

INTRODUCTION

In the past few years there has been a growing interest in cyclical or short-run fluctuations in output per man hour. An understanding of these fluctuations is important in the analysis of such things as short-run fluctuations in unit labor costs, the short-run distribution of income, the longer-run movements in output per man hour, and the growth of potential or full employment output. In the estimation of long-run aggregate production functions, which has become so popular recently, some account must be made of cyclical fluctuations in output per man hour and in capital stock utilization. For policy purposes, an understanding of the relationship between aggregate output changes and changes in the unemployment rate, of which the short-run relationship between output and employment is a significant part, is also of considerable importance.

Beginning with the work of HULTGREN (1960) and KUH (1960), there have been a number of studies of short-run fluctuations in output and employment.¹ There are two basic procedures which have been used in these studies. In some of the studies output per man hour has been examined directly in an attempt to discover how it fluctuates with respect to short-run fluctuations in output. In other studies models determining employment (men or man hours) as a function of output and other relevant variables have been developed and estimated, the results of which reveal the short- and long-run relationships between employment and output. Both of these kinds of studies seem to find that output per man hour varies directly with output in the short run, and the latter kind also appears to find evidence of increasing long-run returns to labor services alone. This rather universal finding is contrary to what would be expected from the law of diminishing marginal productivity of classical economic theory, and Solow has commented that

¹ See HULTGREN (1960, 1965), KUH (1960, 1965a, 1965b), NEILD (1963), RAINES (1963), SOLOW (1964), WILSON and ECKSTEIN (1964), BRECHLING (1965), BALL and ST CYR (1966), SOLIGO (1966), BRECHLING and O'BRIEN (1967), DHRYMES (1967), IRELAND and SMYTH (1967), MASTERS (1967), and SMYTH and IRELAND (1967).

it is one of two main paradoxes, "whose resolution would be a major step toward the unification of long-run and short-run theory".¹

In this study a model of the short-run demand for workers and for hours paid-for per worker is developed and estimated. The model provides an explanation of the observed phenomenon of increasing returns to labor services which is not inconsistent with the assumptions of classical economic theory, and it yields substantially better results than the basic model of many of the previous studies, which is based on the postulation of an observable short-run production function and a simple lagged adjustment process. Central to the model developed here is the idea that during much of the year firms have on hand too much labor for the amount of output produced and that during these times the observed number of hours paid-for per worker is greater than the unobserved number of hours actually worked per worker. In the course of this study estimates of the amount of "excess labor" on hand have been made for a number of industries over time, and the empirical results which have been achieved using these estimates strongly suggest that the amount of excess labor on hand is a significant determinant of the short-run demand for workers and for hours paid-for per worker. The results also suggest that the time stream of expected future output changes is a significant determinant of these short-run demands as well.

The relationship between the number of workers employed and the number of hours worked per worker has largely been ignored in previous studies. In this study both this relationship and the relationship between the number of workers employed and the number of hours paid-for per worker are examined in detail, and one of the major findings of this study is that the short-run demand for hours paid-for per worker is influenced by many of the same factors which influence the short-run demand for workers. From this analysis the short-run relationship between the number of hours paid-for per worker and the number of hours worked per worker is seen to be such that the former cannot be taken as an adequate measure of the latter except during peak output periods. Having determined the short-run demand for workers and for hours paid-for per worker, the short-run demand for total man hours paid-for can be derived, and this in turn provides an explanation of the relationship between total man hours paid-for and output.

The data which have been used in this study are considerably more

¹ SOLOW (1964, p. 19).

disaggregated than those of previous studies. Monthly three-digit industry data have been used, as opposed to quarterly data for zero-, one-, or two-digit industries. In a short-run study the use of monthly data has obvious advantages over the use of quarterly data, and problems of aggregation bias should be lessened by the use of three-digit industry data. The question of seasonal adjustment is an important one in a study such as this, and it will be seen that the universal use of seasonally adjusted data or seasonal dummy variables in previous studies is unwarranted. All data used in this study are seasonally unadjusted.

The outline of this work is as follows. In ch. 2 the previous studies of short-run employment demand are summarized and discussed, and the basic model which is common to many of these studies is estimated using the same data and periods of estimation which are used to estimate the model developed in this study. In ch. 3 some empirical evidence on fluctuations in output per man hour is given; the properties assumed about the short-run production function are discussed; the concept of excess labor is discussed and estimates of the amount of excess labor on hand are made; the theoretical model of the short-run demand for workers is developed; and the various expectational hypotheses which have been tested are discussed. In ch. 4 the data which have been used are described, and the results of estimating the model developed in ch. 3 are presented. In this chapter a comparison of the expectational hypotheses is also made.

In ch. 5 a number of hypotheses regarding the short-run demand for workers are developed and tested, using the results presented in ch. 4 as a basis of comparison. The possible short-run substitution of hours for workers is examined; tests of possible cyclical variations in the short-run demand for workers are made; the possible effects of labor market conditions (as measured by the unemployment rate) on short-run employment decisions are examined; the relationship of the model developed in ch. 3 to an alternative "lagged adjustment" model is discussed and other possible reaction behavior is examined; and finally the possible effects of capacity constraints on the short-run demand for workers is examined. In ch. 6 the Holt, Modigliani, Muth, and Simon (HMMS) model is described and estimated, and an alternative model which is similar to the model developed in ch. 3 but which uses some of the HMMS ideas is developed and estimated. The results of estimating these two models are then compared with the results of estimating the model developed in ch. 3. Ch. 6 concludes with a discussion of some results achieved using different output data.

In ch. 7 a theoretical model of the short-run demand for hours paid-for

per worker is developed and estimated. The effects of labor market conditions on the short-run demand for hours paid-for per worker are examined, and tests of possible cyclical variations in the short-run demand for hours paid-for per worker are also made. In ch. 8 the results of chs. 4 and 7 are brought together. The short-run demand for workers and for hours paid-for per worker are compared, and the short-run demand for total man hours paid-for is discussed. The relationship between the number of workers employed and the number of hours paid-for per worker is clearly seen in this chapter, as is the relationship between fluctuations in total man hours paid-for and fluctuations in output. The economy-wide implications of the results achieved in this study are also discussed in ch. 8.

In ch. 9 some further statistical tests of the equations which were estimated in chs. 4 and 7 are presented. The residuals are tested for first-order serial correlation, and Zellner's two-stage Aitken estimator is used to estimate the workers and hours equations simultaneously. Zellner's method is also used to estimate a number of different industry equations simultaneously. The chapter concludes with a brief comparison of the short-run demand for workers across industries.

In ch. 10 a theoretical model of the short-run demand for non-production workers similar to the model developed in ch. 3 for production workers is developed and estimated, and the demands for the two kinds of workers are compared. In ch. 11 a summary of the major results and conclusions is presented, and in the data appendix the individual industry data and the adjustments which were made in these data are described.