ABSTRACT

This paper presents a representative set of three macroeconomic models out of a larger set of models used to teach macroeconomic theory and policy analysis at the intermediate level. Besides solving the models by hand, students solve them on the microcomputers. This pedagogical approach is designed to accomplish three objectives: (1) to answer student criticisms that most macroeconomic textbooks do not present them with concrete, numerical models, (2) to improve students' mathematical skills, and (3) to reinforce computer skills.

INTRODUCTION

A few years ago when I began teaching macroeconomics, I soon realized that a deficiency common to almost all textbooks was that they tended to utilize economic concepts which were highly abstract for most students and they never seemed to reduce the concepts to a concrete, operational level, or model which the students could easily manipulate. Student complaints about a variety of texts that we tried through the semesters first made me aware of this problem. Finally, in response to their continued pleas for more concrete examples that they “could get a handle on,” I began developing a series of macroeconomic models of the economy to illustrate the major schools of thought. At first we used the mainframe computer at the university but later when we acquired a number of microcomputers which were readily available to students, we modified our models to run on the micros. Over the years, the series of examples, along with their attendant explanations, has gradually grown into the main pedagogical device that we use in teaching Intermediate Macroeconomic Theory. The purpose of this paper is to present three of the models that are used in class, to discuss briefly the advantages and disadvantages of this technique, and to inform you of future plans for the project.

The Classical School of Thought

Two models of the classical system are presented. The first contains only production and consumption sectors—no government sector. Illustrative simulations, using this model, include:

1. Impact of a policy decision by the Fed to change the money supply.
2. Effect of a shift in the economy’s production function caused by a change in technology.
3. Impact of a change in profit expectations of businessmen manifesting itself through a shift in the investment function. Figure 1 presents the BASIC computer program to accomplish these simulations. Data entry is explained in program statements 140-220. Figure 2 presents the mathematical model, the values of parameters, exogenous variables, and policy variables, data statements for each simulation, and the output for each simulation. The first simulation demonstrates the classical conclusion that increasing the money supply merely influences the...
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price level—when the money supply is doubled, the price level doubles, and so on. Equilibrium values of real variables are left unchanged. The second simulation shows how an increase in the economy’s production function, through perhaps improved technology, can increase real output and the real wage as well as lower the price level. The third simulation demonstrates that increased profit expectations under the classical model, manifesting themselves through an increased demand for loanable funds, will tend to increase the interest rate as well as increase the equilibrium values of the quantity of loanable funds demanded and supplied.

The second classical model introduces the government sector into the model equations, making adjustments in variable definitions where necessary, and simulates the following situations: 1. A growing government with a balanced budget. 2. Growth in government financed by borrowing. Figure 3 presents the computer program to accomplish these simulations. Data entry is explained in program statements 210-320. Figure 4 then presents the mathematical model, the values of parameters, exogenous variables, and policy variables, as well as the output of each simulation. The first simulation demonstrates the classical conclusion that if government finances its own growth through taxation, the result will be a partial “crowding out” of the consuming sector. The second simulation shows that if the expansion is financed through borrowing rather than through taxation, both the consuming sector and the investment sector (i.e., the private demand for loanable funds) will be partially “crowded out.”

The Keynesian School of Thought

In class, we first develop the familiar two-sector model consisting of a consumption sector and a production sector. We solve the algebraic model under the assumption that investment is exogenous. Second, we introduce the government sector with its attendant modifications. Third, we return to the question of investment and introduce an investment function that changes the investment variable from an exogenous to an endogenous status. Finally, we add the monetary sector, which enables us to develop the familiar IS/LM analysis. Since the Keynesian models, at this stage, are all linear, and since our students have been exposed to matrix algebra by the time they take this course, in the junior or senior year, we use a matrix format to set up the models for computer solution:

\[
\begin{bmatrix}
A \\
X
\end{bmatrix}
= 
\begin{bmatrix}
B
\end{bmatrix}
\]

where \([A]\) is the matrix of coefficients, \([X]\) the vector of solution variables, and \([B]\) the right hand side vector. The computer program to solve this model is presented in Figure 5. Data entry begins with statement 700 showing the number of equations in the system. Beginning in statement 710, the elements of the \([A]\) matrix are entered and the last element of each statement is the corresponding element of the \([B]\) matrix. This will be clear when examining Figure 6. In Figure 6, we present the final Keynesian Model, which includes the government and monetary sectors. This model specification makes it very easy for students to enter new values of policy variables such as the money supply, government spending, or the tax rate, and explore the consequences of such changes on the endogenous variables. It is also very easy to play...
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the "what-if game" with behavioral equations such as the consumption function, the investment function, the demand for money, and so on to see how shifts in the parameters of these functions affect the model solution. Multiplier concepts are also easy to illustrate by, for example, changing autonomous investment and noting the impact on Y.

Advantages and Disadvantages of the Computer Modeling Approach to Learning Macroeconomics

We have found this method of instruction to have three advantages. First, students seem to develop a fuller and deeper understanding of the economic theory when they work with concrete models such as these. They are better able to constructively criticize the models, understand their assumptions and suggest ways of making the models more realistic. Second, students, of necessity, must reinforce their mathematical skills to successfully manipulate the smaller models by hand, which we have them do before working on the computer. Third, it gives the students another opportunity to reinforce their computer skills, which we believe should be done more frequently in classes outside the computer discipline itself.

Unfortunately, these advantages do not come without a cost. The main cost we have discovered is that it is very difficult to cover as much material as is usually covered in a more traditional macroeconomics class. For example, we have not yet been successful in getting beyond the Keynesian model to the Rational Expectations Model. We are currently trying to develop a series of models to help students explore the rational expectations philosophy, but we suspect that to cover this material might require a two semester sequence. Another possibility is to offer the full course at the graduate level rather than at the junior/senior level as it is currently offered. If this were done, it is likely that the graduate students could cover the entire range of models in one semester. We intend to explore this alternative in the future.