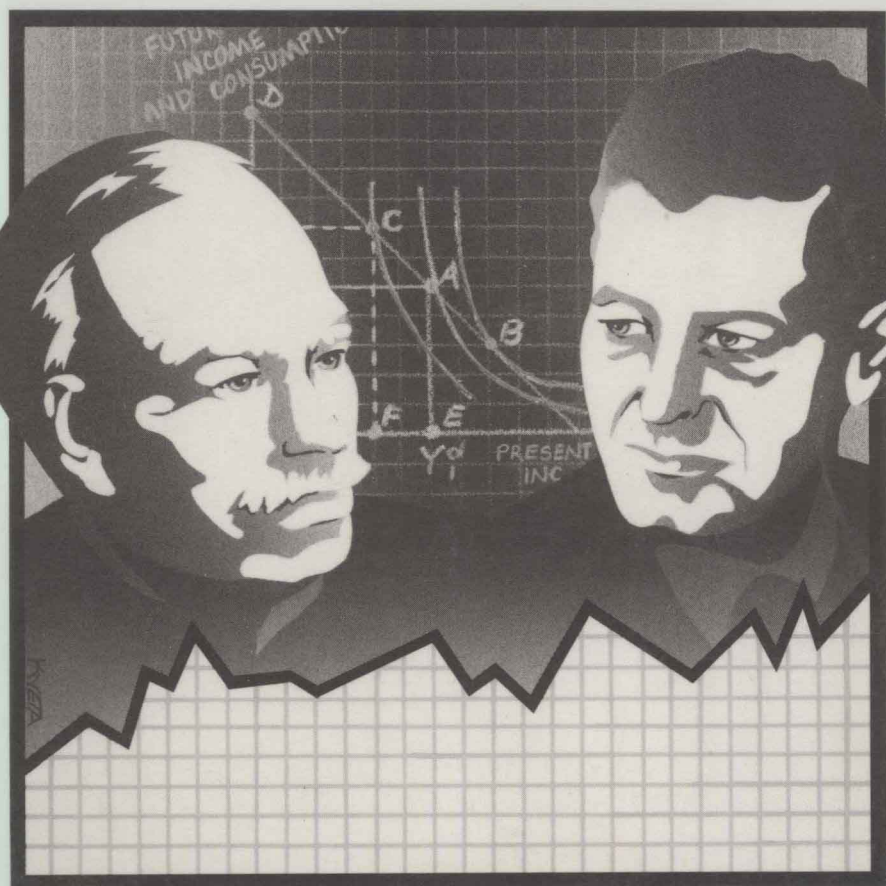


MACROECONOMICS

An Introduction to Advanced Methods



WILLIAM M. SCARTH

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TO MY PARENTS

PREFACE

In the late 1970s, Thomas Sargent and Robert Lucas argued that conventional macroeconomic methods were “fatally flawed”: since then, macroeconomics has become a most exciting part of our discipline. After all, it is stimulating to be involved in the very initiation of a new research agenda. But while all this activity has been exciting for researchers in the field, it can be frustrating for students and their instructors. Journal articles by original researchers rarely represent the best pedagogic treatment of a subject, especially when the analysis involved becomes quite technical.

I have taught both graduate students and upper-level undergraduates throughout the last fifteen years, and have found that these developments in our subject have created an increasing demand, from year to year, for an organized set of lecture notes. This book is the result — an attempt to fill the gap between intermediate texts and the advanced analysis found in the journals. While it can be used on its own with upper-level undergraduates, at the MA level the book is intended to complement, rather than to replace, the journal readings.

The theme of the book is that a useful synthesis of Keynesian and New Classical ideas *can* be constructed, and is indeed now emerging. For example, the internal consistency that follows from well-specified micro foundations is an advantage of the New Classics, but this methodology can be exploited by Keynesians if their analysis is based on well-defined reasons for market failure.

Some Keynesians do not regard the imperfect micro underpinnings of their models as an important limitation. They consider the methods used by rational-expectations theorists to solve nonuniqueness problems just as arbitrary as not basing macroeconomics on formal constrained maximization. Instead, these Keynesians focus on certain empirical-prediction problems in some of the New Classical models. New Classics, on the other hand, downplay such empirical limitations on the grounds that it is no victory for Keynesian models to obtain better fits simply by allowing more of what they call free parameters.

Strengths and weaknesses such as these, on both sides of the debate, are

explored throughout the text. Among the issues considered are: nonuniqueness problems with rational expectations, stabilization policy analysis (incorporating the Lucas critique), stock-flow dynamics, open-economy issues, micro models of sticky wages, and the effects of the rational expectations approach on empirical work. A brief chapter-by-chapter summary of the book's contents is provided on pages 4–5 of Chapter 1.

Using basic mathematics throughout, this text will introduce its readers to the actual research methods of macroeconomics. But in addition to explaining methods, the book presents the underlying logic at a common-sense level to help elucidate the essence of each controversy.

Before writing this book, I asked myself why, if a text like this one is so necessary, hasn't someone already written it? I think there are two parts to the answer. First, the literature was initially developing at such a pace that only a daring author would attempt to set down what the key conclusions might be that would have lasting significance in the years to come. But now that some of the issues are more settled, important elements of a synthesis have come to light. Thus, and only quite recently, has the extent of the gamble for the prospective textbook writer decreased significantly. The second consideration is that many macroeconomists are either in one camp or the other, and so are not particularly interested in expositing a synthesis.

It is obvious that my particular emphasis on the different issues will not coincide with that favored by all instructors. One reason for keeping the book a concise, reasonably priced paperback is to allow instructors to assign numerous "favorite" journal articles to be read along with the text. The book is meant to make those articles more accessible.

Comments and suggestions from users are most welcome, and may be sent to my attention, in care of the publisher.

I have many debts to acknowledge. The following economists have either made helpful comments on an earlier draft, or have been a general source of insight during numerous conversations on macro issues, or have helped in both capacities: Roy Bailey, John Burbidge, James Butkiewicz, Thomas Cargill, Peter Howitt, Peter Kennedy, David Laidler, Bennett McCallum, Tony Myatt, Thomas Moutos, Gord Myers, Michael Parkin, Craig Riddell, Brian Scarfe, John Smithin, and Junsen Zhang. I also wish to thank Tom Sargent for his encouragement to complete this project. It should, of course, be emphasized that none of these individuals can be held responsible for how I may have filtered their remarks.

As to the production of the book, many individuals at Harcourt Brace Jovanovich, Canada were most helpful. In particular, Keith Thompson, Darlene Zeleney, and Lenore d'Anjou were remarkably understanding and flexible, while making significant contributions at every stage.

But my greatest debt is to my wife, Kathy, whose unfailing love and support have been invaluable.

MACROECONOMICS

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Preface / xi

CHAPTER 1 Microeconomic Foundations 1

1.1 Introduction / 1

1.2 Firms in the Standard Macro Model / 5

1.3 Households in the Standard Macro Model / 10

1.4 The Labor Market / 15

1.5 Conclusions / 20

CHAPTER 2 Aggregate Demand and Supply 22

2.1 Introduction / 22

2.2 The Structural Equations / 22

2.3 Short-Run Analysis / 27

2.4 Convergence or Stability Analysis / 29

2.5 Full Equilibrium Analysis / 32

2.6 Alternative Government Policies / 32

2.7 Some Implications of Uncertainty / 34

2.8 Conclusions / 38

CHAPTER 3 Keynes and the Classics 39

3.1 Introduction / 39

3.2 The Labor Market with Flexible Wages / 40

3.3 Money-Wage Rigidity / 45

3.4 Money-Wage and Price Rigidity:
 “Generalized Disequilibrium” / 48

3.5 Conclusions / 51

CHAPTER 4	Expectations and the Desirability of Wage and Price Flexibility	52
4.1	Introduction / 52	
4.2	Adaptive Expectations / 53	
4.3	Inflationary Expectations and the Monetary Instrument Question / 57	
4.4	Cagan's Convergence Requirement / 59	
4.5	Perfect Foresight / 62	
4.6	Conclusions / 64	
CHAPTER 5	Rational Expectations and the Lucas Critique	65
5.1	Introduction / 65	
5.2	Static and Rational Expectations Compared / 66	
5.3	The Lucas Critique / 73	
5.4	Sticky Wages and Prices / 75	
5.5	Conclusions / 79	
CHAPTER 6	Rational Expectations: Current Controversies	80
6.1	Introduction / 80	
6.2	Time Inconsistency / 80	
6.3	Alternative Information Sets / 83	
6.4	Problems of Nonuniqueness / 86	
6.5	Announcement Effects / 90	
6.6	Conclusions / 101	
CHAPTER 7	Intrinsic Dynamics	102
7.1	Introduction / 102	
7.2	The Ricardian Equivalence Controversy / 103	
7.3	Financing Budget Deficits: Aggregate Demand Considerations / 107	
7.4	Financing Budget Deficits: Aggregate Supply Considerations / 115	
7.5	The Desirability of Bond-Financed Deficits / 118	
7.6	Conclusions / 121	
CHAPTER 8	An Introduction to Open-Economy Macroeconomics	123
8.1	Introduction / 123	
8.2	The Standard Mundell/Fleming Model / 123	
8.3	Fixed Exchange Rates: The Impact Period / 127	
8.4	Fixed Exchange Rates: Full Equilibrium / 128	
8.5	Flexible Exchange Rates / 129	

8.6 Graphic Summary for the Small, Open Economy /	131
8.7 Conclusions /	132

CHAPTER 9 **The Open Economy: Recent Contributions** **134**

9.1 Introduction /	134
9.2 Exchange-Rate Expectations /	134
9.3 Supply-Side Effects of Exchange Rates /	138
9.4 Stocks versus Flows in the Balance of Payments /	142
9.5 Conclusions /	144

CHAPTER 10 **Theories of Sticky Wages and Unemployment** **146**

10.1 Introduction /	146
10.2 Risk-Sharing and Implicit Contracts /	147
10.3 The Efficiency-Wage Hypothesis /	151
10.4 Unions in the Labor Market /	153
10.5 Adjustment Costs /	156
10.6 Multiple Equilibria /	158
10.7 Conclusions /	161

CHAPTER 11 **Current Controversies** **162**

11.1 Introduction /	162
11.2 Stabilization Policy /	163
11.3 Empirical Considerations for Particular Structural Relationships /	166
11.4 Alternative Theories of Business Cycles /	173
11.5 Conclusions /	180

APPENDIX **Aggregation Issues** **183**

A.1 Introduction /	183
A.2 Aggregation across Goods /	183
A.3 Aggregation across Capital Goods /	185
A.4 Aggregation across Tradable Assets /	186
A.5 Aggregation across Individuals /	188
A.6 Conclusions /	188

<i>Questions</i> /	189
<i>References</i> /	197
<i>Index</i> /	207

MICROECONOMIC FOUNDATIONS

1.1 INTRODUCTION

Fifty years have elapsed since the publication of Keynes's *The General Theory of Employment, Interest and Money*, yet the controversy between his followers and those macroeconomists who favor a more classical approach has never been more active. The purpose of this book is to examine this controversy and to draw attention to developments suggesting that progress toward a synthesis of important ideas from both traditions can be—and is being—accomplished.

To ensure a useful selection of macro models, the economist must use two broad criteria. First, models must be subjected to empirical tests, to see whether the predictions are consistent with actual experience. This criterion is fundamentally important. Unfortunately, however, it cannot be the only one for model selection, since empirical tests are often not definitive. Thus, while progress has been made in developing applied methods, and further work in this area is most important, macroeconomists have no choice but to put at least some weight on a second criterion for model evaluation.

Since the hypothesis of constrained maximization is at the core of our discipline, many argue that macro models should be evaluated as to their consistency with optimizing underpinnings. Without a microeconomic base, there is no well-defined basis for arguing that an ongoing stabilization policy improves welfare. Keynesians must acknowledge this point. They must also admit that it is utility and production functions that are independent of government policy; agents' decision rules do not necessarily remain invariant to shifts in policy. A specific microeconomic base is required to derive how private decision rules may react to major changes in policy. Another advantage is that a specific microeconomic rationale imposes more structure on macro models, so the corresponding empirical work involves fewer "free" parameters (parameters that are not constrained by theoretical considerations and can thus take on whatever value will maximize

the fit of the model). It must be admitted that the empirical success of a model is compromised if the estimation involves many free parameters.

Despite these clear advantages of an explicit microeconomic base, those who typically stress these points—the New Classics—must make some acknowledgments too. They must admit that thus far their models are inconsistent with several important empirical regularities (as we shall see in Chapter 11). Also, since the primary goal of this school of thought is to eliminate arbitrary assumptions, its followers cannot downplay the significance of aggregation issues or of the nonuniqueness problem that often plagues the solution of their models. (This latter problem is thoroughly discussed in Chapter 6.)

Where does all this leave today's student of macroeconomics? Controversy always provokes a variety of reactions: some people are excited by it, while others are confused. Some see the discipline as becoming fragmented into schools of thought that do not interact; others take the opportunity to combine the best features of the competing approaches so that real, lasting progress occurs. Happily, a growing number of macroeconomists have recently been having the latter reaction, with promising results. This group, sometimes referred to as the New Keynesians, acknowledges that stabilization policy must be justified by reference to a clear source of market failure—one that any well-trained microeconomist would recognize. This group is beginning to exploit the concepts and solution methods used with the rational expectations hypothesis, seeking to bring more rigor to Keynesian notions such as multiple equilibria. These economists are trying to combine the rigor of the New Classics with the policy concern that stems from the Keynesians' belief in certain market failures. Given today's limits on tractability, this group of economists often disappoints strict New Classics to some degree regarding the completeness of their model's underlying microeconomic rationale. New Keynesians respect this criticism, however, and are attempting to overcome it. We hope that by highlighting their work, this book will support the development of a constructive synthesis.

The Structure of Models

The purpose of any model is to provide answers to a series of if-then questions: if one assumes a specified change in the values of the exogenous variables (those determined outside of the model), what will happen to the set of endogenous variables (those determined within the model)? A high degree of simultaneity seems to exist among the main endogenous variables (for example, household behavior makes consumption depend on income, while the goods market-clearing condition makes income depend on consumption). To cope with this simultaneity, we define macro models in the form of systems of equations for which standard solution techniques can be employed. A model comprises a set of structural equations—definitions, equilibrium conditions, or behavioral reaction functions that are assumed on behalf of agents.

Mainstream macroeconomists have disciplined their selection of alternative

behavioral rules by appealing to microeconomic models of households and firms. In other words, their basis for choosing structural equations is constrained maximization at the individual level, without much concern for problems of aggregation. To keep the analysis manageable, they often restrict attention to particular components of the macroeconomy one at a time, recording the resulting decision rules (the consumption function, the investment function, the money-demand function, and so on, which are the first-order conditions of the constrained maximizations) as a list of structural equations. This series of equations is then brought together for solving as a standard set of simultaneous equations in which the unknowns are the endogenous variables.

In other words, the procedure has two stages:

Stage 1: Derive the structural equations, which define the macro model, by presenting a set of unconnected constrained maximization exercises (that is, do a set of independent microeconomic problems).

Stage 2: Use the set of structural equations to derive the solution or reduced form equations (in which each endogenous variable is related explicitly to nothing but exogenous variables and parameters) and perform the counterfactual exercises (for example, derivation of the policy multipliers).

Until about 1970, macroeconomics developed in a fairly orderly way, following this two-stage approach. In recent decades, however, the discipline has seen some changes in basic approaches following from the fact that macroeconomists have tried to consider even more consistent and complicated theories of household and firm behavior. That is, the specification of the constrained maximizations in stage 1 of the analysis has been made more general by allowing for such things as dynamics and the fact that agents must make decisions on the basis of expectations of the future.

This expansion has led to some conceptual and methodological complications. Many analysts now regard it as unappealing to derive any one component structural equation without reference at stage 1 to the properties of the overall system. For example, if agents' behavior turns out to depend on expected inflation, it is tempting to model their forecast of inflation so that it is consistent with the actual inflation process, which is determined as one of the endogenous variables within the model. From a technical point of view, such an approach means that stages 1 and 2 must be considered *simultaneously*. It also means that the form of at least some of the structural equations and, therefore, the overall structure of the model itself depends on the assumed time paths of the exogenous variables. Thus, it may be a bad practice for economists to use an estimated model found suitable for one data period when they predict what would happen in another period under a different set of policy rules. We shall consider this problem, which is referred to as the Lucas critique, at various stages in later chapters; for the introductory material in this and the next three chapters, however, we shall restrict ourselves to models whose structures are assumed to be independent of the behavior of the exogenous variables.

The Plan for This Book

The overall plan of the book is as follows. The remainder of this chapter will present the basic microeconomic foundations for standard macroeconomics. Then, in Chapters 2 and 3, we shall review the standard aggregate demand and supply model to clarify the key distinctions between Keynesian and Classical positions and to explain the formal methods for deriving policy multipliers and stability (convergence) conditions. Expectations of inflation will be introduced in Chapter 4, as we focus on the question: is an increased degree of wage flexibility a good thing for macroeconomic stability?

The question of how to model expectations has been at the core of recent controversies in macroeconomics, so Chapters 5 and 6 will be devoted to examining how the hypothesis of rational expectations affects the debate on whether ongoing stabilization policies should be pursued. Once our assumptions concerning expectations are more explicit, we can distinguish the effects of unanticipated disturbances from the anticipated results of current and future policy measures. Important issues such as nonuniqueness and the credibility of policy rules will be examined here.

A macro model is necessarily dynamic if it includes accumulation identities that relate the stock and flow variables. Examples of such accumulation identities include: (1) in a closed economy, the increase in the stocks of money and government bonds must equal the government budget deficit; and (2) in an open economy, a balance of payments deficit (which reduces the central bank's holdings of foreign exchange reserves) must change the level of some other central bank asset or liability and, therefore, the stocks of money or government bonds outstanding. Chapters 7 to 9 will examine the implications of these sources of intrinsic dynamics, so that we can reach conclusions concerning the importance of budget deficits and the relative efficacy of fixed and floating exchange rates.

One important theme emerging from the macroeconomic analyses is that "sticky" wages are important for the Keynesian explanation of business cycles. Thus, in Chapter 10 we shall consider a series of microeconomic models that have been proposed to explain sticky wages. In Chapter 11, we shall discuss two empirical issues: (1) using the data as the criterion, how does the sticky-wage approach to explaining business cycles fare compared to Classical theories? and (2) how does the rational expectations approach change the way in which analysts undertake empirical work on particular structural relationships?

Also in Chapter 11, we shall return to a discussion of how policy can be used to affect the built-in stability characteristics of the economy. It is emphasized that the macroeconomic tools that have been pioneered by the New Classics can be fruitfully applied to policy proposals that are typically advocated by Keynesians. This permits us to end our study by clarifying the payoff that follows from learning these methods, whatever the individual's policy priors may be.

Before we begin our progression through macroeconomic issues, we must determine whether the usual intertemporal theories of decision-making by households and firms can provide an adequate microeconomic rationale for macroeconomics. This issue will occupy us for the remainder of this chapter. (These

sections, as well as the remaining chapters of the text, have been written so that the material on micro foundations can be read at any stage. Thus, if the reader wishes to postpone consideration of these issues, he or she can proceed directly to the analyses of macro models in Chapter 2.)

1.2 FIRMS IN THE STANDARD MACRO MODEL

In the standard macro model, we assume firms produce real output, Y , by combining labor, N , and capital, K , according to a production function:

$$Y = F(N, K).$$

The assumptions that both marginal products are positive but diminishing are incorporated by two restrictions: $F_N, F_K > 0$ and $F_{NN}, F_{KK} < 0$, where subscripts stand for partial derivatives. We also assume that the two factors are complements: $F_{NK} = F_{KN} > 0$.

Now consider a set of perfectly competitive firms that wish to maximize the present value of net revenues for their owners:

$$PV = \sum_{t=0}^{\infty} \left(\frac{1}{1+r} \right)^t \left[P \cdot F(N_t, K_t) - WN_t - P_I I_t - bP_I I_t^2 \right],$$

subject to the accumulation identity,

$$I_t = (K_{t+1} - K_t) + \delta K_t,$$

where I stands for gross investment, P for product selling price, P_I for the purchase price of investment goods, W for the money wage, r for the real interest rate, and δ for the depreciation rate. The t subscripts indicate time periods.

At each point in time, net revenue equals sales, PY , minus the wage bill, WN , minus the purchase costs of investment goods, $P_I I$, minus the installation costs for capital, $bP_I I^2$. With $b > 0$, we have assumed that firms incur disruption costs when adjusting their capital stocks. The quadratic functional form is the simplest specification that has these adjustment costs increase more than in proportion to the amount of investment undertaken, as shown in Figure 1.1.

Figure 1.1 Installation Costs Incurred during Investment

