Chapter II. GDP, employment and unemployment

The purpose of this section is to derive estimates of par GDP, i.e. the level of GDP which would be the counterpart of 2.5% unemployment, both for the period 1960-71 and projected over the period 1972-5. In addition we shall examine the implications for employment and unemployment of a steady growth of GDP at 4.5% per year starting from the estimated 1971 actual level to see what reductions in unemployment and increases in employment could be expected. This chapter starts with a simple formal scheme for the analysis of past data and a discussion of implied past trends in par productivity and employment. We then project future changes in par employment and productivity to derive par GDP and finally reverse the process by which par series were inferred for the past to estimate the future effects of the hypothetical projection of 4.5% per year growth of GDP

2. The table below summarizes the results of this analysis. Detailed results are given in Appendix Table 1. Par GDP is substantially lower than actual GDP at the beginning of the past period 1960-71 because the pressure of demand was then much higher than the level we have used as a definition of par. Although the growth of actual GDP has fallen off since 1965 par GDP is estimated to have continued to rise by over 3% per year up to 1971, and is expected to continue to grow at almost the same rate up to 1975. Future growth of actual GDP at 4.5% per year would raise the pressure of demand back to the par level by the end of 1973 and reduce unemployment well below the par level of 2.5 per cent by 1975. As later paragraphs will show these projections are subject to a substanti margin of uncertainty.

(Table II-1 - see next page)

Table II-1 GDP and unemployment

Year	Unemployment[1] (thousands)	Actual GDP (£ million, 1963 prices)	Par GDP (£ million, 1963 prices)
1961	347	25504	24417
1965	281	29124	27604
1969	558	31803	31466
1971	n.a.	32714	33596
Growth rates (% per year)			
1961-5	...	3.4	3.1
1965-9	...	2.2	3.3
1969-71	...	1.4	3.3
Projected			
1975	462[2]	39012[2]	38022
Growth rate (% per year)			
1971-5	...	4.5[2]	3.1

(1) Adjusted for time lag (see paragraph 4)

(2) Hypothetical projection (see paragraph of Chapter I)

Estimates of par GDP, 1960-71

3. We have measured GDP at constant factor cost by the compromise index (1963=100) converted into £ million, 1963 prices, by multiplying the index by the 1963 expenditure estimate of GDP. This procedure introduces a residual error in adding up expenditures for years other than 1963, but it would not be appropriate to ignore altogether the evidence on changes in GDP provided by income and output data.

4. Unemployment is measured by the average of monthly seasonally-adjusted figures (in thousands) for wholly unemployed excluding school leavers in the U.K. A major problem in analysing the relationship between GDP, employment and unemployment is the existence of lags in the adjustment of the two latter to changes in the growth of GDP. For each year we attempt to estimate the

'equilibrium' level of unemployment, $\bar{U}$, as the level to which unemployment would have risen after lags had worked themselves out if the average pressure of demand in that year had been maintained. In years when unemployment was rising we assume that $\bar{U}$ exceeded actual unemployment, U, and vice versa for years in which unemployment fell. We have therefore measured U as first-quarter unemployment in each year and estimated $\bar{U}$ as a weighted average of U in the first quarter of the current year and the following year;

$$\bar{U} = (0.5 + \alpha_u) U_{+1} + (0.5 - \alpha_u) U$$

With $\alpha_u = 0.4$ this equation makes $\bar{U}$ very nearly equal to the value of U in the first quarter of the following year.

5. Employment is measured as the seasonally-adjusted March figure for employee in employment plus the self-employed and armed forces (in thousands). Just as in the case of unemployment we have estimated 'equilibrium' employment as

$$\bar{E} = (0.5 + \alpha_E) E_{+1} + (0.5 - \alpha_E) E$$

Since the lags for adjustment of employment are not longer than those for unemployment, α_E must not therefore be set higher than α_u. We have found that it is reasonably satisfactory to assume $\alpha_E = \alpha_u = 0.4$.

6. Having allowed for lags by estimating $\bar{U}$ and $\bar{E}$ we may consider the adjustment of actual GDP to an assumed steady level of unemployment. Applied research in this field has generally found that a one per cent adjustment of unemployment requires a four per cent adjustment of GDP over the usual range of variation; we have used various values for this ratio, denoted β_Y, in the range 2.5-4 but our central estimates are based on the value $\beta_Y = 4$. An initial estimate of par GDP in each past year (1960-70) is constructed by applying this ratio to the deviation of $\bar{U}$ from its par level of 2.5 per cent and adjusting GDP accordingly. Up to 1969 actual unemployment (and $\bar{U}$) was always below 2.5 per cent and par GDP is therefore lower than actual. But in 1970 and 1971 equilibrium unemployment ($\bar{U}$) was above 2.5 per cent and par

GDP therefore rises above actual

7. The year-to-year growth of par GDP inferred in this way is rather uneven because the simple model used cannot capture the real lags and expectational effects at all accurately. The growth of par GDP can be analysed into constituent movements of par productivity and employment by making adjustments for the deviation of $\bar{U}$ from 2.5 using assumed ratios β_P and β_E which must add up to β_Y. Of a range of values used in this exercise, the central estimates are based on $\beta_E = 2.5$ and $\beta_P = 1.5$, i.e. allowing a larger variation of employment with respect to unemployment than the variation of output with respect to employment

8. The estimates of par productivity and employment both show rather erratic fluctuation, sometimes off-setting and sometimes combining to produce erratic movements in par GDP It was therefore decided to smooth par GDP by pinning the series at certain years and interpolating with constant growth rates for intermediate years. The years chosen were 1961, 1965 and 1969. Comparison of growth rates between the two periods 1961-5 and 1965-9 showed some acceleration of GDP growth and a marked acceleration of productivity growth in the second period.

9. The par GDP series can be checked in intermediate years by reversing the process of inference to predict actual $\bar{U}$ and $\bar{E}$ given the interpolated figure for par GDP These predictions confirm that although $\bar{U}$ and $\bar{E}$ are not accurately predicted in each year (because the original par GDP series was not smooth), the pattern of cyclical fluctuation in actual $\bar{U}$ and $\bar{E}$ is well preserved and the errors are not large or systematic Extrapolation to 1970 and 1971 also provided reasonable predictions for $\bar{U}$; the estimates for the latter year ranged from 750 - 900,000, tending towards the lower end of the range. But it is reasonable to expect that this would happen as the ratio β_E (and possibly also β_P) would tend to fall in periods of high unemployment as

a larger proportion of those leaving employment would be on the register.

10. As noted above, calculations of par GDP have been made using a range of values for the parameters β_P, β_E and β_Y. The prediction of $\overline{U}$ and $\overline{E}$ in years for which par GDP is interpolated is sensitive to the values of these parameters but over the range investigated improvements in prediction of certain years were largely offset by worsening predictions of other years so that there seemed to be little to choose between alternative parameter values. As one might expect, higher values of β_Y result in less smooth par GDP figures because the adjustment of GDP is more sensitive to fluctuations in $\overline{U}$.

Par employment and productivity, 1960-71

11. For the period 1961-5 the estimated growth of par employment and productivity is much the same for any values of β_E and β_P because the pressure of demand as measured by $\overline{U}$ was almost the same in both years. We find a substantial increase in par employment, expected because the population of working age was increasing quite rapidly as a result of the 'bulge' in younger age groups and because of immigration. Regardless of the parameter values, par productivity shows a growth rate of about 2.6% per year for this early period.

12. For the period 1965-9 there is much greater uncertainty about the growth of par productivity and employment, simply because of the fall in pressure of demand and higher unemployment through the period. There is no real presumption from the demographic evidence that par employment should have fallen since 1965. As long as the value of β_E is assumed to be at least as high as 2.5 no reduction in par employment is shown by 1965 on our estimates. But any reasonable value of β_E shows a large fall in par employment between 1969 and 1970 because of a large fall in actual employment not accompanied by much rise in unemployment. The need to assume a relatively high value for β_E (the variation in employment relative to that in unemployment) has led us to adopt a rather high value for β_Y (4.0) and low value for β_P (1.5) for our central estimates.

These values imply little change in par employment 1965-9 and a growth of par productivity of about 3.3% per year, considerably in excess of estimates for the earlier period 1961-5. But alternative parameter values show par productivity growth anywhere in the range 3.0 to 3.5% per year without much change in par employment, provided that β_Y and β_P are adjusted together so as to maintain a value of about 2.5 for β_E.

13. The aggregate analysis shows an increase in productivity growth in the second period (1965-9) as compared with the first period (1961-5). An examination of sectoral changes in employment on a disaggregated basis confirms that there were important differences in the growth of productivity between the two periods. The table below shows estimates of actual mean annual changes in employment in broad sectors of the economy.

Table II.2 Mean annual change in employees in employment and armed forces Great Britain, thousands, June to June.

	1960-5	1965-9	1969-71 est.
Total	203	-147	-402
Manufacturing	31	-56	-192
Mainly private non-manufacturing	137	-117	-244
Mainly public non-manufacturing	37	26	34

Note: Changes 1970-1 are estimated from recorded March-March and June-June changes and assumptions about the relationship of employment to unemployment.

Prior to 1965 private non-manufacturing employment (principally in construction, distribution and services) showed no response to changes in the pressure of demand (it continued to increase substantially through 1962-3 despite the recession). But since 1966 there has been a large reduction in this category of employment in each year. The cumulative increase of about 730,000 over the six years 1960-6 was followed by an equally large reduction in the four years 1966-70. If employment in these industries had continued to increase after 1966 at the previous average rate, total employment would have been well over one million higher than it actually was in 1971. Assuming that

this change in the rate of absorption of labour in the private non-manufacturing industries is largely a trend factor (and due in part to Government policy) rather than a conjunctural effect, then given a continuation of the previous pattern of output growth in the various industries this change in trend behaviour alone has contributed an increase of the order of 1% to the growth of par productivity since 1966.

Projected par GDP, 1972-5

14. The central estimate obtained in our aggregate analysis is that the growth of par productivity has been about 3.3% per year in 1965-9 compared with 2.6% per year 1961-5, thus showing an increase of 0.7% per year in the second period compared with the first. For the future we expect some slowing down of par productivity growth, partly because the reduction in private non-manufacturing employment since 1966 must be assumed to be the result, at least in part, of the imposition of the Selective Employment Tax which has been reduced in 1971 and will be abolished by 1973. The quantitative assumption we have made is that par productivity growth continues at the average rate for 1965-9 up to 1971 and thereafter slows down by a little under 0.1% per year each year to 1975. This means that our central estimate projects par productivity growth at about 3.0% 1974-5.

15. It must be emphasised that until a convincing explanation of changes in private non-manufacturing employment can be achieved, any projection of the growth of aggregate productivity will be extremely uncertain. If the run-down in employment in this sector since 1966 were entirely attributable to the imposition of S.E.T. and if the effect is reversible, one should expect par productivity growth at less than 2% per year as the effects of the withdrawal of S.E.T. are experienced. Equally if one believes that the decline is nothing to do with S.E.T. it is possible that par productivity might continue to increas at an accelerating rate.

16. Given a projection of par productivity we must make an assumption about the growth of par employment to 1975. Department of Employment projections of labour supply show little net change to 1975 as a small increase in population of working age is offset by increased school enrolment due to the raising of the school-leaving age. Our own demographic analysis is in close agreement with the Department of Employment's projections, and only a very small increase in par employment is projected to 1975. We have smoothed over the uneven movement of labour supply as it rises to 1973 and then falls as the school-leaving age is raised. Both our own projections and those of the Department of Employment are of course based on population forecasts published by the Registrars General. The recent census appears to have cast serious doubt on the accuracy of past forecasts of population of working age and to this extent one must be cautious in using future projections A further source of uncertainty is over the participation rates to be expected for married women. The decline in birth rates since 1966 had not visibly been reflected in higher participation rates for married women up to 1970, but may well result in higher participation in the future.

17. The central estimate of the future growth of par GDP is for an average growth rate of about 3.1% per year 1971-5. A range of slightly higher or lower growth rates is obtained using alternative values for β_p to deduce the past growth of par productivity which forms a base for our future projections. By 1975 the range of uncertainty about par GDP, using plausible parameter values, is of the order of $\pm$ £500 million at 1963 prices. But as we have pointed out in the preceding paragraphs the underlying uncertainty about productivity growth is perhaps rather greater than these figures suggest

The effects of GDP growth at 4.5% per year, 1972-5

18. Given assumed values for par GDP 1972-5, we can use the relationships described above to estimate the levels of employment and unemployment which would be generated by any hypothetical projection of actual GDP. The equilibrium levels $\bar{U}$ and $\bar{E}$ are obtained by applying the parameters β_Y and β_p to the

postulated deviation of actual GDP from par to obtain equilibrium unemployment and productivity. The lags can then be brought in by reversing the relations used to derive $\bar{U}$ and $\bar{E}$ from actual first-quarter unemployment, U, and employment, E, to yield predictors of the form:-

$$U = \frac{1}{(0.5 + \alpha_u)} \bar{U}_{-1} - \frac{0.5 - \alpha_u}{0.5 + \alpha_u} U_{-1}$$

19. Calculations of this kind have been made on the hypothesis of a 4.5% per year growth of GDP from its actual level in 1971. Depending on the assumed parameter values, unemployment falls to 450-580,000 by the first quarter of 1975 and employment rises to 24.6 - 25.0 millions

GDP as a measure of available resources

20. The result of the analysis in this chapter is that par GDP (corresponding to 2.5% steady unemployment) would be 3 - 5% higher than actual GDP in 1971 and that par GDP will continue to grow at a little over 3% per year to 1975. Estimates made by the Cambridge Growth Project using disaggregated methods suggest a rather lower level of GDP as a counterpart of 2.5% unemployment in 1975. One reason for the difference between our results is a considerable divergence of expectations about the expansion of service employment which (as emphasised in paragraph 13 above) is very difficult to predict with confidence A second reason for the difference may well lie in assumptions about the composition of expenditure on GDP.

21. The use of 1963 prices causes serious difficulty for any aggregated analysis of the future availability of resources because the labour content of expenditures, measured at 1963 prices, varies widely from one category of expenditure to another. Public consumption in particular has a high labour requirement per £ expenditure at 1963 prices because by convention no productivity growth is imputed to almost all direct public sector employment. In the remainder of our analysis expenditures on goods and services will be balanced against available GDP by simple addition

and subtraction. But at the margin any given amount of extra public consumption will require a larger reduction in other expenditure (such as private consumption) if the pressure of demand is to be held constant. The use of 1963 prices thus understates the share of total resources absorbed by the public sector to an increasing extent as the productivity of labour supplying other demands rises relative to the measured productivity of labour employed by the public sector.(1)

22. While the labour contents of expenditures, measured at 1963 prices, may differ widely by 1975, our projections of par GDP should not be biassed provided that we allow for changes in the trend composition of expenditure on GDP. The increase in the share of gross fixed capital formation and exports in final expenditure projected for 1972-5 is sharper than recent past trends and therefore reinforces our expectation of fast productivity growth in the future.

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(1) If national accounts at constant prices based on a more recent year were available, the balancing of expenditures against GDP could be regarded as a more meaningful exercise.