4 The Production Function

4.1 INTRODUCTION

This chapter is somewhat different from those which have gone before primarily in paying a good deal more attention to the problems inherent in choosing specific functional forms to represent the production structure. We have, of course, discussed a number of particular functions elsewhere - the linear, the quadratic, the logarithmic, and even the CES - but the list of functions whose properties are well understood is more extensive than those just mentioned and, even for those just listed, detailed comparisons have not been made to this point. Normally, we might consider the study of production after we have studied investment, on the grounds that the latter is part of aggregate demand (two components of which we have already considered in Chapters 2 and 3) while the former is a key concept in aggregate supply. This procedure is not optimal in this study primarily because we use specific functional forms for the production function in our study of investment; that is, the production function (as it is studied here) is one input into an aggregate investment function. There are, of course, other inputs into the investment function - such as a specification of the cost of capital and of tax laws - which are also studied later. Of course, we do not mean to ignore the simultaneous equation nature of the production process either, so it is more a matter of logical order as designed in this study than a matter of principle. We should note, though, that all we have to say on the topic of "aggregate supply" is contained in Chapter 1.[1]

The study of production has a number of important direct and indirect implications of interest to the macro-theorist. We may be interested in the structure of aggregate production itself and that has to go down as our main interest, of course. In addition, we have noted that a production function is an input into the study of aggregate investment, and
it is clear that the choice of specification of production influences the nature of the investment function. We have also noted that the study of functional form is more detailed in this literature and that this is an area which is of broad interest, beyond production studies. We have not noted, but it is nevertheless of considerable interest, that we normally take the aggregate production function as the link between the input markets (capital and labour) and the commodities markets (consumption, investment, and the demand for money) so that it has a key role in any generalization of the economy. Then, too, partly as a result of the specificity mentioned above, the aggregate production function serves as a basic input into macro-growth theory, at least if one wants to concentrate on issues concerning technical progress or of the effects of growth on the quantity and quality of the factors of production. Finally, we note that we can work on the topic of the functional distribution of income by means of a production specification since one can work back to the distribution of the proceeds of production from the production function itself; indeed, the choice of specific production functions (along with input assumptions) provides specific results for the macro-distribution problem.

There is another feature of the literature on the aggregate production function, and that is that it is transparently micro-economic in its orientation, and this fact makes this chapter a little unusual for a macro-study. For one thing, we will be looking at evidence which is often fairly disaggregated, and we will be using a methodology (profit-maximizing, for example) which may well seem micro-inspired. In view of this, we will also add some material to our discussion of aggregation in Chapter 1, focusing here on problems which are more specific to production studies. In particular, we will note a strong thread running through the literature which argues that the aggregation of micro-production functions is unsafe because the individual decision units have (for example) different capacity utilizations, different production techniques, or, even, different motives; in this event, it seems, we may have to study the "aggregate" function in a (somewhat) disaggregated context, the amount of disaggregation depending, of course, on the circumstances. Things may not be as bad as all that, of course, and it may be possible to work with a single (specialized) production function over some important data spaces; further, of course, much of the macroeconomic literature does not specialize the production function but instead merely assumes its existence, in effect ducking the question of aggregation which one must face when he turns to