustrated with a case study. We choose an economy which has recently been subjected to important structural changes, so that the ability of the model to deal with significant exogenous impacts may be tested.

The book has four chapters, one for each of the stages of the research just described. Let us make a brief preview of each chapter.

Chapter 1 looks into recent developments in non-Walrasian macroeconomics, also known as 'macroeconomices with (quantity) rationing' or macroeconomics when markets do not clear. These developments assume prices do not adjust fast enough to ensure that supply and demand are balanced in every market.[9] We will argue that non-Walrasian macroeconomics can provide a sound theoretical framework for the specification of macroeconometric models for the study of structural changes. Still, there are some major difficulties to be solved beforehand. A critical survey of macroeconometric models with quantity rationing is undertaken, and their usual specification will be found to require some adjustments before it can be used in the study of structural changes. The adopted formalisations are either too close or too far from theoretical models.

Chapter 2 develops an eclectic approach to the specification of a macroeconometric model for the study of structural changes. Inasmuch as theoretical developments are outside the fundamental scope of our research, and that the theoretical models, as usually formulated, do not meet the empirical requirements, only those elements which prove to be useful in our research or to have some empirical value will be taken into account. Obviously, we will not loose sight of the theory, for the proposed model should reflect, as much as possible, its main contributions.

The fundamental idea in the model is that shortages in demand, production capacity and labour supply are the three bottlenecks in the activities of any firm, and therefore, in the levels of production and employment in the economy. This is reflected in the specification of the model, which includes four interdependent blocks. Three of the blocks define the levels of production and employment when firms are assumed to be restricted systematically by one of the three bottlenecks. This means that each block, in isolation, sets 'potential' values and not effective values for the levels of production and employment. Effective values are then set by the fourth block, in conjunction with the first three blocks. Production function plays a critical role in the specification of this model. We will, therefore, examine this question in detail, including the reasons which led us to select a capital vintage production function (a Clay–Clay production technology). The chapter closes with a discussion about the ability of the model to deal with structural changes.

Chapter 3 deals with the econometric techniques to be used in the estimation of models embodying structural changes—or multi-regime models. It begins with a survey of the techniques used in the estimation of two-regime linear models. Next, it discusses the estimation method to be used with the proposed model which comprises three non-linear regimes. After solving some of the difficulties related with these extension and the peculiarities of the adopted specification, we propose a non-linear two-stage least-squares method. This method is then justified with special attention being given to the estimation of the Clay–Clay production function.

Chapter 4 illustrates the usefulness of the proposed model for the study of structural changes by using a case study of the Portuguese economy for the years 1955 to 1979. Our attention will be focused on the ability of the model to explain the economic effects of exogenous changes which occurred in 1974 and 1975, following the revolution that broke out on the 25th of April, 1974.

Notes

1. Artus and Nasse (1979, p. 96).
2. See, for example, Cooper (1972).
3. Malinvaud (1981)
4. We may link this line of thought with the more recent studies involving time series analysis, namely the so-called Box–Jenkins methods. For a detailed bibliography, including comparisons with the econometric approach, see Monfort (1978).
5. The critical role played by this shortcoming is stressed in the following quotation from Ullmo (1980, p. 5): "However great the advance to applied macroeconomics brought about by econometrics in the 1970's, shouldn't macroeconometric models be seen as no more than an oversimple representation of the real world, unable to take changes in structure and in behaviour into account?"
6. This is the definition of structural change to be adopted for the moment. We will come back to it later.
7. Traditional macroeconometric models will only be appropriate when the two following conditions are met: (i) the economy remains in the same regime through time, i.e. using Hendry (1983) terminology, observed data are generated by unique process having constant parameterisation, (ii) the equations are good representations of this generating process, i.e. the model is the 'true' model. Clearly nobody argues that these two conditions are met.
8. This is the definition of structural change to be adopted henceforth. Several definitions for this term appear in economic literature. Even in 1950 Machlup

(1950) (quoted in Varga (1980, p. 57)) examined the semantics of the term structural change and discovered over twenty different usages for it in economics. Note that, according to the adopted definition, the model does not have to be a discrete switching model. As we shall see this kind of structural change can also be represented, though in a less attractive way, using a smooth approach.

9. Non-Walrasian macroeconomics is often called disequilibrium macroeconomics in reference to this underlying hypothesis. However, this designation should be avoided, because, as we shall see, can be quite misleading.

1. Macroeconometric models with quantity rationing

In recent years there have been important developments in macroeconomics based on the principle that markets do not necessarily clear because prices adjust too sluggishly or in the wrong direction.[1]

The fundamental assumption of this approach is that quantities adjust faster than prices. It might happen that agents sometimes are unable to exchange on one market all their goods at the prevailing price. If so, the transactions on the other markets will also be affected. For example, if firms cannot sell all their production, they will reduced their demand for labour.

One implication of this type of theory (particularly important to our study) is the possibility of formalising a type of structural change, i.e. economies passing through distinct regimes, each of them being ruled by different but stable behaviour relationships.

According to the above theory, there are mis-specifications and even incoherences in usual macroeconometric models. They contain mis-specifications because they represent economies which are constantly in a Keynesian regime, i.e. in a situation characterised by an excess supply of goods and labour (see the typology in Malinvaud (1977)).

The models also have incoherences because they are based on the principle that prices adjust quickly enough in order to clear each market. But if one assumes these microeconomic foundations, one will obtain different behavioural equations.

Some attempts have been made to amend this. For instance, pressure indicators (like the rate of unemployment and the degree of under-utilisation of production capacities) and even supply constraints (by defining the productive capacity) have been included.[2] According to Muellbauer (1978), these changes, made with the preoccupation of 'realism' and in accordance with an empirical but mostly unsystematic methodology, did not overcome the problems