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UNIVERSITY OF WARWICK
DEPARTMENT OF ECONOMICS

The Declining Return to Professional
Status in the British Economy (with
special reference to scientists and engineers).

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Thesis submitted for PhD
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The research described in this thesis was undertaken on a part-time basis while the author was a member of the Institute for Employment Research, University of Warwick.

October 1983.



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Acknowledgements

I am indebted to various people who have in one way or another contributed to this research. Derek Bosworth, Robert Lindley, Peter Elias, Tom Swallow, Marten Shipman and Sandy Adamson all commented on earlier drafts of material which is included in the thesis. Needless to say I remain responsible for all remaining errors. I am also extremely grateful to various people within government departments and the professional institutes who provided the data without which this project could not have been completed. The genesis of this research lies in a program of work on the labour market for scientists and technologists financed by the Manpower Services Commission, to whom the author is grateful for support. I would also like to thank Robert Lindley for encouraging me to develop work in this area on a part-time basis. Paul Stoneman also deserves thanks for guidance at an earlier stage in the preparation of the thesis, while Ben Knight made various suggestions which have improved the document presented herein.

Declaration

This thesis incorporates some material which the author has already published elsewhere. In particular the results in Chapter 3 are based on two papers in the Scottish Journal of Political Economy (Wilson 1980 and 1983), while parts of Chapters 5 and 6 are based on material published in the Higher Education Review (Summer 1983, p. 22-38).

Summary

This thesis is concerned with the question of how the return to investment in human capital, as represented by the attainment of professional status, has changed over time in Great Britain. In addition it is concerned with differences between different professional groups.

Because of data limitations a very simple methodological approach is adopted building upon work by previous researchers. This uses age earnings profiles at a point in time as a guide to the future earnings associated with different career profiles. The main developments to the conventional methodology are concerned with adjustments to these profiles to reflect differences in the characteristics of different professions.

Previous work in this area for Great Britain has been limited in both the time period covered and the types of qualification and profession considered. The major contribution of the present study is to provide a perspective on how rates of return have altered over time and to compare differences between different professions.

The main finding is that there has been a dramatic secular decline in rates of return from around 17½ per cent in 1955 to 7½ per cent by 1975. This has been common to most professions. The explanation for this phenomenon is argued to be in broad changes in the balance of supply and demand for highly qualified persons. Another important finding is that social as opposed to private rates of return show a similar pattern over time although there are some marked differences in rankings between different professions for the two measures of return.

It is argued that a regular monitoring of rates of return to entering different professions would provide a valuable guide to important policy decisions regarding the pay of people employed in the public sector and on the identification of restrictive practices in professional labour markets.

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1. Introduction

The reasons why earnings differ across different occupations have been of interest to economists since at least as far back as when Adam Smith wrote the Wealth of Nations. Smith himself recognised that the costs of learning different trades was a prime factor in determining such differentials. It was not until much later that attempts were first made to quantify differences and to assess whether they were explicable in these terms. One of the earliest attempts was by Clark (1937) who examined the lifetime earnings of different occupational groups in the United States. A more explicit attempt to take into account training costs was the work by Friedman and Kuznets (1954). However, it was not until the development of the modern theory of investment in human capital by Shultz and others that work in this area really took off. During the 1960s and 1970s numerous studies were published which attempted to assess the costs of training (including, indeed especially, formal education) in order to achieve certain qualifications or attain a particular occupational status.

The most commonly used methodology has been to compute so-called rates of return. These are defined as values of the internal rate of return necessary to discount the net benefits of any future career choice such that the present value is zero. The early work calculated these returns based on cross sectional age earnings profiles using simple accounting techniques. More recently, following Mincer (1974) the preferred methodology has been to estimate so-called earnings functions. The advantage of the latter approach is that the partial effect of education and training on earnings can be distinguished from other influences. Its disadvantage, however, is in the need for very detailed data on both earnings and all sorts of

other characteristics of which education and training undertaken are just one example.

Although a considerable amount of research has been undertaken in this area for the United States, analyses for this country have been few and far between. In Chapter 2 the main studies carried out for the UK are reviewed and summarised. The main objective of the present study is to provide estimates of rates of return to attaining professional status for a range of occupational categories covering the period since 1955. Because of limitations in the data sets available the simpler accounting type methodology is adopted rather than the earnings function approach. Details of the methodology and data sources used are also given in Chapter 2.

Professional scientists and engineers are chosen as a suitable group to illustrate the methodological and practical problems in producing estimates of rates of return on a consistent basis for the period 1955-1980. In Chapter 3 we present estimates of both private and social rates of return to training to become a scientist or engineer. The main finding is that there has been a dramatic secular change in estimated rates of return. For scientists a decline from almost 20 per cent in 1955 to around 10 per cent by 1980 is obtained while for engineers the pattern is slightly more complex with an increase during the 1950s and 1960s followed by a decline to around the same level as for scientists by the end of the 1970s. Another important result is that although social returns show a similar secular profile to the private measures they are at a much lower level and do not appear to provide any prima facie evidence of lack of investment in this area. In Chapter 4 the causes of this secular decline in rates of return are considered in detail. The main conclusion reached is that although government policy (e.g. changes in the level of student maintenance grants etc.) can explain a part of this

decline the main factor responsible has been broad changes in the balance of supply and demand in the labour market for the highly qualified.

In the following two chapters the analysis is extended to cover other occupational groups such as medical professions, legal professions, business professions, architects and quantity surveyers and teaching professions. The main findings here confirm those of the earlier chapters. For nearly all groups there has been a secular decline in rates of return similar to that found for scientists and engineers. In some cases this decline has been much faster than in others. For example, the rate of return to becoming a school teacher was negative by 1980/81, while rates of return actually increased during parts of the 1960s and 1970s for groups such as economists. Once again it seems possible to account for these changes over time by reference to broad movements in the pattern of supply and demand.

There are various theoretical and practical problems raised in attempting to make comparisons between different professional groups. These include differences in length of periods of education and training, differences in hours worked, differences in fringe benefits, differences in the treatment of self-employment incomes and various other factors which are discussed in detail in Chapters 5 and 6. Another important conclusion reached in Chapter 5 is that these and other less quantifiable factors tend to compensate for wage differences and that once full account is taken of them the earnings of groups such as doctors and lawyers are not excessively high compared with other groups. The high incomes obtained in such occupations seem to be attributable to such factors as additional costs of training, longer hours worked, costs connected with being self-employed, differences in ability etc. There is little prima facie evidence of the existence of monopoly rents from these results,

although the very low earnings of teachers does suggest the exertion of some monopsony power by employers in that labour market. Social returns to entering the various professions are considered in Chapter 7. The main finding here is that there are probably much higher social returns to expanding the numbers of social science graduates (business professions and lawyers) than graduates in pure science or engineering and technology.

Finally, in Chapter 8 the sensitivity of the results obtained to various alternative assumptions is considered. These include an assessment of the importance of differences in hours, ability, fringe benefits, length of course of study, prospects of becoming unemployed, risk and uncertainty, alternative assumptions about income foregone etc. Although the basic results would not be altered by changes in these assumptions they illustrate the sensitivity of both private and social estimates to changes in each one. In order to generalise this, a set of ready reckoners is provided in graphical form from which the reader can assess the effects of changes in any assumption, given its implications for the basic age earnings profiles.

The main conclusions of this research stem from the finding of substantial secular changes in rates of return. A number of explanations for these developments are considered. Although various institutional factors may have contributed to this phenomena, a considerable amount of evidence is assembled which suggests the hypothesis that they are primarily a reflection of changes in the balance of supply and demand for the highly qualified. The explanation offered revolves around the long-run adjustment of the labour market to the expansion of the supply of graduates. At the start of the period covered, rates of return to obtaining professional status were generally very high compared with the return to physical capital. In many areas there were

recognised shortages of qualified manpower. The expansion of capacity in the higher education system together with improved access for a significant part of the population via the increased availability of maintenance grants and higher incomes in general provided a scenario in which an unprecedented number of individuals were able to choose to invest in themselves in order to reap the rewards clearly associated with the attainment of professional status.

It was inevitable that, unless demand also changed at the same or faster rate, this would tend to drive down relative earnings, as increasing numbers of individuals entered the labour market with a degree or equivalent qualifications. The obverse of the same coin was that as an increasing proportion of young people opted out of the labour market and into the educational system, this would tend to result in a decrease in supply relative to demand and consequently force up the relative earnings of lesser qualified young people. This increased the foregone income cost of investment in degree level training and explains a significant part of the decline in rates of return. In recent years the world wide recession has hit young people and unqualified workers particularly hard and there is clearly no longer an excess demand for these groups. The rate of growth of the production of qualified young entrants to the professional labour market has also slowed substantially. Together these factors tended to halt or at least slow the decline in rates of return during the latter half of the 1970s.

This general conclusion is at odds with that reached by Routh (1980). In his study of changes in occupational structure and earnings in the British economy over more than a century he concluded that the evidence did not support the classical notion of wage relatives moving in such a way as to bring supply and demand into balance. The results discussed in this thesis support the hypothesis that such movements have occurred in the labour market for highly qualified professionals in the UK.

Another important conclusion centres on the benefits of using rate of return analysis as a guide to important policy decisions concerned with the pay of those in the public sector and the identification of restrictive practice in professional labour markets. As long ago as 1964 the National Incomes Commission in a report dealing with University lecturers considered the problems of comparing the earnings of different professional groups. It concluded that, 'Similarity is not to be looked for in the functional content of (their) work but in the competition between the relevant occupations for the recruitment and retention of staff drawn from the same source of supply' (NIC, 1964. p.25, parenthesis added). The Clegg Commission struggled with essentially the same problem of making comparisons between different occupations. The difficulty is that without clear thinking on these issues by bodies charged with the making of decisions regarding such matters as the future output of graduate teachers or medical students, or the appropriate relative salaries for such persons, then serious problems of shortages (e.g. doctors) or surpluses (e.g. teachers) may arise because of the long training lags involved.

The obvious criterion by which to judge the way in which the market situation is moving is by closely examining relative salaries. It is however crucial to take into account the costs of education and training and it is for this reason that the rate of return concept is so important. Other compensatory factors such as hours worked, adjustments for risks of self-employment etc., can easily be incorporated within this general framework as shown by the analysis presented in this thesis. The only data requirement is basic earnings information which in principle could be collected quite cheaply using existing surveys as a basis. The case for regular monitoring of rates of return in the manner described in this research seems overwhelming.

2. Estimating Rates of Return: the Case of Scientists and Engineers

2.1 Introduction

The expected rate of return to undertaking certain career paths has been cited as a prime influence on individual occupational decisions. It has also been argued that the rate of return measure can be used as an indicator of how tight a labour market is. In a perfectly competitive, risk-free world of complete information, one would expect that rates of return would be equated by market pressures in line with general interest rates. In practice the world is less than perfect; individuals do not have complete information, nor do they have free access to capital markets. For these reasons and because we can only obtain a very crude measure of the true rate of return one would expect observed rates to diverge from current interest rates. Nevertheless we would argue that it is worth examining movements over time in observed rates of return as these will provide some guide as to whether markets are becoming tighter or more slack. Furthermore they provide a guide as to whether further investment in this type of human capital is worthwhile from both the individual and social viewpoint. Such measures will, of course, reflect the influence of both supply and demand on relative earnings.

In the 1960s and early 1970s various studies were published concerning the private rate of return to undertaking a university degree in the United Kingdom.¹ These studies addressed the general question of whether, from the individual's point of view,² investment in higher education was worthwhile. Using age earnings' profiles as proxies for an individual's expected lifetime income, they were able to show that the return to such investment compared very favourably with alternative investments. All these studies concentrated on obtaining an accurate snapshot of the situation prevailing

-
- (1) For example, Layard et al. (1971), Maglen and Layard (1970) and Ziderman
- (2) Various studies carried out at this time (for example, Layard et al., 1971) also examined rates of return from society's viewpoint.

at a particular point in time. The objective of the present study, in contrast, is to obtain a longer term perspective on both the private and social return to undertaking investment in higher education in Great Britain between 1955 and 1980.

Section 2.2 begins with a brief review of the theoretical considerations in computing rates of return. Previous work in the area is then considered in Section 2.3, concentrating on the empirical results for the U.K. in order to put the present work into perspective. Section 2.4 provides a corresponding discussion of the previous UK work on social rates of return.

2.2 Theoretical Considerations in Computing Rates of Return

The literature on human capital formation is immense and for general reviews the reader is referred to Blaug (1965) or Psacharopoulos (1975). The part of the theory that concerns us here is the notion that someone who remains at school and continues by taking a degree (or equivalent qualification) can be regarded as investing in himself. The private rate of return is the reward the individual receives for the sacrifice he makes in terms of costs incurred and income foregone during the period of his education. Consider an individual aged 16. His expected lifetime income, if he undertakes no further education but seeks immediate employment, might be represented by the curve OABC in Figure 2.1. Up to the time he leaves school earnings are zero, but then his earnings curve follows the well established humped profile until he retires. If, on the other hand, he had remained in school and gone on to University, his expected profile might be given by ODEFHI. Up to 18 earnings are zero, rising to the level ED (equal to the student maintenance

grant net of any direct costs to the individual incurred) while undertaking the course. On graduation, expected earnings rise to a very much higher level, remaining high until retirement at age 65. The area DEFGC is common to both profiles. The area ABGFED represents the cost of the investment in terms of income foregone and any direct costs (fees etc.), while area GHIC is the net monetary benefits from the investment.

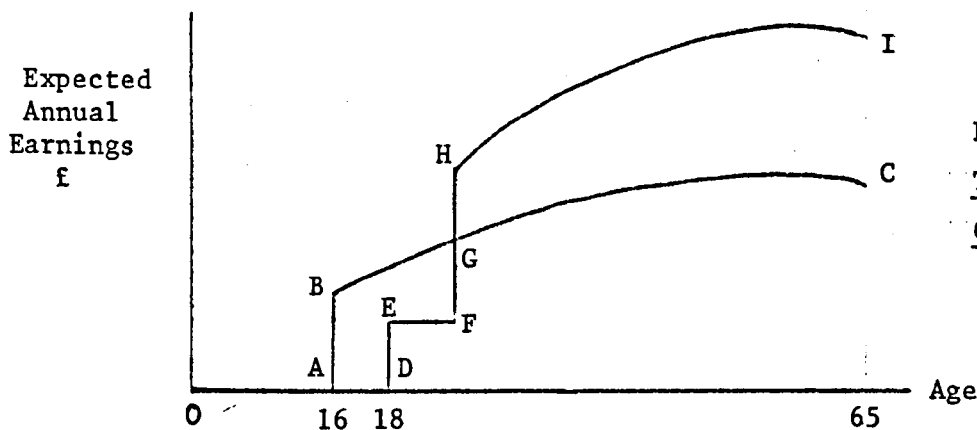


Figure 2.1
The Rate of Return
Calculation

The internal rate of return is then found by solving for r in the expression

$$\sum_{t=16}^{65} \frac{B_t - C_t}{(1+r)^{t-15}} = 0 \quad (1)$$

where B_t are the expected benefits from education in each year measured by the earnings profile of someone investing in education and C_t the costs measured by the alternative income profile ABGC. By comparing income profiles of the type presented in Figure 2.1 we can therefore compute the average private rate of return to undertaking investment in higher education.³ Social rates of return can be computed in an analogous manner if earnings are assumed to be an accurate reflection of an individual's contribution to society (i.e. wages = marginal product and there are no external benefits or costs) and the full costs of the course of training and education is included in C_t (this is discussed at greater length in Section 2.4).

3. With the raising of the minimum school leaving age to 16 in 1972/3 the calculation needs to be modified to begin from the 17th year.

While the methodology outlined above appears very straight forward in theory, in practice there are a number of additional complications. Shultz (1961) has suggested that the benefits from extra education are of three kinds: an investment in higher future earnings; a consumer goods component, increasing the individual's current utility while undertaking the investment; and finally, a consumer durable element conferring future additions to the individual's utility throughout his lifetime. The rate of return as defined above clearly only incorporates the first type of benefit. Whilst we recognise that these are not the sole benefits from education, in view of the disagreement about the importance and measurement of the other types of private benefit, it seems most useful to concentrate here on the purely financial rewards that an individual might anticipate from investment in higher education.

A second set of complications arises in deciding the precise definition of the income profiles we need to consider. Presumably we should include benefits in kind as well as monetary benefits when assessing an individual's expected earnings profile. These should include not only physical goods but any psychic benefits the individual may receive resulting from the work that he is able to do as a result of his investment. Even if we regard these benefits as unmeasurable there are other factors which are perhaps even more important, such as differences in hours worked, that is in the amount of time the individual will need to work to attain the incomes in the alternative profiles. If a graduate has to work only $37\frac{1}{2}$ hours to receive profile ADFGHI compared with 45 for the non-graduate profile ABGC, this is clearly not an insignificant consideration. Similarly, differences in holidays might also be important. Other non-income benefits such as insurance and pension schemes paid by the employer should also be considered for a complete picture of the real relative income profiles.

Although these considerations might be extremely important in theory, in practice, due to data limitations, it is not very easy to take them into account. While this could be very important if we were concerned to accurately estimate the internal rate of return at a point in time, it is perhaps less important if our objective is to compare rates of return over time. As long as we have no reason to expect these factors to have altered significantly over the period we are considering, then computing conventional rates of return ignoring these complications will still give us a realistic picture of changes over time. Such considerations should be borne in mind however, in comparing the results for different groups at a point in time. Few of the previous studies on rates of return have in fact taken such factors into account, mainly due to the problem of measurement. One notable exception here is the work by Ekhaus (1973a,b) on the effect of allowing for differences in hours worked on estimated rates of return. He found that rate of return estimates for many professions in the U.S. were substantially reduced when hours worked were taken into account. This result has been supported by further research summarised in Psacharopoulos (1975) p.116-117. The sensitivity of the results to alternative assumptions about hours is discussed in Chapter 8.

A third set of complications in the case of private rates of return arises as a result of the individual's concern with the income he actually expects to receive rather than the observed cross-sectional gross income profile of the average individual. Thus we should incorporate into our calculation the fact that an individual will be primarily interested in the disposable income that he will probably receive. We therefore need to consider income streams net of tax. Furthermore, for both private and social rates of return calculations these streams should be corrected for the probabilities of dropping out during the course or failing the examination, for the probability of actually obtaining a job and for mortality. Once again, however, in practice such adjustments to the basic calculation are

severely restricted by data limitations. Although it is in principle possible to make fairly arbitrary adjustments to account for these factors, in practice we found that it was less straight-forward to correct for drop-outs, failures or mortality. The latter is not really a serious problem since this adjustment only makes a significant difference to those parts of the income streams which are very heavily discounted. The drop-out or failures problem may be more serious. However, as long as we are willing to assume that this factor has not changed in importance over time, ignoring it should not be too significant. A further correction that needs to be made in comparing different expected income streams is to allow for the fact that a cross-sectional age-income profile will not reflect expected improvements in real income over the individual's life-time. Following Layard et al. (1971) and others, we chose to add 2 per cent to our estimated rates of return to allow for an expected growth in real income of this amount in the future.⁴

The fourth set of complications to consider introduced by the notion that a prime function of education is to act as a screening device, providing information to employers about the inherent ability of their potential employees rather than leading to any improvement in the individual's marginal productivity per se. This difficulty is more important when considering social rates of return (see below). From an individual viewpoint however, it would seem to make very little difference whether his increased earning power results directly from improvements in his productivity due to education or because the qualifications he obtains enable employers to label him as a high or low ability person. More serious from the point of view of estimating social rates of return is the question of whether without undertaking higher education the more able individual would have

(4) This also applies to both private and social calculations in the next chapter. The conditions under which it is appropriate to simply add 2 per cent to the calculated rate of return estimates to allow for secular growth in real income is discussed in Appendix A.1.

obtained an above average income. If this is the case, then only a part of the differential between the "qualified" and "unqualified" earnings profiles can be attributed to undertaking the course of education, the remainder being due to the individual's inherent ability.⁵ Again, as long as we have no reason to suspect any systematic change in the 'ability' factor over time, then it seems reasonable to ignore this complication. Although this may mean our rates of return over-estimate the true financial benefits of undertaking a degree course or equivalent route to becoming a professional scientist or engineer at a particular point in time, changes over time in the true rate of return should be reflected in our measures.

Given that most of the above factors, while they may be important, are in practice immeasurable we are in any case forced to ignore them. We therefore accept with very little modification the methodology adopted by Zideman (1973) although also recognising the problems and limitations of such an approach. We argue that these problems, although serious if one is primarily interested in comparing rates of return between alternative investments at a point in time, are less problematic if the objective is to compare rates of return for the same type of investment over time. Any bias involved may affect the absolute level of our estimates but not the profile over time. To the extent that non-financial factors do not change in importance over time our measures of the change in the financial rate of return to individuals over time will also reflect changes in the true rate. Further consideration of some of these issues is however necessary when it comes to making comparisons between professions.

(5) Psachoropoulos (1975) in a review of work in this area concludes that previous estimates of the ability factor which attribute up to a third of earnings differentials to ability are too large. He concludes that roughly 90 per cent of earnings differentials can be directly attributed to education. An analysis of the sensitivity of the results to alternative assumptions about ability is given in Chapter 8.

Another important question is whether it is meaningful at all to compute rate of return for particular professional groups rather than for particular courses of education or training. Rates of return have been computed for occupational groups by various authors (Wilkinson (1966), Hansen (1967), Carol and Perry (1968) are some early examples). When educational investment is defined as a degree which is occupation specific (e.g. MD degree, B Sc in engineering etc) the rate of return to that degree may be viewed as pertaining to that occupation. In practice the match between qualifications and occupations is far from perfect. Bosworth and Wilson (1980) show that for groups such as engineers and scientists for example less than half those qualified may be working in the associated occupations, while less than half those in the occupational group may be qualified at degree or equivalent level.

Furthermore, occupational status is not fixed for any individual in contrast to educational status (which is, at least for those aged over 25 years). There is thus the danger of estimating returns which do not reflect the true earnings prospects of those who enter a particular profession. For example, the more dynamic engineer as he gets older may move into management, barristers become judges and so on. Great care is therefore needed to ensure that occupational earnings profiles reflect a meaningful career profile.

This is, however, only one of the problems involved when attempting to calculate comparable rate of return estimates for different professional groups. Apart from differences in factors such as ability or hours worked that we have already considered there are many other important differences between different professions. These include such matters as the length of training required and the treatment of supplementary income, fringe benefits and self-employment incomes. These issues are discussed in Chapter 5.

In the next chapter, using scientists and engineers as an example, private rates of return to an individual are computed assuming that age earnings

profiles at a point in time can be used as a proxy for the expected profile of earnings over his lifetime. Direct costs are assumed to be zero. We therefore concentrate almost entirely upon the financial rewards that the individual might expect from investment in higher education. Psychic costs and benefits, benefits of education as a consumer good (both while it is being undertaken and through the individual's lifetime in the form of services from a consumer durable) are ignored. Non-income benefits, payment in kind, differences in the amount of time an individual will need to work to attain the incomes in alternative profiles, benefits of alternative pension schemes, holidays etc., are also omitted. Furthermore we abstract from the question of whether the observed rate of return reflects ability as well as investment in education or the extent to which education is merely a screening device. The main modification that we have chosen to make to the basic calculation described in Figure 2.1 is to adjust for taxation. The sensitivity to some of the other assumptions such as unemployment probabilities and ability are discussed in Chapter 8, while problems in comparing results for different professions are discussed in Chapter 5.

The comparison of rates of return over time introduces the question of how inflation and expectations of further inflation should be taken into account. The approach adopted here is to take the cross-sectional earnings profiles at a point in time as representing the expected real costs and benefits of alternative career profiles. Comparison of the calculated rates of return over time therefore is a comparison of real rates of return. This, of course, assumes that the price deflator for qualified and unqualified persons is the same. However, when comparing the computed rates of return

with alternative investments these also need to be considered in real terms. That is the expected rate of inflation should be deducted from the nominal rate of interest. This is not necessary for comparison of our estimates of rates of return as long as cross-sectional earning profiles are regarded as indications of expected real income in the future. ⁶

2.3 Previous Empirical Work for the U.K.

In order to put the current study into perspective it is useful to briefly summarise the results of other studies into the private rate of return to higher education in the U.K. The earliest attempt to compute rates of return was by Blaug (with Henderson-Stewart, 1965). A pilot study by Blaug, Peston and Ziderman (1967) and the resulting work by Maglen and Layard (1970) and Layard, Sargan, Ager and Jones (1971) provide an important set of estimates which concentrates in particular on engineering qualifications. Further work has been published by Birch and Calvert (1973) and Khanna and Bottomley (1970) but only the latter gives detailed results for scientists or engineers.

The data sources and methodology adopted in these studies vary considerably. Table 2.1 summarises the main similarities and differences. Despite these differences, the results provide a fairly consistent picture of the rate of return for males to undertaking a first degree. The Blaug/Henderson-Stewart results suggest a marginal private rate of return ⁷ for males of about 14 per cent in 1963. However, this assumes an adjustment for ability which attributes only two thirds of the earnings differential to education. Henderson-Stewart estimated that the "private rate of return actually received by graduates is well above 20 per cent". Blaug, Peston and Ziderman (1967) reported marginal private rates of return in excess of

(6) This issue is discussed at greater length in Appendix A.1.

(7) That is the return to undertaking a degree for an individual possessing the necessary entry qualifications.

Table 2.1 UK Rate of Return Studies (private rates of return for males only)

Study	Data	Methodology	Results
(1) Blaug. Manchester School, (1965) Appendix by Henderson Stewart	Random sample of 6,500 male heads of households, aged 20 or more in Great Britain, 1963. Data collected on mean gross incomes and terminal education age, by age.	Data adjusted: (i) Earnings profile obtained by fitting a smooth curve. (ii) To remove non-wage income. (iii) For ability [weighting difference in profiles by (1-a)] (iv) Tax adjustment effected by assuming a lower value for a. Assumptions: (i) Private costs = lump sum equivalent to the estimate of earnings foregone.	Private, marginal rates of return: 13% for 'A' level or equivalent 14% for 1st degree or equivalent. (Strictly defined in terms of terminal education age rather than course or qualification).
(2) Blaug, Peston & Ziderman. "The Utilization of Educated Manpower in Industry." (1967).	Non-random pilot survey of 2,800 males and 340 females in engineering firms, Great Britain, 1964/65. Data collected on mean gross earnings and highest qualifications held, by age.	Data adjusted: (i) To net out tax. (ii) Addition of 2% for expected growth in real earnings. (iii) Net earnings include maintenance grant and vacation earnings. Assumptions: (i) Private costs = zero other than income foregone.	Private average rates of return: 10-11% for 'A' level. 11-12% for 1st degree or equivalent. Private marginal rates of return: 15% + HNC/'A' level > 12% 1st degree/'A' level
(3) Maglen & Layard. Higher Education Review, (1970).	Full survey of engineering firms in 1966/7. 68 firms were sampled (males only; lesser qualified persons grossed up to same sampling %). Data collected as above.	Data adjusted: (i) For ability. (ii) To net out tax. (iii) Plus 2% for expected growth in real earnings. (iv) Net earnings include maintenance grant and vacation earnings. (v) For drop-outs. Assumptions: (i) Private costs = zero other than income foregone.	Private marginal rates of return: † 8% (7%) 'A' level. 14% (13%) 1st degree.
(4) Layard, Sargan, Ager & Jones. "Qualified Manpower and Economic Performance" (1971).	As for Maglen & Layard.	As for Maglen & Layard.	As for Maglen & Layard.

(continued)

Table 2.1 UK Rate of Return Studies (continued)

Study	Data	Methodology	Results
(5) Ziderman. Oxford Economic Papers, (1973).	OPCS follow-up survey to 1966 Census, of 30,000 qualified persons in Great Britain, 1966/ 67. Data collected on mean and median gross earnings and qualifications held by age. Unqualified earnings profiles obtained from a DHSS survey and the DE's New Earnings Survey for all Workers.	Data adjusted: (i) To exclude certain groups. (ii) For mortality. (iii) For labour market partici- pation. (iv) For probability of obtaining a job. (v) For ability. (vi) For drop-outs. (vii) To net out tax. (viii) For expected earnings growth. (ix) Vacation earnings assumed to be £80 per annum. Assumptions: Private costs = zero other than income foregone.	Average rates of return: 10% (8.5%) 'A' level. 15% (12.5%) 1st degree. Marginal rate of return over 'A' level ⁰ . 22.5% (20%) 1st degree. (After adjustment for dropout this falls to 16.5%.)
(6) Birch and Calvert. Higher Education Review, (1973).	Sample of earnings of teachers obtained from a DES survey in 1970. Data collected on median gross earnings and qualifications held by age. Unqualified earnings profiles obtained from the New Earnings Survey.	Data adjusted: (i) For mortality. (ii) For labour market partici- pation. (iii) For probability of obtain- ing a job. Assumptions: (i) Private costs = zero other than income foregone.	Average rates of return: Males 11.7% (14.1%) 1st degree. Figures in parenthesis include adjustment for 'holiday perks'.
(7) Khanna and Bottomley. Accounting & Business Research, (1970).	Commarket salary survey results for 1967 (October) extrapolated using American age earnings profiles for 1949 (from Houthakaar RES 1959) to obtain the "qualified" earnings profile (median gross earnings). Data from Ziderman for earnings of school leavers with 'A' levels was updated using the change in the index of average earnings (+ 17%) to obtain the "unqualified profile".	Data adjusted: (i) To net out tax. (ii) Large addition made for vacation earnings. Assumptions: (i) Private costs = zero other than income foregone.	Marginal private rates of return: Physics 24.0% Chemistry 22.5% Elec. eng. 19.5% Mech. eng. 19.5% 1st degree

* α = proportion of difference in earnings profiles attributed to education, (1- α) being the proportion attributed to 'ability'.
† Estimates in parenthesis, after adjustment for drop-outs.
⁰ Figures in parenthesis adjusted for ability ($\alpha = 0.66$).

12 per cent for 1964/65 while the average private rate of return⁸ was estimated as about 12 per cent. In the major follow-up to this pilot study, Layard et al. (1971) and Maglen and Layard (1970) reported similar results for the full survey two years later. The estimated marginal private rate of return was 14 per cent. Both these studies and the Blaug, Peston and Ziderman work are based on surveys of firms in engineering and concentrate upon people qualified in these subject areas.

Ziderman (1973), using data from the follow-up to the 1966 Census of Population presents results for a much larger sample. Taking his figures not adjusted for ability, he obtains estimates for the average private rate of return of about 15 per cent while the marginal rate is about 22 per cent. Birch and Calvert, using data for a sample of teachers in 1970, find average private rates of return of 12 per cent. Finally, Khanna and Bottomley (1970) using age earnings profiles constructed from a variety of sources find marginal private rates of return to undertaking a degree at Bradford University of over 20 per cent for 1966/67.

Given differences in data samples, methodology and assumptions, these results are reasonably consistent. Certainly the results show nowhere near the variation reported by Campbell and Curtis (1975) in a review of empirical results for the U.S.A. Consider firstly the average private rate of return. The Blaug, Peston and Ziderman study for 1964/65 and the Ziderman study for 1966/67 shows a slight increase in the rate of return over this period although the former is a far more restricted sample and results reported below suggest that much of this difference might be due simply to different returns for a study in different disciplines. Birch and Calvert's results for 1970 seem to indicate a slight decline to 12 per cent but again the results of Ziderman suggest that most of the difference between this and Ziderman's result is probably due to the fact that Birch and Calvert's sample is for teachers who have lower average earnings ceteris paribus. On the other hand

(8) That is the return to undertaking a degree for an individual with no qualifications, i.e. the average return to both the degree and any qualification necessary to undertake a university or equivalent degree level

Birch and Calvert do not make an adjustment for taxation, choosing to use gross income profiles. The Henderson-Stewart results and our own experiments suggest that this might add 1-2 per cent to the calculated rate of return.

The marginal rates of return appear to show greater variation. In particular, the results from the surveys of the Engineering industry by Blaug, Peston and Ziderman and Layard et al. are substantially lower than those reported in the other studies. This^{is} probably due to the different comparison income profiles used to represent the expected earnings stream of persons qualified to go on to higher education but who do not take up this option. The results of this brief survey seem to indicate that, allowing for differences in data samples, methodology and assumptions, the average private return to obtaining a degree or equivalent qualification was around 14 per cent from 1964/65 up to 1966/67. Furthermore, there is some indication that the return for engineering qualifications was slightly lower. This provides the background for the next chapter which is concerned with examining movements in rates of return for scientists and engineers in Great Britain since that date.

2.4 Social Rates of Return

Although private rates of return are of prime interest if one is concerned with analysing the decisions of individuals they are inappropriate as a measure of social returns to investment in education. The individual is interested in his prospective disposable income from different courses of action. However, from the view point of society as a whole it is the net marginal contribution of the individual to the national product that is important. If gross earnings are taken as a reasonable reflection of marginal productivities then the age earnings profiles may be used to calculate social rates of return to investment analagous to those presented for the private case.

The problems in computing private rates of return all apply equally to the social calculation. The main differences arise from the need to concentrate upon net contributions to output rather than disposable income. This implies, that one should concentrate on earnings gross of taxation; that the direct cost of education should be included as well as earnings foregone; but that transfer payments such as the student maintenance grant should be ignored. Before describing the methodology and data used in more detail we turn to a brief review of previous estimates of social rates of return for the UK.

Most of the studies referred to above also produced estimates of the social rate of return to a first degree. The results of this research are summarised in Table 2.2 for males. All these studies adopted the same basic methodology as outlined in the introductory section to this chapter. The earliest estimates were produced by Blaug/Henderson Stewart (1965). The average social rate of return to 6 years of secondary and higher education was found to be around 8 per cent. The marginal returns to 3 extra

years of schooling beyond the minimum school leaving age (i.e. an 'A' level course for most students) was 12.5 per cent while the marginal return to a further 3 years in higher education (typically a first degree) was 6.5 per cent. All these calculations assumed an ability adjustment factor of 0.6. These estimates, particularly that for the social rate of return to a first degree, suggest social returns considerably below those that might be anticipated by the private individual. This reflects the inclusion of the direct cost element in particular. The study by Blaug, Peston and Ziderman (1967) based on a pilot sample of engineering firms for 1964/65 (two years later than the Blaug results) obtained rather similar estimates. The average return to a first degree being around 10 per cent. Again these estimates were significantly below the private return. The same basic conclusions were reached by Layard et al (1971) and Maglen and Layard (1970). The estimates in these studies were for marginal rates of return but showed the same differential between private and social rate of return estimates. Layard et al (1971) presented a range of estimates from 10.2 to 6.5 per cent depending upon the assumptions made with regard to ability and dropouts. They also tested the sensitivity of the results to changes in other assumptions. From these experiments it is clear that the ability assumption is the crucial factor. Making no adjustment for ability they derive estimates of about 10 per cent for social rates of return to a first degree.

Probably the most comprehensive study was that published by Morris and Ziderman (1971). This research used the same data set as the paper referred to by Ziderman (1973) in Section 3.2. The data upon which the age-earnings profiles are based comes from the

follow up survey to the 1966 census conducted by OPCS. A summary of this data was published in DES (1971). This survey was considerably larger than those used in the other studies and much more comprehensive.

Social rate of return estimates were made for various educational qualifications for both males and females. This study produced very detailed estimates of the costs of different courses/qualifications including recurrent and capital costs and also costs of research. Various estimates of the social return to a first degree were produced depending upon the precise assumptions made. With no ability adjustment and excluding research costs the average social rate of return is 10 per cent. This, in common with the Blaug/Henderson Stewart results, does not include any addition for the expected secular growth in real incomes which is included in the estimates by Blaug et al and Layard et al.

Finally the study by Khanna and Bottomley (1970) also produced estimates of social rates of return based upon evidence from the University of Bradford. Their estimates of marginal social returns vary across subject category but in general are much lower than those obtained by Morris and Ziderman. Making no adjustment for ability and excluding research cuts the latter obtained a value of 12 per cent for the marginal social rate of return of a first degree compared with 'A' level. Khanna and Bottomley's estimates for the same year range from 11 per cent for statisticians to 5 per cent for mechanical engineers. Differences between the two studies arise for a number of reasons. Probably the most important however is that Khanna and Bottomley's results are peculiar to the structure of Bradford University, and reflect in particular the experience of pure and applied science which in general are more

costly to provide than arts and humanities. As for private returns it seems reasonable to conclude that these various studies have provided a fairly consistent picture of the average social return to a first degree. Adding 2 per cent to reflect the secular growth in real incomes, making no adjustment for ability and excluding research costs a value of about 10 per cent is derived. This compares with the average private rate of return of 14 - 15 per cent noted above.

Table 2.2

Social rates of return: Summary of previous results for the UK^a

per cent

Study		Results	Notes
Blaug/Henderson-Stewart (1965)	1963	12.5 6.5 8.5	marginal, 'A' level marginal, first degree average, first degree $\alpha = 0.6$ throughout
Blaug <u>et al</u> (1967)	1964/65	9 10	average, 'A' level average, first degree $\alpha = 1.0$; + 2% increase of secular growth in real incomes
Maglen & Layard (1970) Layard <u>et al</u> (1971)	1966/67	10.2 8.1 7.0	marginal, first degree $\alpha = 1.0, 0.66$, and 0.5 respectively
Morris & Ziderman (1971)	1966/67	12.1 10.0	marginal, first degree average, first degree $\alpha = 1.0$, excluding research costs
Khanna & Bottomley (1970)	1966/67	11.0 10.0 7.5 6.5 6.0 5.0	marginal, first degree for statistics, economics physics, chemistry engineering and mechanical engineering respectively

Note: (a) Males only

3. Rates of Return for Scientists and Engineers

In this chapter estimates of private rates of return to becoming a professional engineer or scientist in Great Britain are presented. These are based on data from various sources including the follow-up surveys to the 1966 and 1971 censuses of population. The prime sources, however, are the surveys carried out by the various scientific professional institutes. The basic methodology is as described in the previous chapter. Further details of sources and methods are given in Section 3.1. This is followed in Section 3.2 by estimates covering the period 1966/67 to 1979/80. There are various problems in extending the analysis backwards in time before 1966/67. These are discussed in Section 3.3. In Section 3.4 the emphasis changes to social rates of return while our conclusions are contained in Section 3.5. The results in this chapter provide a good illustration of the use of the basic methodology. Some of the problems in extending the analysis to other professions are discussed in Chapter 5.

3.1 The data, methodology, assumptions

The new sources of data which are exploited in the current study are the surveys of the earnings of members of various professional institutes. These are combined with information from the Department of Employment's New Earnings Survey and data from the Census of Population. Some scientific institutes such as the Royal Institute of Chemistry have undertaken surveys of their members at irregular intervals for over 30 years, although others such as the Institute of Mathematics and its Applications, having only recently come into existence, were only able to provide data for a much shorter period.

The total sample covered in the scientific institute surveys is quite large. The sample sizes for individual institutes compare favourably with those used in previous studies. The samples are based on a

complete sampling of all the members of each institute. Table 3.1 indicates the sample size for 1971 together with the response rate. The sample numbers given here are adjusted by the institutes to remove replies which were not acceptable, for example, due to wrong completion or not belonging to the defined population (i.e. being a member of the institute and being in employment). Some further adjustment is also made by the institutes to correct for known imbalances in response rates and to ensure the sample is representative of the whole profession.¹

By the side of the response rates in Table 3.1 we present estimates of the numbers in our samples as a proportion of the total number of persons qualified at degree level or its equivalent in science or engineering (QSEs). The latter are based on estimates by the Department of Industry (1977). The response rates themselves are well over 50 per cent in every case, while the sample also represents a considerable proportion of the total number of the active stock of QSEs. We have no way of knowing the extent to which our sample is representative of the total number of QSEs. However, the results discussed in Section 3.2 below suggest that this would not be an unreasonable assumption. Certainly one would expect that the experience of our sample would be indicative of the population of QSEs who are actually employed as scientists or engineers (about 45 per cent of the total) into which category most of the sample will fall.

The data available from the surveys distinguishes various types of membership which reflect seniority. However, it is difficult to compare the titles used within different institutes and so we have worked throughout with the

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- (1) For a full list of the bodies which have provided data see Appendix A. The samples are probably not of as high a quality as those conducted by the Department of Employment in its New Earnings Survey or by OPCS in its follow up to the 1966 Census. However, given their size, the large response rate and the care taken to make the sample representative it is arguable that they are sufficiently robust for the purpose in hand.

entire sample. A few of the surveys also distinguish between graduates possessing a university or CNAA degree and non-graduates possessing a professional qualification. The differences between these two groups are noted below. However, the data for graduates is not available for all years and so in order to compare the situation at different points in time one is forced to restrict the comparison to the whole sample. This might cause problems in comparison over time if the structure of the sample changes so as to bias the estimated rate of return. Graduates, who might be expected to obtain a higher rate of return than non-graduates, make up some 75 per cent of the total number of professional scientists, this proportion not changing much throughout the period. The figure for professional engineers in contrast shows a strong upward trend in the proportion of graduates from below 40 per cent at the start, to over 50 per cent at the end of our period. However, the results obtained below show that although there is a difference in the rate of return for these two groups it is small. Furthermore the experience of graduates and non-graduates seems to have been much the same over this period, both experiencing declining rates of return (see footnote 6 below). Therefore changes in the proportion of graduates should not cause any major bias in the comparison of rates of return over time, for the two groups combined. In any event one of the main conclusions concerns the decline in rates of return over time. Correction of any bias resulting from such changes in the occupation of the sample would therefore merely serve to reinforce these conclusions.

Changes in the proportion of females in the sample might cause similar problems. Again, however, this bias is not likely to be large since the proportion of females is very small, particularly for professional engineers and it has not changed greatly over time. As for the proportion of graduates, any bias that changes in the structure of the samples may cause is in any case likely to reinforce the results discussed below. For example

in the case of the engineering institutes the underlying trend is to increase the proportion of graduates and women in our sample for recent years.

Since both groups have higher rates of return than the average, allowing for any bias would therefore reinforce the observed decline in rates of return over the period.

One final question concerns the comparability of results from different institutes. Attempts have been made by those organising the surveys to ensure consistency. Indeed the results of the 1968 surveys have been used by the Department of Trade to compare earnings profiles for scientists and engineers (DTI, 1970). Reference to Table 3.1 indicates that there are differences in response rates between institutes. However, there is no information on any bias that this might introduce. Also the structure of the sample might affect comparisons between disciplines if this varies a great deal between them. In 1971 and throughout the period the percentage of females was considerably higher in the Institute of Biology sample (around 15 per cent compared with 5 per cent or less in the other institutes). Given the observed differences in rates of return for men and women this can be expected to bias upwards the estimate for biology compared with the rest. The percentage of graduates also varies between institutes, being much higher (95 per cent) in the Institute of Physics and the Institute of Mathematics and its Applications samples compared with the Royal Institute of Chemistry and Institute of Metallurgists samples (65 per cent). Ceteris paribus this will bias the estimates for the last two institutes downwards relative to the others, however, for the same reasons as those outlined above this bias is unlikely to be large. As with the comparisons over time discussed there, since it is not possible to correct for this bias directly by use of more homogenous samples due to lack of data it is important to bear those considerations in mind when assessing the results discussed in Section 3.2.

Table 3.1 Sample numbers for professional institute surveys, 1971.

	Numbers replying to survey	Respondents as a percentage of:	
		Membership of institute	Persons in GB with a degree or equivalent qualification in the discipline
Institute of Biology	3,529	62	16.2
Royal Institute of Chemistry	15,442	69	32.8
Institute of Mathematics	2,063	55	8.3
Institute of Metallurgists	4,089	58	46.1
Institute of Physics	7,077	65	30.8
All Scientific Institutes	32,200	65	15.8
Council of Engineering Institutes	32,675	80*	16.0

From the Census of Population 1971.

* Estimate for 1968. Response rate for 1971 not published.

These surveys do not provide estimates of the unqualified earnings profile. For this purpose we use the average profile for all workers as a proxy in the absence of superior measures. Obviously this will include a small proportion of the population who are qualified. However, the extent to which this is likely to reduce our rate of return estimates is small. The basic source of this data was the Department of Employment's New Earnings Survey. This data is available for both mean and median earnings. Male and female earnings were aggregated together using the proportion of males to females in the professional institute sample in order to obtain a suitable comparison earnings profile. This was further adjusted to take into account discrepancies between the dates of the various surveys by multiplying each element of the comparison earnings profile by the percentage change in the index of average earnings between these dates.² A similar method was used to produce a "tax year" version for comparison with some of the professional surveys which refer to income over such a period rather than at a point in time. All estimates were converted to an annual income basis by multiplying by 52. For private rates of return the individual is assumed to be primarily interested in take home pay. Both profiles are therefore adjusted on to a net of tax and national insurance contributions basis. This adjustment assumes a typical individual, single up to the age of 23, who marries and has a family of two children. The direct costs to the individual of undertaking a course are assumed to be zero; foregone income is therefore the sole cost. The B_t profile is adjusted however to include the student maintenance grant. Student vacation earnings are added to B_t for years when the individual would otherwise have zero income. Estimates of vacation earnings are based on various surveys and the index of average earnings. Further details of sources and methods are given in Appendix A.2.

-
- (2) Experiments indicated that applying this method to results from one New Earnings survey sample produced an almost perfect estimate of the results for the next survey. In other words, the age earnings profiles for all workers were very stable over the period considered (1968-80).

It is important to know to what extent the failure to make further refinements may have affected our estimates. In order to clarify this a preliminary analysis of data from the follow-up to the 1966 Census was carried out. This enables us to compare our results directly with those of Ziderman. A number of questions can be posed. What is the impact of not adjusting for relative unemployment probabilities and mortality? What difference does the use of median as opposed to mean earnings profiles make and finally, how does the rate of return to scientific disciplines compare with those for all subjects? In addition this data source is of interest in its own right since in 1971 a similar survey was carried out as a follow-up to the 1971 Census of Population thus providing us with further information to judge how rates of return may have changed over time. Data for this piece of analysis is based on a one in ten follow-up enquiry to the 1966 and 1971 Censuses of Population. Full details of the sample, response and specimen questions are given in DES (1971). This survey was directed at qualified persons only; to obtain the comparison income profile for this analysis we have used the $\frac{1}{2}$ per cent DHSS survey results used in Morris and Ziderman (1971).

3.2 Rate of Return Estimates 1966-67 to 1979-80.

Results from the Census follow-up, 1966-67 and 1971-72

In Table 3.2 we present initial estimates of the expected average private rate of return to undertaking a degree assuming that age earnings profiles current at that time accurately reflect the future earnings prospects of an average individual. These estimates for 1966-67 are compared with those in Ziderman (1973). The main differences between the estimates are as follows:

- (i) Sample. Ziderman's results are based on a restricted sample from the OPCS survey that includes teachers. The present results are from the same survey and for a larger sample but one that excludes teachers. Ziderman's results for marginal rates of return show that the exclusion of teachers from his sample increases the estimated rate of return by 1-1.5 percentage points for males. No estimates are made for females, however, a priori one might expect that if anything, exclusion of teachers would reduce the rate of return for females since relatively speaking teaching is a much better paid profession for women than men. The results of Birch and Calvert support this view.
- (ii) Ziderman's data is adjusted for mortality. This seems unlikely to make much difference due to the part of the earnings profile that such an adjustment affects being so heavily discounted.
- (iii) Ziderman's data was adjusted for differences in participation rates for qualified and unqualified profiles. (The earnings data from the follow up survey to the Census implicitly adjusts for the probability of unemployment and for the extent of part-time working).
- (iv) Ziderman uses the same data set as described in Morris and Ziderman (1971). From this it is clear that the data used to make the actual rate of return calculation is for individual years rather than the average values for 5 yearly age groups used in the

the current study. A priori one might expect the use of 5 yearly age groups to bias the estimated rates of return upwards. While the earnings of the oldest in each age group will be underestimated, those at the lower end are overestimated. Since earnings are being discounted the latter will in general tend to offset the former and consequently differentials between the B_t and C_t profiles will be exaggerated. To the right of GH in Figure 2.1 this implies an increase in the net benefits from undertaking a course of education. To the left of GH this effect might be expected to operate in the same way thus increasing the discounted net costs. However, because earnings up to the age of 18 are explicitly assumed to be zero, yet in practice, using an average value for the period 16-19 take on a positive value (reflecting the student grant and vacation earnings), this could be offset and net costs may be implicitly reduced for the first few years by using grouped data. This would reinforce the impact of using grouped data in the estimates of net benefits to the right of GH, and result in higher rate of return estimates than would be obtained using annual data.

- (v) Finally there are very minor differences with respect to the assumptions made about taxation.

A sensitivity analysis was conducted to assess the importance of (iii) and (iv). Private rate of return calculations were made for all subjects at first degree level for males using an annual version of the age earnings profile and adjusting for different participation rates. Comparing these results with unadjusted profiles using grouped age data suggested that these two factors reduced the estimated rate of return by about 2 percentage points. On adding back 2 percentage points to account for the expected secular growth

in real incomes³, the basic result given in Table 3.2 was obtained. Of the remaining differences (v) probably leads to a small upward bias compared with Ziderman's results while (ii) will probably have the reverse effect. Both however are certain to be very small. Therefore, it seems reasonable to conclude that the remaining differences are the result of differences in the data sample used to obtain the B_t profiles, in particular with respect to the treatment of teachers. The actual differences observed seem consistent with such an interpretation. For females after adjusting the basic figure for participation and the use of grouped data by age the present estimate is 1.0 per cent higher than obtained by Ziderman. This difference is consistent with the effect of excluding teachers from the sample. For females the effect of this exclusion is likely to have a somewhat smaller impact on expected rates of return since teaching is not such a poorly paid profession for women as it is for men.

Since the bulk of the remaining estimates are based on median earnings profiles, it is therefore of interest to establish what difference this might make to estimated rates of return. This can be examined by use of the OPCS data for 1966/67 since mean and median earnings figures are available for all higher qualifications. The main difficulty is in obtaining a median earnings comparison income profile.

In Wilson (1980) it was claimed that use of mean as opposed to median earnings profiles to calculate rates of return would raise the estimates by 1½-2 percentage points. This it was argued results from the fact that the mean is generally some 5-10 per cent above the median value of earnings. However further analysis suggests this conclusion is incorrect. From a theoretical viewpoint the use of mean as opposed to median earnings will tend to raise the earnings profiles for both groups, except perhaps at the extreme ends of the age profile. There is no reason a priori to expect this to affect the unqualified profile more or less than the qualified one.

(3) This is justified in Appendix A.1.

Table 3.2 Average private rates of return to a first degree 1966-67^a

	per cent	
	Males	Females
1. Basic Result ^b	16.5	21.5
2. Ziderman Result	15.0	20.5
3. Remaining discrepancy	+1.5	+1.0
4. NES based C_t	15.0	21.5

Notes: (a) Rounded to nearest 0.5.

(b) After adjustment for participation, use of annual age groups and the addition of 2 per cent for expected secular growth in real incomes.

As a consequence, if the ratio of median to mean is the same for both profiles one would expect no impact on the rate of return calculation at all. The impact would be analogous to a common inflationary factor applied to all B_t and all C_t values (as discussed in Appendix A.1). Only if the ratio varies systematically on either side of the cross-over point for the two profiles will the rate of return calculation be affected. There is some evidence from the GHS that for graduates for example the median (and mode value of) earnings may be greater than the mean for those just starting their careers. This would therefore tend to result in a higher rate of return estimate from using median data. On the other hand even if there were an identical relationship between median and mean, because there is no median estimate of the student maintenance and vacation earnings (and so the same value is used in both mean and median calculation), net costs are reduced relative to the net benefits in the case of the median calculation. The net benefits will be reduced by N per cent if the median is N per cent below the mean, but the net costs will be reduced by more since the C_t profile will be reduced by N per cent but part of the B_t profile (that applying to the period the person is at University) will not change. This will tend to reduce the rate of return estimate compared with using mean values of earnings. On balance it is difficult to say a priori which effect might predominate. Without more systematic evidence on the ratio of mean to median earnings of young qualified people, it is impossible to quantify the first effect. The second might tend to reduce rates of return by about $\frac{1}{2}$ per cent.

The result obtained in Wilson (1980, p.53), that mean earnings profiles resulted in rate of return estimates some 1-2 per cent above those obtained using median earnings turns out on more detailed analysis to result from the slightly different coverage of the surveys used for the comparison income profiles for mean and median incomes. The DHSS survey used for the mean income C_t profile in the calculations described so far, includes a small proportion of part-time males, whereas that used for the median was based on the New Earnings Survey and is for full-time workers only.

In order to compare like with like, a comparison profile for median earnings on a DHSS basis must be constructed by applying the ratio of median to mean earnings from the 1968 NES data. This profile is some $2\frac{1}{2}$ per cent lower than that used in the calculation described in Wilson (1980).⁴ Although the method described there is in fact the correct one as outlined here, the profile used in the earlier paper was simply the 1968 NES median value adjusted for inflation between 1966/67 and September 1968. The results of using the preferred median profile is that the rate of return estimate obtained is less than $\frac{1}{2}$ per cent below that obtained using mean earnings profiles. These results do however suggest that the use of NES data rather than the DHSS data to compute the comparison earnings profile makes a significant difference to the estimated rate of return. Reworking the calculation for males using a C_t profile based on the New Earnings Survey for 1968, adjusted for movements in average earning between the tax year 1966/67 and September 1968, results in the fourth estimate given in Table 3.2. This estimated rate of return is some 1.5 per cent below that using the DHSS based C_t profile. (This result applies to males only, the estimate for females being already based on NES data). For comparison with the results for professional scientists we have therefore reworked the rate of return calculations on OPCS data presented in Wilson (1980) using an NES based C_t .

In Table 3.3 we present the results of estimating rates of return for different subject groups. The estimates show some clear differences between subject groups for males and a much higher return generally for females. Degrees in science and engineering and technology had a lower expected rate of return although the difference was not very large and the return to all the subjects was high compared with alternative investment opportunities available to individuals at that time. Considering changes over time

(4) Given a proportion of part-time male workers of about $2\frac{1}{2}$ per cent, earning an average of 35 per cent of the full time rate, the bulk of this $2\frac{1}{2}$ per cent difference is explained by the difference in coverage of the two surveys.

Table 3.3

Average private rates of return for different disciplines 1966-67

	per cent			
	Science	Engineering and technology	Other subjects	All subjects
Males	14.0	14.5	16.0	15.0
Females	22.0	n/a	21.5	21.5

Notes: (1) Rounded to nearest 0.5

(2) Male results differ from those in Wilson (1980) because they are based on NES data for C_t .

(3) Adjusted for participation.

estimates using the data from the follow-up to the 1971 Census of Population suggest that, at least for males, the rates of return for different subjects had all declined between 1966/67 and 1971/72. Our re-estimates are presented in Table 3.4.

In Table 3.5 estimates are presented for persons obtaining a degree who are working in particular occupations. These represent average rates of return for HNC and HND as well as degree level qualifications, but are indicative of the variation in earnings prospects for alternative careers. Again the results for 1966/67 show a slightly higher return to engineering and technology as a career than to science. Persons in these occupations are not necessarily qualified with a degree in these subjects but the results suggest that the return to undertaking alternative degree subjects reflects the occupational labour market which these individuals are likely to enter.

The results for 1971/72 show a similar pattern to that observed for those qualified at degree level. It is interesting to note that in contrast to the returns for different subjects although the overall picture is of a substantial decline especially for engineers, scientists particularly chemists avoided this precipitous fall. Physicists and biologists however also experienced a marked decline. Mechanical engineers were the only engineering occupation to avoid this fate.

It is important not to read too much into these comparisons between 1966/67 and 1971/72 at this stage. Slight differences in coverage and definition together with large sampling errors particularly for the 1971/72 survey, may affect our estimates. The 1971/72 sample was a much smaller one than that for 1966/67 (less than one third the size) and the results for individual occupations for the later period are subject to quite a large margin of error. In addition the 1971 survey is not automatically corrected for the probability of finding a job. Ceteris paribus the latter implies a higher rate of return compared with 1966 since the C_t profile is not adjusted in both cases. This probably biases the estimates for 1971/72 upwards by between 0.5 and 1 percentage points compared with those for 1966/67.² Taking this into account reinforces the general conclusion of a decline in expected rates of return between the two years.

Table 3.4 Average private rates of return 1966/67 and 1971/72

				per cent
Males	Science	Engineering and technology	Other subjects	All subjects
1966/67	14.0	14.5	16.0	15.0
1971/72	12.5	13.0	14.0	13.5

Notes: As for Table 3.3.

Table 3.5: Average private rates of return in different occupations

... per cent		
Males	1966/67	1971/72
Civil Engineers	16.0	9.5
Mechanical Engineers	12.0	12.0
Electrical Engineers	12.0	8.5
Technologist nec	12.5	10.5
Chemists	12.0	12.0
Physicists and Biologists	13.5	8.5
All Engineers	13.5	10.5
All Scientists	12.5	11.0

Notes: As for Table 3.3.

The Rate of Return to Becoming a Professional Scientist or Engineer 1967-80

In Table 3.6 we present results on the average private rate of return to becoming a professional scientist or engineer as estimated for 1967 to 1980. These estimates have been produced using the methods and assumptions described in Section 3.1. It is worth emphasising a number of points before comparing these results with the previous estimates based on OPCS data.

- (i) The earnings profiles for qualified persons used in this analysis cover persons holding various types of qualification, although they are all regarded as being equivalent to a university degree by the professional institutions who collect the data. The rates of return presented here should therefore be regarded as average expected returns from taking a number of different, albeit broadly equivalent, routes to becoming a professional scientist or engineer rather than to obtaining any particular qualification. In practice, the university first degree or CNA degree is by far the most common route to professional status.⁵

- (5) Comparison of those with a university degree or a CNA degree with the whole sample showed that although such qualified persons receive a higher return than those who achieve professional status via the HNC/HND and professional qualification route, the differences were not large. Results for 1968 and 1971 were as follows:

Comparison of rates of return for graduates and total sample professional institutes 1967/68 and 1970/71

	1967/68		1970/71	
	Graduates*	All respondents	Graduates*	All respondents
All scientists	15.0	14.0	13.5	12.5
Engineers	16.0	14.5	14.0	13.0

* University first degree or CNA degree.

- (ii) They represent average results for males and females combined (although, the proportion of females is very small especially for engineers).
- (iii) The earnings data used are median earnings rather than means for each age group. The analysis described above suggests that the difference in rates of return calculated on median or mean earnings from the same samples are however quite small, probably less than 0.5 percentage points.
- (iv) No adjustment is made in these basic results for the probability of obtaining a job, for ability, or for differences in hours of work. However, we return to some of these questions in Chapter 8 below.
- (v) The rates of return calculated represent the expected real costs and benefits of alternative career profiles and should therefore be compared with real rates of interest, not nominal rates.
- (vi) We have assumed no change in the structure or composition of the samples on which the earnings profiles are based. Rates of return may be altered if the structure of the sample alters significantly over time. For example, significant changes in the proportion of graduates or females could lead to changes in estimated rates of return solely due to these compositional effects. In practice, such compositional effects do not appear important.
- (vii) The estimates for all scientists in 1967/68 and 1970/71 are based on median earnings profiles for combined samples from all institutes. These profiles were not available for later years and so the figures for all institutes are formed from weighted averages of the

individual profiles, the weights being the sample numbers in each age group from each institute.⁶

The initial estimates for 1967/68 for both scientists and engineers suggest an average private rate of return of about 14-15 per cent. This is the same order of magnitude as the results obtained in other studies for the early to mid 1960s. Allowing for differences in the samples covered in the professional institute surveys, these estimates agree very closely with those based upon the much more comprehensive follow-up earnings survey to the 1966 Census of Population given in Table 3.5. The latter estimates are, however, for male first degree graduates only. The B_t profile is automatically adjusted for unemployment probabilities but the C_t profile is not, which is one reason the census based estimates tend to be slightly smaller.

The results are remarkably consistent with those presented earlier. The slight advantage of engineering and technology compared with pure science observed for 1966/67 is repeated here, at least up until the most recent years. The results for individual institutes also appear to reflect the occupational results for 1966/67 with physicists maintaining their advantage over chemists in 1967/68. The results for 1971/72 from the census for certain groups such as physicists look rather suspect when compared with the results in Table 4. As noted above the sample size for some occupations in the census follow up was very small.

(6) A similar set of calculations carried out for 1967/68 and 1970/71 suggests that this may lead to a slight upward bias in the aggregate figures for 1973/74 and 1976/77. Rates of return computed on the median profiles for all institutes and the estimated profiles for all institutes obtained as described in the text were as follows for 1967/68 and 1970/71:

	All institutes profile	Estimated all institutes profile
Average rate of return 1967/68	14.0	14.5
1970/71	12.5	12.5

The most striking result however, is the substantial decline in the expected rate of return for all groups due to the shifts in relative income profiles over this period. This decline has occurred slowly but steadily for all groups up to 1973/74 although there are some signs that it had ceased if not been reversed after this date. While the decline between two observations for a particular institute might result from sampling error, these results appear to provide strong evidence of a substantial decline in the average private rate of return to undertaking the type of educational courses necessary to become a professional scientist or engineer. By 1973/74 real rates of return had declined for all categories to about two-thirds of the levels of 1967/68. Note, however, that at this time many real rates of interest (nominal rates - expected inflation rates) were in fact negative. The estimated rates of return were therefore still substantially above those obtainable from most alternative investments.

After 1973/74 estimates for most groups show signs of picking up again. This, however, only proves to be a temporary reversal for most subject categories. There are also differences in the timing of the recovery (compare engineers, physicists and mathematicians). Perhaps the most one can say is that overall there has been a leveling out in the late 1970s with an average rate of return of about 9 per cent being the rule. For qualified scientists the revival continued in 1979/80 for chemists and mathematicians. For biologists, and metallurgists, however, the increase in 1976/77 has since been reversed. Physicists and engineers have had a reasonably stable rate of return throughout the mid and late 1970s (around 10 per cent). Engineers saw a recovery in the early 1970s before rates of return fell to about 9.5 per cent at the end of the decade.

Table 3.6 Average private rates of return to becoming a professional scientist or engineer¹

	1967/68	1970/71	1972/73	1973/74	1974/75	1976/77 ²	1978/79	1979/80
Engineers	14.5	13.0	10.5	-	10.5	9.5	9.5	-
Scientists (all institutes)	14.0	12.5	-	9.5	-	9.5	-	9.0
Biology	14.0	11.5	-	8.5	-	9.0	-	8.0
Chemistry	14.5	12.5	-	9.0	-	9.5	-	9.0
Mathematics	16.5	14.0	-	10.0	-	9.0	-	10.0
Metallurgy	14.5	12.5	-	9.0	-	10.0	-	8.5
Physics	15.5	13.5	-	10.0	-	10.0	-	10.0

Notes: (1) Based on median earnings profiles; all estimates rounded to nearest 0.5 per cent.
 (2) Estimates for 1976/77 have been revised slightly from Wilson (1980) Table 7.

Results for individual engineering institutions

Since 1974/75 the survey of professional engineers has presented separate data on the earnings of members of individual engineering institutions. While the sample sizes upon which these estimates are based are necessarily smaller than those used for the aggregate analysis, they appear large enough to enable broad comparisons to be made. Results of private rate of return estimates based on the same methodology as described above are presented in Table 3.7.

The pattern observed for engineers as a whole is apparent for most of the institutions. Expected rates of return fall between 1974/5 and 1976/7 before recovering in some cases in 1978/79. Only for the Institution of Mining and Metallurgists and the Institute of Metallurgists was this pattern not observed. The highest rates of return are obtained for members of the Institute of Chemical Engineers and the Institute of Marine Engineers. No institution can be clearly ranked as having the lowest expected rate of return, the rankings varying from year to year. Overall there is a small but significant variation between institutions. In 1974/75 the Institute of Marine Engineers was top with a figure of 13.5 per cent compared with 9.0 per cent in the Institution of Metallurgists. In the 1976/77 top spot is claimed by the Institute of Mining and Metallurgy. By 1978/79 (ignoring a rather freakish observation obtained for the Institute of Naval Architects) the Institute of Marine Engineers had regained the top spot. Given the smaller sample sizes on which these results are based, too much should not be read into comparison over time or across institutions. Nevertheless, the consistent time profile and the consistency of rankings over time suggests some stability in wage structures between different groups of engineers while similar forces have affected the earnings of all types of engineers relative to average earnings for all workers.

Table 3.7 Results for Individual Engineering Institutions

Institution	per cent		
	1974/5	1976/7	1978/9
Royal Aeronautical Society	9.5	8.5	9.0
Institution of Chemical Engineers	12.5	11.0	12.0
Institution of Civil Engineers	11.0	10.0	9.0
Institution of Electrical Engineers	10.0	9.0	9.5
Institution of Electronic & Radio Engineers	10.0	8.5	9.5
Institute of Marine Engineers	13.5	11.0	13.0
Institution of Mechanical Engineers	10.0	9.5	9.5
Institution of Metallurgists	9.0	10.0	8.5 ^c
Institution of Mining & Metal Metallurgy	11.5	12.5	11.0
Institution of Mining Engineers	10.5	10.0	11.5
Institution of Municipal Engineers	12.0	10.5	8.5
Royal Institution of Naval Architects	11.5	11.0	14.5 ^b
Institution of Production Engineers	10.0	9.0	9.5
Institution of Structural Engineers	10.5	9.5	8.0

Notes: (a) Estimates rounded to nearest 0.5.

(b) This exceptionally high figure arises from an estimate of the earnings of those below 25 years of age well above the average.

(c) 1979/80.

3.3 A longer perspective on rates of return

It is in principle possible to extend the analysis described in Section 3.2 backwards in time beyond 1966/67. The various scientific and engineering institutions have as noted there carried out surveys of the earnings of their membership for many years. The main problem in carrying out such an exercise, as noted in Wilson (1980, p.58), is that the NES which we have used as a basic source for the comparison income profile C_t was not started until 1968 and no obvious alternative source exists. It is therefore necessary to estimate C_t for the earlier years. In doing this there is a danger that in constructing the unqualified income profile, by for example adjusting the NES data according to movements in the average level of earnings, we may prejudice the judgements we are attempting to make. It seems reasonable to adjust such profiles over a matter of months, as we have done to ensure that B_t and C_t profiles refer to the same date (e.g. January 1st) or the same period (e.g. the tax year). However, to assume stability of the profiles over a longer period would be rather hazardous, unless one can demonstrate that there is evidence to support such an assumption.

Although there was no survey directly comparable to the NES prior to 1968 there were a number of other surveys which provide some information on earnings by age. In this section we show how this information can be used to check whether the assumption of a stable age earnings profile for all workers over a 10 - 15 year period is acceptable. The evidence from these other surveys tends to support such an assumption once allowance is made for the differences in coverage etc. Having established that the C_t profile can be regarded as remaining basically unchanged in shape over time, the results from various surveys carried out by the professional institutes can be used to generate rate

of return estimates for years prior to 1966/67. Various problems of comparability over time distort some of the initial comparisons.

Solutions to these difficulties are proposed and a set of results comparable with those presented in Section 3.2 are produced.

Construction of the C_t profile

Various ad hoc surveys were carried out during the 1950s and early 1960s which asked questions about earnings and age in Great Britain. Although these differ in many respects from the NES data used to construct the C_t profile for more recent years they provide a check on how realistic it is to produce estimates of C_t for years prior to 1966/67 assuming the basic shape of the age earnings profile is stable.

The earliest of these is for the year 1951/52, when Lydall (1955) carried out a quite large survey of incomes and consumption patterns in Great Britain. The results presented by Lydall include mean income from employment of heads of household for 6 age groups from which a fairly accurate age income profile can be estimated.

The next survey of which I am aware was that used by Henderson-Stuart to calculate some very early rate of return estimates for the UK reported in Blaug (1965). However, the data from this survey enables only a very crude age income profile to be constructed. In 1964/5 a survey was carried out by Blaug Peston and Ziderman (1967) covering firms in engineering and for 1966/67 a survey was conducted on behalf of Maglen and Layard (1970). These surveys together with the DHSS survey for 1966/67 already referred to are in themselves not particularly suitable for use as comparison income profiles. The survey by Lydall for example includes all heads of households, full-time and part-time workers and both males and females. It is thus not directly comparable to the C_t profiles used in Section 3.2 which for engineers at least are for males only and do not include part-time workers. The early surveys do enable a close check to be made on the accuracy and shape of age earnings profiles based on the NES results for 1968 however. A consistent set of comparison income profiles was

constructed for 1955/56, 1958/59, 1961/62, 1964/65 and 1965/66 based on the profile for all male workers from the NES for 1968. This profile was adjusted by movements in the Index of average earnings or by movements in the earnings of manual men from the DE's earnings and hours survey for years before the Index was introduced.⁷

This constructed series was then compared with the age income profiles available from the other sources referred to above. The constructed profile appears to be quite consistent with these other sources once the differences in definition and coverage are taken into account. For example comparing the constructed comparison profile extended back to 1951/52 with that reported by Lydall, it is clear that what initially appear to be large differences can be easily explained. In Table 3.8 Lydall's estimates of income from employment of all heads of households are compared with the series on annual earnings of all employees in employment based on the NES and the series movements of average earnings as outlined above. The main differences arise as a result of;

- (i) the fact that Lydall's data is for mean incomes whereas the comparison income series is based on median incomes;
- (ii) the fact that Lydall's sample of heads of households contain quite a large proportion of females;
- (iii) the fact that Lydall's sample will necessarily contain a small proportion of people who are not full time workers (although in 1951/52 such persons constituted a much smaller proportion of employment than in more recent times);
- (iv) the fact that Lydall's data is for household units, and therefore may include more than one income recipient. This is likely to become progressively more important for households with older heads up to the age of 45 - 55. As these

(7) For those below 20 years of age the growth in the earnings of manual youths and boys was used, for those aged 21-25 an average value. This refinement is quite important since earnings of youths and boys grew significantly faster than for adults between 1955/56 and 1965/66.

people's children grow up and become income earners and as wives are released from the primary function of child rearing household income will increase.

The estimates in the table show adjustments of the 1968 NES based median comparison income to obtain the estimate in column 5 of annual income for an average (male/female) head of household. This is compared with figures based on Lydall's survey results (column 6) converted on to a median basis. This comparison therefore makes allowance for (i) and (ii). The other two factors would be expected to affect the comparison in opposite directions. Lydall's inclusion of some part-time workers will tend to make his estimates lower than those based on the NES data which is for full-time workers only. The inclusion of other income recipients within the household on the other hand will tend to result in higher figures from the Lydall survey. This factor might be expected to predominate as heads of households get older up to the point at which dependents leave home and when some individuals might wish to reduce their commitment to full-time work. This is indeed the pattern revealed in the table. For age groups up to 25 the Lydall data is somewhat lower than the NES based series. Thereafter the Lydall estimates become progressively higher, the difference rising to a peak in the 45-55 age bracket. By and large therefore this analysis suggests that the NES based C_t is a reasonable estimate for the early 1950s.

Similar comments apply to the differences that emerge between the comparison income profiles for other years and results from other surveys. The surveys for 1964/65 and 1966/67 referred to above collected data on mean incomes for people within the engineering sector. These two factors result in age earnings profiles substantially higher than for the median based age incomes profile for all workers.

Table 3.8 Reconciliation of Estimates of Age Earnings Profiles

Age	NES 1967/68		(medians) 1951/52		Males & Females	Lydall data median
	Males (1)	Females (2)	Males (3)	Females (4)		
15-19	483.6	400.4	142.5	142.2	142.4	140.6
20-24	967.2	650.0	285.1	230.9	267.8	263.1
25-29	1216.8	738.4	398.6	268.3	357.1	393.3
30-34	1320.8	717.6	432.6	260.7	377.8	409.5
35-39	1362.4	698.8	446.3	253.9	385.0	417.1
40-44	1352.0	686.4	442.9	249.4	381.3	427.4
45-49	1289.6	676.0	422.4	245.6	366.1	436.6
50-54	1222.0	665.6	400.3	241.8	349.8	430.7
55-59	1154.4	655.2	378.1	238.1	333.5	373.8
60-64	1071.2	655.2	350.9	238.1	315.0	317.1
65+	910.0	572.0	298.1	207.8	269.3	204.7

Sources and Notes:

- (1) NES (1968) Table 9 , multiplied by 52; some age groups interpolated graphically.
- (2) As (i).
- (3) (1)* movements in average earnings between September 1968 and 1951/52 as described in the text.
- (4) (2) adjusted as for males.
- (5) Weighted average of males and females based on split in Lydall's survey of heads of households.
- (6) Lydall (1955) Table 14 adjusted by ratio of median to mean income by age as indicated by the 1968 NES results.

Finally the comparison income profile for males used by Zideman and Morris, based on the DHSS survey for 1966/67 gives an age earnings profile with earnings about 2 per cent lower than one based on NES data. The DHSS survey includes part-time workers. Given that some 2½ per cent of males worked part-time, earning around 35 per cent of the full-time weekly wage the bulk of the difference is accounted for by the inclusion of this group in the DHSS survey. These comparisons suggest that the estimates of comparison incomes for the period prior to 1967/68 based on the NES and on movements in average earnings for adults and young people are reasonably accurate. Obviously they are subject to rather wider margins of error (especially for the earliest years) than those used for the period subsequent to 1966/67. The implications of this for the estimates of rates of return are considered below .

Rate of Return : estimates for earlier years

Although various professorial institutes carried out earnings surveys prior to 1967/68 data are not available for all of the groups considered so far. The extension back in time is therefore limited to Chemists, Physicists and Engineers. For Engineers the first survey published by the Council of Engineering Institutions was for 1965/66. However two earlier surveys were conducted for 1959/60 and 1962/63 by the Engineers Guild. In addition in 1955/56 a series of surveys of earnings was carried out under the auspices of the Royal Commission on Doctors and Dentists Remuneration (RCDDR). This data was published in RCDDR (1960). As well as collecting information on the medical professions the Commission was also concerned to make comparisons with other groups such as engineers, architects, university teachers, the legal professions etc. Data was collected on earnings by age enabling rate of return calculations to be carried out for various groups as well as scientists and engineers. The Mechanical, Civil and Electrical

Engineering Institutes carried out surveys of their corporate members as part of this exercise. This data is therefore not directly comparable with that used in Section 3.2 which was for all engineering institutions and for all the membership not just for corporate members. For this reason some adjustment is necessary to the raw data to ensure comparability.

The Royal Institute of Chemistry (RIC) has published surveys of the earnings of its members since the 1930s. In view of the fact that the comparison income profiles for years prior to 1966/67 are of necessity estimates based on rather limited information it was decided to limit our calculations to 1955/56 onwards. The other reason for choosing this date was the availability of data for professional groups other than scientists and engineers from the RCDDR surveys which enable comparisons of a wide variety of professional groups to be made.⁸ As for engineers these earlier surveys for chemists are not directly comparable with those carried out in more recent years, covering just members and associates and excluding licenciates and graduates. This does affect the age earnings profiles quite significantly and it is necessary to adjust the results to allow for this difference.

For physicists the Institute of Physics conducted surveys in 1956/57 and again in 1960. It then amalgamated with the Physical Society before producing a further survey in 1964 and all the subsequent surveys. No major problems of comparability over time arise in this case.

(8) This is done in Chapter 5.

Results for 1955/56 - 1965/66

In order to ensure comparability with the results presented in Section 3.2 the earnings profiles for engineers were adjusted;

- (a) to take into account the fact that the profiles for 1955/56, 1959/60 and 1962/63 are for corporate members only;
- (b) to take into account the fact that they cover just three institutes.

These adjustments were based on estimates of the effect of these differences on the average level of earnings as indicated by the Council of Engineering Institutions in its 1965/66 survey report. On average this adjustment tends to reduce median incomes by about 15 per cent. The appropriate adjustment is not constant across age groups however since the proportion of the more senior corporate members declines for the younger age groups implying a larger downward adjustment. Without making this adjustment the rate of returns for 1955/56 would be about 21.5 per cent (assuming a 3 year course of study). This figure however represents the expected return for the exceptional individual who attains corporate status at an early age and is not typical. The expected return for the typical professional engineer is 14.5 per cent as given in Table 3.9 . This figure is almost exactly the same as obtained for 1967/68. Thus over the 12 year period rates of return had not altered. However in the intervening period the earnings of engineers changed quite significantly compared with most other groups of workers rising to a peak in 1962/63 (see Figure 4.4 in Chapter 4) before falling steadily thereafter. This was reflected in a sharp increase in expected rates of return as measured from cross-sectional data in both 1959/60 and 1962/63 to around 17 per cent. After the 1962/63 peak average private rates of

Table 3.9 Average private rates of return for engineers

	per cent	
	Corporate members of three institutes	All members all institutes
1955/56	21.5	14.5
1959/60	-	17.0
1962/63	-	17.0
1965/66	-	14.5
1967/68	-	14.5

return fell for engineers to around 14.5 per cent in 1965/66.⁹

For chemists a similar problem arises to that described for engineers. Although the RIC survey gives detailed estimates of the age earnings profile the figures are based on the earnings of fellows and associates only. It cannot therefore be compared directly with the results presented earlier for the period from 1967/68 onwards. The data on which the latter are based covers both graduates and licenciates. Comparing results for 1967/68 the average private rate of return based on the earnings of fellows and members only is 16 per cent compared with the value of 14.5 when all the membership were included. This suggests the estimates in the first column of Table 3.10 should be reduced by a factor of about 0.925 to make them directly comparable with those in Table 3.6. Adjusted figures are presented in the second column. From these results it is clear that even when the differences in the sampling frame are accounted for there has been a substantial decline in rates of return between 1955/56 and 1967/68. The preferred estimate of 20 per cent is also substantially greater than that obtained for engineers, but identical to the value found for physicists (see Table 3.11). The results for physicists confirm (in contrast to engineers) the sharp fall in rates of return for scientists between the mid-1950s and the mid-1960s. Although we have expressed some doubts about the accuracy of the comparison income profiles it seems improbable that errors here could explain this large fall. As noted above there is in any event no evidence to support any substantial bias in the measures used and the results for engineers show that such a result is not an inevitable consequence of the assumed change in the comparison income profile. However as noted above there is undoubtedly a wider margin

(9) All numbers rounded to the nearest 0.5 per cent. In fact the estimates suggest slightly higher rates of return in 1959/60 than in 1962/63 and in 1965/66 compared with 1967/68.

Table 3.10 Average private rates of return for chemists^a

		per cent
	Members and Fellows only	All Membership ^{b,c}
1955/56	21.5	20.0
1958/59	19.5	18.0
1961/62	18.0	16.5
1964/65	17.5	16.5
1967/68	16.0	14.5

Notes (a) Members of the Royal Institute of Chemistry

(b) Including graduates and licenciates

(c) Based on results for members and fellows only for
1955/56 to 1964/65

Table 3.11 Average private rates of return for physicists

	per cent
1956/57	20.0
1960/61	19.5
1964/65	18.5
1967/68	15.5

of error associated with the C_t profile in these earlier years. Sensitivity analysis suggests that if the C_t profile was in error by ± 10 per cent the impact on estimated rates of return would be no more than ± 2 per centage points on a rate of return estimate of 20 per cent. Thus even if the C_t profile is quite a long way out the substantial changes in rates of return for scientists between 1955/56 and 1967/68 would still arise. From the discussion in Chapter 5 it will become apparent that the precipitous decline for scientists is common to most professional groups.

Turning to the estimates for the other years for chemists and physicists there are again notable differences in the experience of scientists and engineers. Both chemists and physicists experience a slow and steady decline in estimated rates of return between 1955/56 and 1967/68, estimates of all three groups converging to around 15 per cent in this year. This decline in estimated rates of return is in contrast to movements in average earnings relativities between physicists and all workers (see Figure 7.4 in Chapter 4). In Chapter 4 it is demonstrated that a major cause of the declining estimated rate of return is the fact that the foregone earnings of young people at the start of their training has increased more rapidly than average earnings as a whole.

3.4 Social Rate of Return Calculations

Data, methodology, assumptions

The basic methodology is the same as described for private rates of return in Section 3.2. The income profiles are the same as used there. For social rate of return calculations gross income profiles are required since gross earnings are assumed to reflect marginal productivity. No adjustment is therefore required for taxation.

The main refinement to the calculation is to include an estimate of the average cost of providing a degree level course. These estimates are the average cost of training a person to first degree level, including both recurrent and capital costs, but excluding research, for both 'A' level and a university degree course. They include allowances for wastage, repeat and examination failure rates and course length. They are based on very detailed unpublished estimates provided by the Department of Education and Science for 1971/72 and extended to other years using an index of costs.¹⁰ This procedure therefore assumes that factors such as wastage rates have remained fairly stable over the period in question. (The DES provided some evidence to corroborate this assumption.) A large number of alternative routes are available to individuals aiming at a first degree or equivalent qualification especially for those following science subjects. The costs of these various courses differ according to whether students study full-time or part-time as well as the type of qualifications undertaken. Since there are difficulties in comparing estimates of costs across different routes we have taken the figure relating to students doing 'A' levels at school and continuing with a first degree at university as typical. Basically this amounts to assuming that

(10) This index is an average unit cost measure for universities at 1971/72 prices for full time students.

they have moved in similar fashion over time. The cost estimates used are given in Appendix A3. This series is converted to an annual average for inclusion into the C_t profile as part of the costs of undertaking education.

In contrast to the private rate of return estimates the student maintenance grant is not included as part of the B_t profile, since this payment represents a transfer between the State and the individual and does not reflect any contribution to output. Vacation earnings are however included in the B_t profile. No adjustments were made in the basic calculations for such factors as ability, or the probability of finding employment. The sensitivity of the results to these assumptions is discussed in Chapter 8 .

Results based on the Census follow up 1966-67 and 1971-72

In Table 3.12 we present results of the average social rate of return to a first degree which can be compared with the values obtained by Morris and Ziderman. These are based on the OPCS surveys of earnings that followed up the 1966 and 1971 Censuses.

As for the private estimates we would expect the estimates presented here to differ from those of Morris and Ziderman for an assortment of reasons:

- (i) There are differences in the sample coverage although these are not as important as for the private case. In particular the series used by Ziderman and Morris includes teachers in contrast to that used by Ziderman (1973).
- (ii) Morris and Ziderman use annual observations rather than 5 yearly age groups.
- (iii) Morris and Ziderman make adjustments for mortality and participation.

Table 3.12 Social Rates of Return - Comparison with Morris and Ziderman ^(a)

	per cent
1. Morris and Ziderman (1971)	
(No adjustment for ability, excluding research costs)	10.0
2. Basic result	9.0
3. Plus addition for secular growth in incomes	11.0
4. Plus adjustment for using grouped data and participation	9.5
5. Plus adjustment for differences in direct costs	10.0

(a) Males, average rate of return to a first degree.

(iv) Finally, the direct costs of education are not directly comparable. On average the present estimates for the cost of 'A' level plus first degree are about 7 per cent higher than those used by Morris and Ziderman.

Morris and Ziderman's estimate of the average private rate of return to a first degree for males, making no adjustment for ability and excluding research costs was 10 per cent. Our basic estimate is 9 per cent. Adding 2 per cent for the expected secular growth in real incomes is offset by adjustments to account for the use of grouped data and the fact that no adjustments have been made for differences in activity rates between qualified and unqualified. A further half of a percentage point is added if we use the lower average direct cost figures used by Morris and Ziderman. We are therefore left with a discrepancy of below 0.5 per cent. This as anticipated is much smaller than for the private rate of return case where the discrepancy was 1.5 percentage points, attributable to differences in the sample covered.

Once teachers are returned to the sample the remaining differences are therefore very small. For comparison with the results in the rest of the chapter we will use the basic result in Table 3.12 of 9 per cent. This estimate compares with the value of 16.5 per cent obtained for the private rate of return. This difference between private and social rate of return estimates is a common feature of all the results obtained. It reflects of course the addition of the full cost of educating a person to degree standard and the inclusion of the full cost of income foregone making no allowance for the transfer payment to students when carrying out the social calculation.

In Table 3.13 estimates of social rate of return are presented for different subject categories for 1966/67 and 1971/72 based upon the census data.¹¹ These results make no adjustment for ability, use the NES based C_t profile and the direct costs of education as presented in Appendix A.3.

For 1966/67 science and engineering qualifications have a lower social rate of return than the average for non scientific subjects. This result corresponds to that for private rates of return. In contrast however the social return to taking an engineering degree is marginally less than that for a science degree. This reflects the much higher direct costs for the former. The results in the table also assume a three year course of study. In Chapter 5 it is shown that many students on engineering courses are on 4 year courses. Taking this into account would further reduce the return for engineering and technology.¹²

Comparing the estimates for 1971/72 all the results show a slight decrease. As discussed above for private rates of return this result may be subject to error. The sample survey for 1971/72 was considerably smaller than for 1966/67, the possibilities for sample bias are therefore larger. However the 1971/72 data for qualified people is not adjusted for unemployment whereas it is for 1966/67. This may add as much as 0.5 percentage points to the estimate for 1971/72. Adjusting for this would therefore reinforce the downward trend between 1966/67 and 1971/72.

In Table 3.14 estimates of the average social returns to attaining different occupational titles are presented. As mentioned in Chapter 2 these estimates should be regarded as measuring the return

(11) A more detailed breakdown by subject is presented in Chapter 6.

(12) For a more detailed discussion see Chapter 8.

Table 3.13 Estimates of average Social Rates of Return to a first degree by discipline

per cent				
Males	Science	Engineering & Technology	Other Subjects	All Subjects
1966/67	8.0	7.5	9.0	8.5
1971/72	7.5	7.0	9.5	8.0

Table 3.14 Average social rates of return in different occupations

	per cent	
Males	1966/67	1971/72
Civil Engineers	8.0	4.5
Mechanical Engineers	6.0	6.0
Electrical Engineers	6.5	3.5
Technologist nec	6.5	6.5
Chemists	7.5	7.0
Physicists and Biologists	8.0	5.5
All Engineers	7.0	5.5
All Scientists	7.5	6.5

to an average bundle of qualifications. In 1966/67 the average value obtained for scientists was 7.5 per cent compared with 7.0 per cent for engineers. Although this difference is slight it tends to confirm the results for different disciplines. Apart from civil engineers the results for other engineers are all less than 7 per cent. There is a clear difference of between 1 and 2 percentage points between these groups and the return to producing physicists or chemists.

Overall the rates of return for those in scientific and engineering occupations is rather lower on average than for those obtaining a degree in these subjects. This reflects the fact that; first, not all those in the occupational categories are qualified at degree level or equivalent; and second, that not all those qualified in science and engineering work in the corresponding occupational categories (See Bosworth and Wilson 1980 p.298).

Between 1966/67 and 1971/72 the estimates for most of these categories fell significantly especially for civil engineers. The problems in comparing these two years also apply to this table. From the discussion above the results for 1971/72 are probably biased upwards which suggests that there is clear evidence of a decline in estimated rates of return over this period.

Further light may be thrown on this question by referring to the data used in Section 3.3 from the professional institutes for science and engineering. Although as noted in that section these have some problems of their own they do provide an important source of information of the earnings of professional scientists and engineers. In Table 3.15 we present estimates of social rates of return to producing professional scientists or engineers corresponding to the private rate of return estimates in Section 3.3. These estimates are based on earnings data from the surveys carried out by the professorial institutes as described there. As for the estimates based on the

Table 3.15 Average social rates of return to training a professional scientist or engineer¹

	1967/68	1970/71	1972/73	1973/74	1974/75	1976/77	1978/79	1979/80
Engineers	7.5	7.0	6.0	-	6.0	5.5	5.5	-
Scientists (all institutes)	8.5	8.0	-	6.0	-	6.0	-	6.0
Biology	8.5	7.5	-	6.0	-	6.0	-	5.5
Chemistry	8.5	8.0	-	6.0	-	6.0	-	6.0
Mathematics	10.0	8.5	-	6.5	-	6.0	-	6.5
Metallurgy	8.5	7.5	-	5.5	-	6.5	-	5.5
Physics	9.0	8.5	-	6.5	-	6.5	-	6.5

Note: (1) Based on median earnings profiles; all estimates rounded to nearest 0.5 per cent.

post censal surveys, the effect of adding in the direct costs of training and education, and of removing student grants and the adjustment for taxation means that overall levels of rates of return are substantially reduced compared with the private estimates. For 1967/68 all the estimates are around 8-9 per cent compared with 14-15 per cent for the private returns. The higher direct cost of training and educating engineers as opposed to scientists is reflected in the higher return to scientists. This result is in direct contrast to the results for private rates of return where the return for engineers is marginally higher. This differential is a feature of the results throughout the period covered, the social rate of return of scientists as a whole always being at least as high as that for engineers. It also confirms the results obtained using the OPCS data presented in Table 3.13. Physicists and mathematicians (and, to a lesser extent, chemists) appear from these crude estimates to command a higher social rate of return than engineers. This again confirms the results presented in Table 3.14 for the returns to different occupations. These results contradict the popular belief that the education system should be producing more engineers compared to scientists. Furthermore they suggest that if anything the signals received by individuals in terms of expected private rates of return may be working in a perverse way, encouraging people to undertake engineering rather than science courses ceteris paribus. The impact of adjustment for unemployment probabilities and other factors on this result is discussed in Chapter 8.

As far as movements over time are concerned the pattern is similar to that observed for the private rates of return and again confirms the results based on the OPCS data particularly as far as the occupational category engineers is concerned. A substantial decline occurs between 1967/68 and 1973/74. Thereafter there is a levelling out at around 5-6 per cent for most scientific professions.

While these rates of return still exceed the Treasury test discount rate of 5 per cent they are not sufficiently large to suggest any serious underinvestment in this type of manpower from a social viewpoint over this period. However these estimates are rather crude. In Chapter 8 we assess the effect of relaxing some of the restrictive assumptions we have made and whether this affects the basic conclusion. It is of interest to note, however, that a similar conclusion to ours was reached in an unpublished study by Adamson and Reid (1980), although their estimates are for marginal social rates of return to a first degree.

3.5 Summary and Conclusions

The results presented in the first part of this chapter provide strong evidence that expected rates of return based on cross-sectional age earnings profiles do fluctuate systematically over time. Moreover, although the basic profile of rates of return over time are similar for scientists and engineers it is clear that they can and do move independently. It has also been demonstrated that data from the professional institutes can be used to construct meaningful estimates of rates of return that are broadly consistent with results obtained when using data from the much larger follow-up surveys to the 1966 and 1971 Census.

Various differences between data sets used have been examined and their impact on the estimated rates of return quantified. For example, the use of median as opposed to mean earnings; the use of grouped age data as opposed to annual observations and the use of different comparison income profiles. The results obtained appear to be fairly robust. The basic pattern of differentials across different subject categories is shown to be stable over time. The profile over time also appears to move in a systematic fashion, rates of return decline substantially for all the groups of scientific manpower considered. This suggests that common forces may have been acting upon the relative earnings of all these categories. The reasons for this decline are discussed in Chapter 4 below.

In Section 3.3 we have also demonstrated the feasibility of extending the rate of return calculations backward in time before 1968 assuming a stable age income profile for all workers. Comparison of the constructed profile with data from various ad hoc surveys suggests that such an assumption is supported by the available data once allowances are made for obvious differences in sampling frames and definitions.

The rate of return estimates obtained suggest a sharp decline in estimated rates of return between 1955/56 and 1966/67 for scientists. Even very substantial errors in the estimation of the comparison income profile ($\pm 10\%$) would not alter this conclusion. For engineers a rather different pattern emerges with estimated rates of return rising in the late 1950s and early 1960s before declining again. This is broadly in line with movements in the earnings of engineers relative to all workers. The pattern for scientists is not so easily explained however since the earnings of these groups relative to all workers did not decline very much between 1956 and 1967. The reasons for this apparent paradox are discussed in Chapter 4 .

Finally in Section 3.4 we have presented estimates of the social rate of return to producing persons qualified at first degree or equivalent level in science and engineering. After reviewing previous work and discussing data and methodology a comparison was made of the results using the present methodology and those obtained by Morris and Ziderman (1971). From this comparison it is clear that our estimates are broadly comparable with the results obtained from previous studies that in the mid 1960s the average social rate of return to a first degree was of the order of 9-10 per cent.

The main conclusions were that social rates of return to science and engineering in particular have in general been below those for other subjects. Compared with the estimate for all subjects of 9-10 per cent, a figure closer to 8 per cent was the general rule for science and engineering subjects. The results for the corresponding occupational categories were generally even lower. For both the

estimates by subject and for occupational categories the social rate of return obtained was greater for science and scientists than for engineering or engineers due to the higher cost of producing the latter.

It does not take into account the fact that for many engineers the course length is 4 years as opposed to 3. This significantly increases the value of earnings foregone and further reduces estimates of rates of return as discussed in Chapter 8 . Over time the value of social rates of return have tended to decline in line with private returns. By the end of the 1970s they were hovering just above the Treasury Test Discount Rate of 5 per cent.

Comparing social and private estimates it is clear that ^{the} former are well below the latter (by as much as 6 or 7 per centage points). Even more worrying is the fact that, whereas the private returns for engineering are generally higher than for scientists (thus ceteris paribus influencing career choices in favour of engineering), the social returns consistently show the opposite ranking. The sensitivity of this result to different assumptions is discussed at greater length in Chapter 8 . The social rates of return to other subject categories are discussed in Chapter 7 .

4. Explanations for the Decline in the Rate of Return

4.1 Introduction

The results presented in the previous chapter indicate a substantial secular decline in rates of return for scientists and engineers. In later chapters, estimates are presented which demonstrate that this result is common to most professions. The purpose of the present chapter is to provide an explanation for this phenomena. The rate of return as we have calculated it may have declined for a number of reasons. Changes in government policy, on the size of grants paid to students and taxation, may have a direct impact on the benefits and costs of education. Incomes policies may also affect those on higher incomes to a greater degree, thus influencing prospective rates of return. Less directly, government policy on the provision of places in higher education may affect the balance of supply and demand in the labour market and so influence earnings differentials. More generally, the normal workings of the labour market will tend to alter rates of return in response to any discrepancy between demand and supply.

This chapter attempts to explore in general terms the possible reasons for declining rates of return using as examples the experience of professional scientists and engineers. We begin in Section 4.1 with an attempt to disentangle the different effects of changes in tax rates, the student grant, starting salaries and average salaries in the overall decline. From this analysis it is clear that the main reason for the decline in rates of return observed is the fall in relative earnings of professionals aged below 30. In the two subsequent sections some of the reasons for this narrowing of differentials are explored. Section 4.2 begins with an assessment of the importance of market forces. In Section 4.3 the role of various institutional factors is considered including the use of market power, 'credentialism' and the raising of the

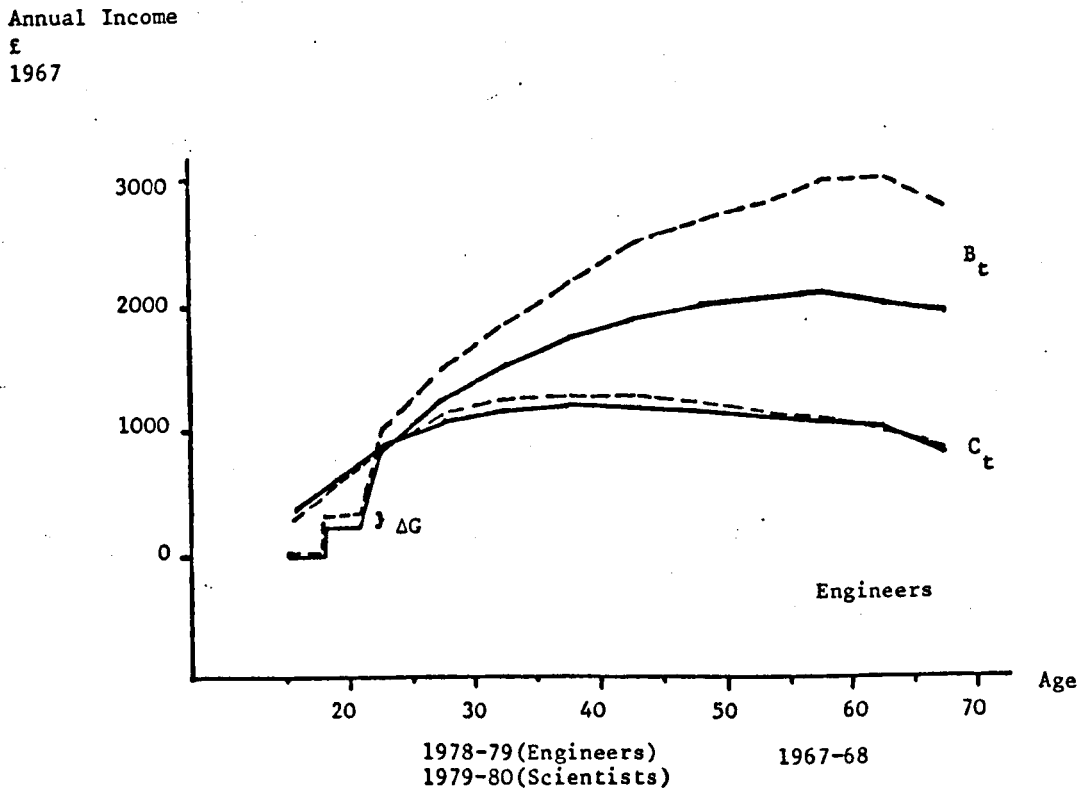
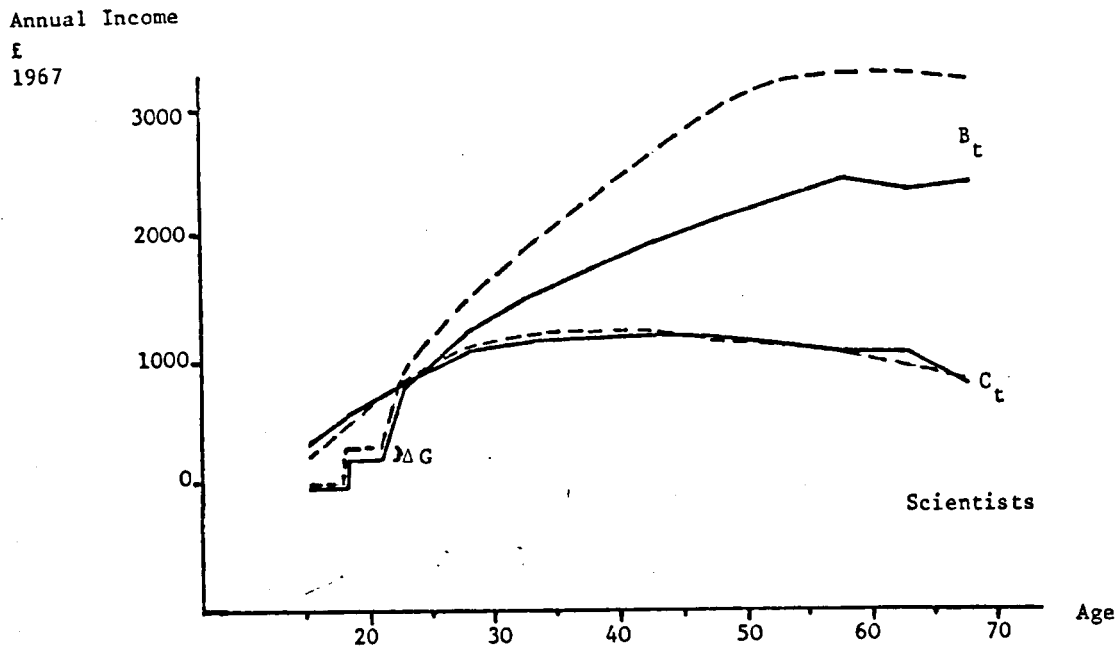
school leaving age (ROSLA).

Finally, from the analysis in this chapter, it is apparent that the government has played a very important role in developments in the labour market for qualified manpower. As well as controlling the tax regime, the value and availability of student grants, the provision of places in higher education, the school leaving age and, to some degree at least, the level of incomes via incomes policies, the government is also a major and often the dominant employer of professional manpower. The fact that student grants have not been increased in line with earnings can explain a significant part of the observed decline in rates of return. Institutional changes such as ROSLA have also had an impact. However, the most important factor has probably been the indirect effects of the policy of improving the access to higher education. For certain groups such as teachers the government has also been able to exert a more direct impact on earnings and this has probably had a very important effect on rates of return to entering this particular profession.

Accounting for the decline

To begin to provide an answer to the question as to why rates of return have declined it is useful to disentangle changes over time in the various components of the age earnings profiles that form the basis for our estimates. A straightforward comparison of age earnings profiles for the late 1960s and late 1970s is however complicated by the effects of inflation and the growth of real income over this period. Between October 1967 and 1979 the index of average earnings increased by 380 per cent. In order to make a comparison over time we have therefore deflated the age earnings profiles by the index of average earnings. These deflated profiles are presented in Figure 4.1. Since our comparison income

Figure 4.1 Deflated Age-Earnings Profiles



profiles (C_t) are based on the average earnings of all workers, it is not surprising that these show little movement for either scientists or engineers over this period. The qualified income profiles (B_t) show a significant shift over the period. This is composed of three main elements: first, a reduction in income received while studying (grant plus vocational earnings). This is shown as ΔG on the figure; second, a reduction in starting salaries,⁽¹⁾ and finally, a much flatter age earnings profile once qualified people start work. The gap between the 1967/68 and 1979/80 profiles (1978/79 in the case of engineers) widens considerably as we move along the age earnings profile. In proportionate terms the difference does not widen so dramatically. However, even so, the reduction in 'real' income is about 20 per cent for those of 25-30 years of age and 35-40 per cent for those in their 50s. In terms of impact upon the rate of return estimates it is of course the first few years that are most relevant since income expected later in life is so heavily discounted. The data in Figure 4.1 clearly illustrate that the decline in relative earnings for both scientists and engineers has affected older workers much more than those just starting in their careers. This point is reinforced by the recent revival in starting salaries since 1973/74 as shown in Figure 4.3 below. The gap between B_t and C_t in net terms will also depend on the tax regime of course.

It is possible to assess the impact of these factors more precisely by carrying out simulation exercises in order to examine the effect on the rate of return estimates if the tax rates, starting salaries or the student maintenance grant had behaved

(1) The surveys by the professional institutes do not publish starting salaries as such but the implied estimates from the profiles show a fall of about 10 per cent for scientists and even more for engineers from the late 1960s to the late 1970s.

differently over time. This was done covering the full period 1955-1979. Using engineers and chemists as examples, six basic simulations were carried out to compare with the original results obtained for these groups.

- (i) The student maintenance grant was assumed to grow in real terms from 1955 in line with the Retail Price Index.
- (ii) The student maintenance grant was assumed to grow in real terms from 1955 in line with the Index of Average Earnings.
- (iii) The student maintenance grant was assumed to grow in real terms from 1955 in line with the earnings of all workers below the age of 20.
- (iv) The tax regime was assumed to remain fixed in real terms at the 1955 levels. For this purpose tax rates were kept fixed while allowances were raised in line with the index of average earnings.
- (v) The 'starting salaries' of qualified persons was assumed to grow in real terms from 1955 in line with the earnings of all workers below the age of 20.
(For this purpose 'starting salaries' refers to the earnings of qualified persons aged between 20 and 25).
- (vi) Simulations (iii), (iv) and (v) were combined, together with the assumption that the earnings of qualified persons aged 25-30 moved in line with the earnings of all persons in the economy of that age.

The original results showed a rise in the estimated average private rate of return for engineers from 14.5 per cent in 1955/56 to 17.0 per cent in the late 1950s and early 1960s. Thereafter there was a fairly steady fall to 9.5 per cent by 1978/79. For chemists

Table 4.1 Simulation Analysis of Causes of the Secular Decline in
Rates of Return for Chemists and Engineers

per cent							
	Original Result	(i)	Net effect of simulations:				
			(ii)	(iii)	(iv)	(v)	(vi)
Chemists							
1955	20.0	0	0	0	0	0	0
1961	16.5	-0.1	0.5	0.3	-0.3	0.7	0.7
1967	14.5	-0.4	0.7	1.3	-0.3	1.7	4.0
1973	9.2	0	0.9	1.8	-0.3	2.4	9.0
1979	8.8	-0.1	1.0	2.2	-0.6	2.9	11.1
Engineers							
1955	14.2	0	0	0	0	0	0
1962	16.9	-0.9	0	0.4	-0.5	-0.8	-1.4
1967	14.6	-0.4	0.8	1.6	-0.3	1.1	0.7
1972	10.7	0.1	1.2	1.7	-0.1	1.2	3.8
1978	9.4	0.1	1.2	2.5	-0.8	1.5	5.0

Notes:

Simulation (i) assuming the student maintenance grant kept pace with the Retail Price Index.

(ii) assuming the student maintenance grant kept pace with average earnings.

(iii) assuming the student maintenance grant kept pace with the earnings of young people.

(iv) assuming tax rates and allowance remained fixed in real terms.

(v) assuming earnings of 20-24 year old professional kept pace with earnings of manual juveniles.

(vi) combination of (iii) and (v) plus assuming earnings of 25-29 year old professionals kept pace with corresponding earnings of all workers.

the profile was rather different, a continuous and fairly steady decline from 20.0 per cent in 1955/56 to 9 per cent by 1979/80 being observed. (For details see Chapter 3 above). The results of our simulations around these basic results are shown in Table 4.1.

The maintenance grant has more or less kept pace with inflation so simulation (i) results in basically no change from the original results. When allowed to grow in line with the index of average earnings (resulting in a 'real' value of £2401 for 1980 compared with the actual nominal value of £1430) rates of return fall by 1.2 per cent less for engineers and 1.0 per cent less for chemists over the period 1955-1980. However, the earnings of young people below the age of 20 increased much more rapidly during this period than the index of average earnings. If the grant had grown in line with their earnings the decline in rates of return would be reduced by 2.5 per cent for engineers and 2.2 per cent for chemists (see results for simulation(iii) in Table 4.1).

The fourth simulation attempts to assess whether changes in taxation rates and allowances have contributed to the decline in private rates of return. Holding the 1955 tax regime constant in real terms for all years in fact results in a lower rate of return by the end of the 1970s. If anything, changes in tax rates have therefore favoured the person undertaking this kind of investment in human capital. For engineers the adjustment for taxation increases the decline in the estimated rate of return by 0.8 per cent and for chemists by 0.6 per cent. All these results are very much in line with those reported in Wilson (1980), which only covered the late 1960s and early 1970s.

Turning to simulation (v), the assumption that starting salaries of qualified persons move in line with the earnings of young people has a significant impact on the results. The earnings

of professional/qualified persons aged 20-25 have risen much less rapidly than those of young people in general. This accounts for 1.5 per cent of the decline for engineers and 2.9 per cent for chemists. Finally, in simulation (vi) these various assumptions are combined, together with the assumption that the earnings of qualified persons aged 25-30 moved in line with the earnings of all persons in the economy of that age, with the results that the decline in rates of return is almost exactly explained for both groups.

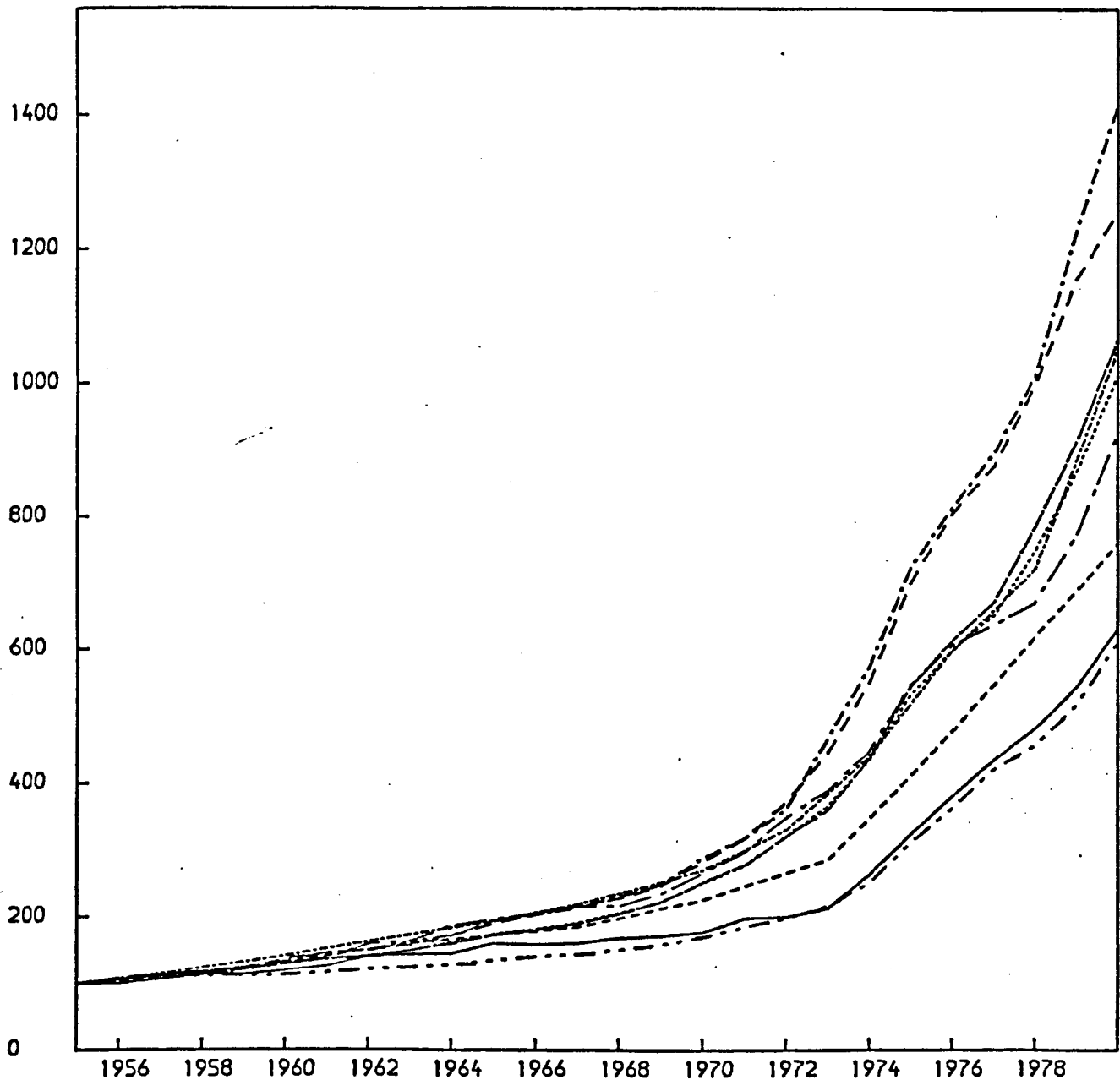
This analysis therefore suggests that changes in tax rates etc. have played little part in the declining returns observed for most professional groups. The student maintenance grant, although it has kept pace with the retail price index, has failed to reflect the increasing amount of real income foregone by those undertaking a degree. This alone explains about 2 - 2.5 percentage points of the decline observed. The most significant factor however has been the fall in relative incomes especially for those aged below 30.

Movements in relative incomes

Figure 4.2 illustrates the movements since 1955/56 of various labour market indicators. By way of an example we again concentrate here on the labour market for scientists and engineers but similar remarks would apply to most other professions. From the figure it is clear that although all these measures reflect the effects of inflation there is a considerable variation in the growth in money values especially after the early 1960s. The bottom line is provided by the Retail Price Index (RPI). Between 1955 and 1980 this indicated a more than 6-fold rise in prices. Over the

Figure 4.2

Selected Labour Market Indicators 1955-1980



Notes: 1955/56 = 100

KEY: Student grant

Cost of first degree

Index of average earnings

Retail price index

Earnings of adult manual men

Earnings of manual youths

C15-19

All scientists

All engineers

Sources relating to Figure 4.2:

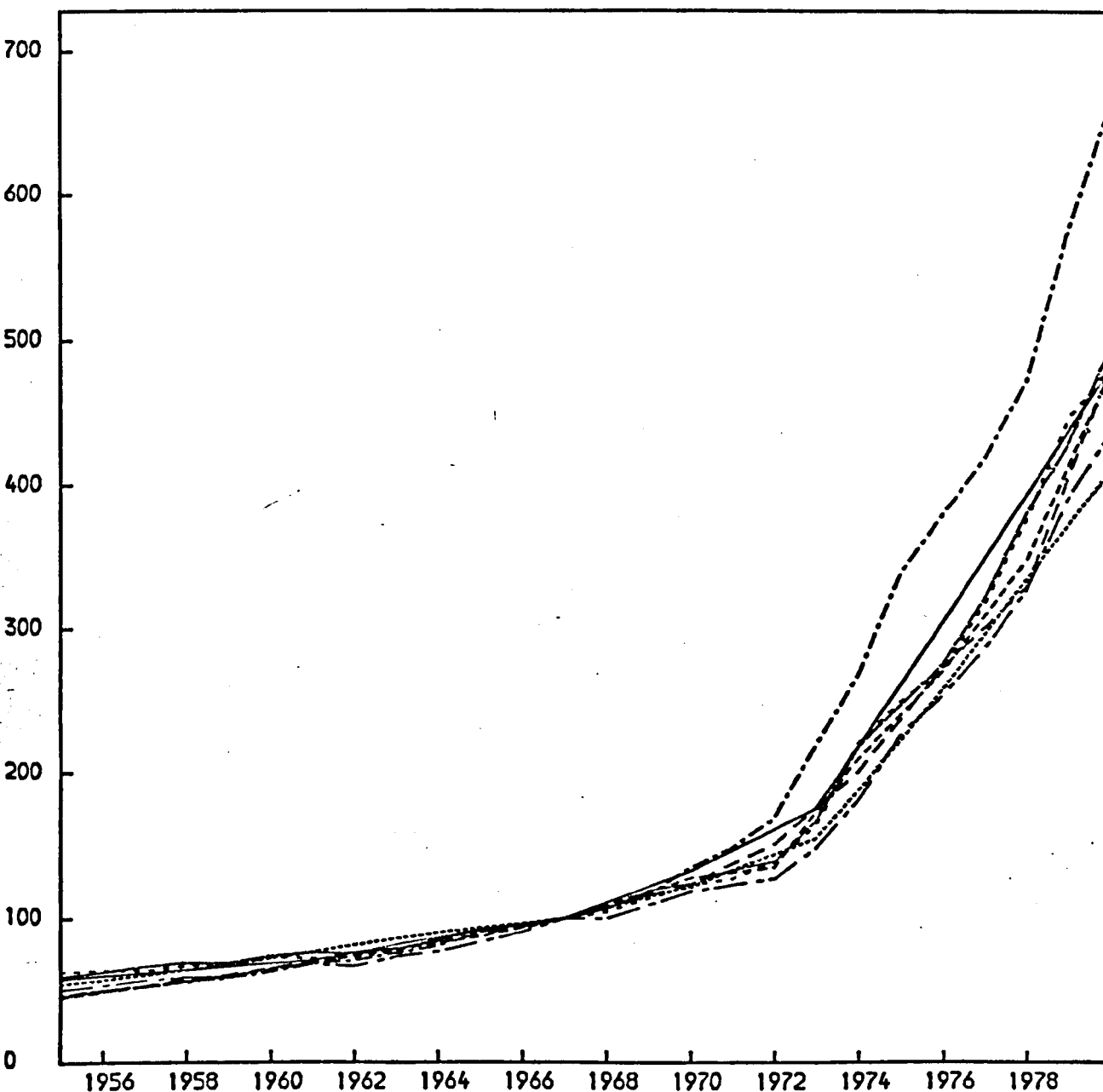
- (1) Student grant - average student maintenance grant (see Appendix A for details).
- (2) Cost of first degree - average costs of educating someone to first degree level including 'A' level costs (see Appendix A for details).
- (3) Index of average earnings - Department of Employment Gazette, various issues.
- (4) Retail price index - as (3).
- (5) Earnings of adult manual men - Department of Employment Gazette, pp. 520-530, May 1978 and subsequent issues.
- (6) Earnings of manual youths - as (5).
- (7) C_{15-19} - earnings of those aged 15-19 used to represent income forgone in the rate of return calculations, based on the New Earnings Survey for various years.
- (8) All scientists - earnings of all professional scientists, aggregated from survey data for individual scientific institutes. Results for the early years are for chemists and physicists only.
- (9) All engineers - earnings of all professional engineers, based on CEI Surveys extended back to 1955 using data from surveys by the Engineers Guild and RCDDR.

same period an index of average earnings rose almost 11-fold. Over the whole period this was slightly faster than the increase for manual adult men. These growth rates were themselves easily exceeded by the earnings of manual youths. Between 1955 and 1980 the earnings of the latter increased 12.5-fold. This underestimates the true increase for young people however since juveniles are increasingly being employed on adult rates. The measure C_1 , which is the average earnings used for the C_t profile for those below 20 years of age, shows a more than 14-fold increase over the same period. (Changes in the latter for recent years are based on the NES).

Also shown in the figure are indices of the student maintenance grant - which has more or less kept pace with the RPI - and an index of the direct costs of education for a typical 'A' levels + 3 year degree course student - this has grown rather less rapidly than average earnings but more rapidly than the RPI. Finally, as an illustration of the path of professional earnings the average incomes of all scientists and all engineers are also shown. These groups experienced increases in the case of engineers roughly in line with the index of average earnings, and in the case of scientists, of significantly less.

In Figure 4.3 attention is focussed on the movements in 'starting salaries'. These are represented by the earnings of those aged 20-24 from the main survey of professional chemists and engineers, as well as the results from the University of Leeds' survey of its graduate output. These data illustrate that the earnings of young entrants to the science and engineering professions have risen considerably less than the earnings of young people in general (aged 15-19). In fact the movements of earnings of young entrants to these professions have moved broadly in line with the earnings of scientists and engineers in general. Between 1971 and 1973 the Leeds data

Figure 4.3 Starting Salaries Compared, 1955-1980



Key: 1.	-----	Manual youths
2.	————	Professional chemists aged 20-25
3.	-----	All professional engineers
4.	-----	Professional engineers aged 20-25
5.	All professional scientists
6.	Starting salaries, Leeds University : Applied Science
7.	-----	" " " " : Arts
8.	-----	" " " " : Pure Science

For sources, see over.

Sources relating to Figure 4.3:

- (1) DE six-monthly survey of earnings and hours
- (2) RIC surveys
- (3 & 4) CEI surveys extended back to 1955 using data from surveys by the Engineers Guild and RCDDR
- (5) Aggregated from survey data for individual scientific institutes. Results for the early years are for Chemists and Physicists only. The latter constituted 70 per cent of all professional scientists in 1971 and probably a very much higher percentage before this.
- (6, 7 & 8) Starting salaries of graduates of Leeds University for those entering industry and commerce.

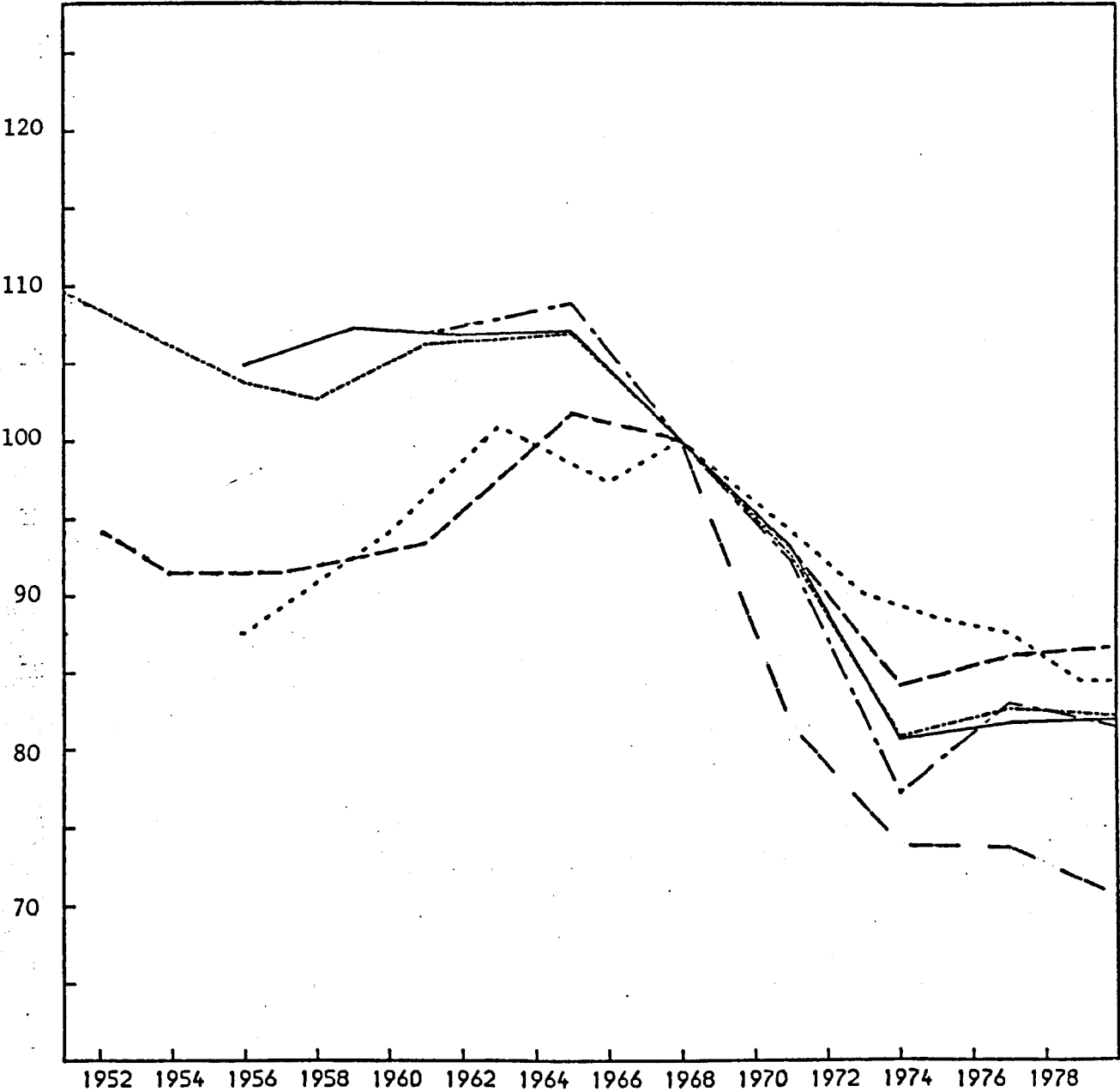
(which refers only to graduates from that university) indicates a quite rapid rise in starting salaries for graduates but apart from this short period they have moved very much in line with the other measures.

Further insight into movements in relative earnings over the period can be gained from Figure 4.4 which again concentrates upon scientists and engineers. It illustrates movements in the earnings of professional scientists and engineers since the 1950s compared with the earnings of all male manual workers taken from the Department of Employment's six-monthly surveys. The broad pattern for all professional scientists is clear. Earnings relative to manual workers were stable in the 1950s and 1960s. A very sharp decline then occurred between the mid-1960s and the early 1970s before relativities stabilised, but at a much lower level. Chemists account for 50 per cent of all scientists so it is not surprising that their experience very much mirrors that of all scientists. Physicists, in contrast, experienced a rapid rise in relativities in the late 1950s and early 1960s. Biologists and mathematicians, for whom less data is available, appear to have experienced similar patterns to scientists as a whole although the decline in the 1960s was rather more pronounced for the latter. Finally, engineers experienced an even more marked rise in relativities during the late 1950s and early 1960s than did physicists. The decline in relative earnings for this group started rather later in 1967/68 and was less abrupt, although by 1978/79 they had fallen to a similar level to that for scientists.

It is interesting to note that although the trends in relativities broadly reflect our estimates of rates of return there are some notable exceptions. Rates of return for physicists

Figure 4.4. Earnings of Scientists and Engineers
Relative to Manual Workers, 1951-1980

Indices 1967/68 = 100



KEY: Biologists - - - - -
 Chemists _____
 Physicists - - - - -
 Mathematics - . - . -
 Engineers
 All scientists - - - - -

Sources relating to Figure 4.4:

- (1) All series are based on data from surveys carried out by professional institutes as detailed below. These data have been deflated by the earnings of manual workers in the October of each year, the resulting ratios being expressed as indices with 1967/68 = 100.
- (2) Biologists - triennial surveys provide data from 1965 onwards, an earlier survey was also carried out in 1961.
- (3) Chemists - triennial surveys provide data from 1953 onwards although other surveys were conducted much earlier.
- (4) Physicists - triennial surveys were undertaken from 1948 onwards.
- (5) Mathematics - triennial surveys provide data from 1968 onwards.
- (6) Engineers - the Council of Engineering Institutions has conducted surveys since 1965. Before this, data collected by the Engineers Guild and the RCDDR was used.

declined slightly in the late 1950s and early 1960s for example. This reflected the fact that starting salaries of young physicists increased much less rapidly than the average for all age groups and also the fact that the average earnings of all physicists increased, at least in part, due to changes in the age composition of the profession.

4.2 Explanations for the Decline in Relativities: Market Forces

Economic theories concerned with occupational differentials such as those developed by Reder (1955) and Oi (1962) suggest that relativities will tend to widen with the onset of a recession. Such models are however aimed primarily at explaining the cyclical rather than secular behaviour of differentials. The standard neo-classical theory of the labour market predicts that in the absence of non-wage compensating factors, and abstracting from differences in individual abilities and marginal productivity, wages will be equalised in the long run. The classic discussion by Smith (1970), referred to in Chapter 5 below, recognises various 'circumstances' where such non-wage factors may explain differences in wage levels even in the long run. These include differences in the cost of training, the degree of risk, the agreeableness or disagreeableness of the job, the amount of trust and the probability of success associated with each profession. To this list we add the existence or absence of imperfections in the labour market for a particular occupation. We also note in Chapter 5 the need to make allowances for differences in hours worked between different professions in addition to making adjustments for self-employment incomes and fringe benefits. Given these various factors one would not necessarily expect any tendency towards equality of wage rates over time and unless such factors can all be suitably quantified it follows that we should

also expect long-term differences in rates of return. The differences between professions are covered in detail in Chapters 5, 6 and 7 and are not considered here. The emphasis in this chapter is on examining movements over time. It is clear however that any secular change in those 'circumstances' referred to above (or indeed of the other factors we have noted) may be expected to affect the profile of estimated returns over time.

Neo-classical theory predicts that in the absence of market imperfections, supply and demand will be brought into balance at the market equilibrium wage in the long run. In the short run of course, shortages or surpluses may arise driving wages above or below the long-run equilibrium level. Professional labour markets are characterised by the substantial periods of education and training required to attain professional status and by the fact that productivity is closely and positively related to experience. Consequently the simple supply demand model that might be used to analyse the market for a commodity such as corn requires substantial modification before it can be applied to the market for highly qualified manpower.

Freeman (1971) has developed various very simple models of the labour market for qualified manpower in the United States, which make allowances for these important differences. Such models generate short-run cob-web cycles around a long-run equilibrium solution. Short-run temporary equilibria may occur where wages (both starting salaries and earnings in general) differ from the long-run equilibrium solution. Movements in the balance of supply and demand may therefore be expected to affect relative earnings and hence rates of return in both the long run and short run.

Alternatively, divergence from long-run equilibrium may be the consequence of market imperfections such as the restriction of entry to a profession, or other institutional factors. In the

following discussion we consider various aspects of the labour market for highly qualified manpower in the British economy since the war. In the remainder of this section we concentrate on the question of whether market forces, eg. shifts in the balance of supply and demand, can provide an explanation for the movements in earnings differentials and rates of return we have observed. The emphasis then changes towards the importance of institutional and non-market forces.

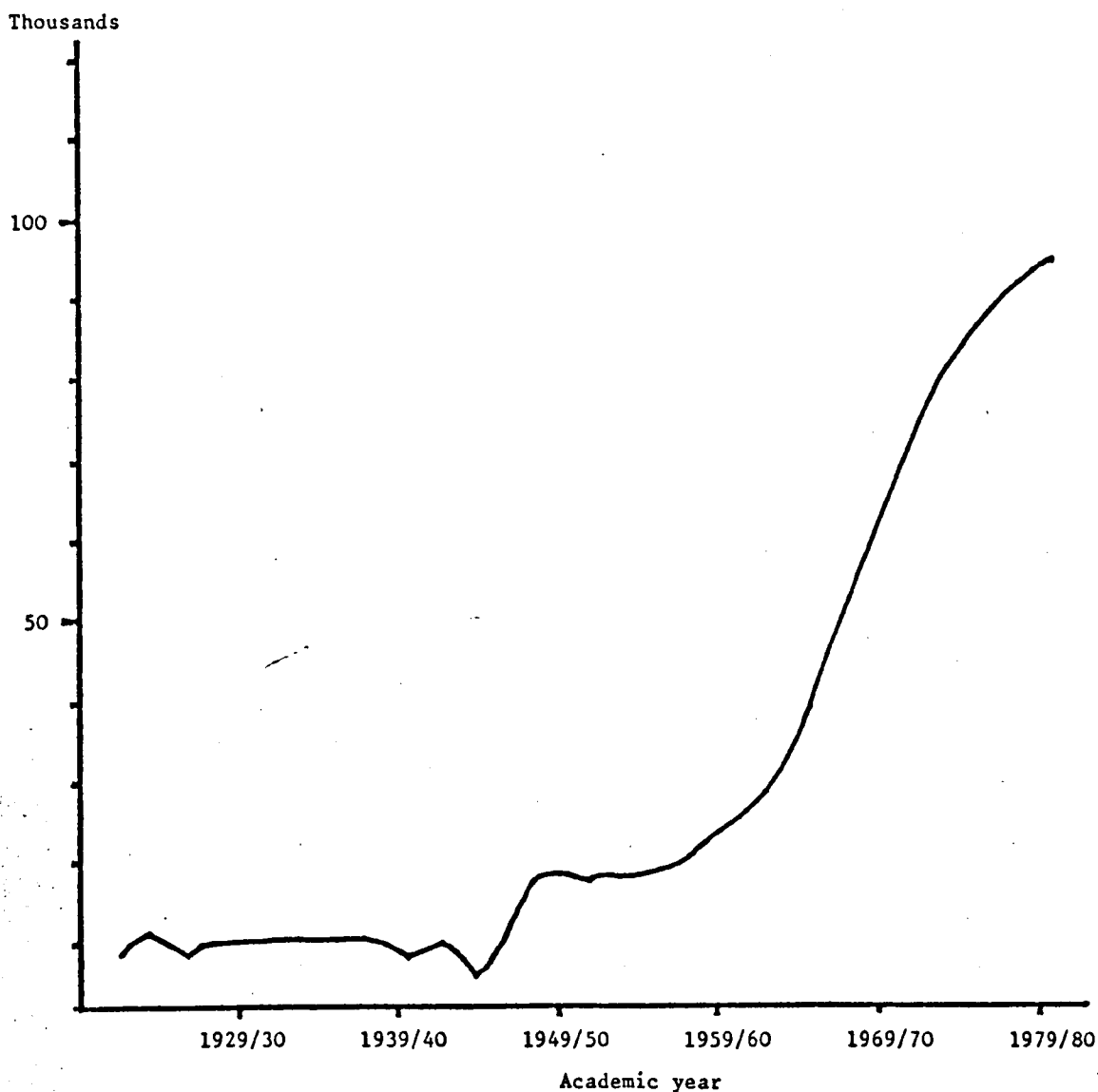
The Growth of Supply of Highly Qualified Manpower

Some indication of the rate of expansion of the educational system can be obtained from Figure 4.5. This shows that up until the Second World War there were roughly 10 thousand first degree graduates produced annually. During the war years this figure fell, but immediately after rose rapidly to just under 20 thousand by the late 1940s. This figure was maintained until the mid 1950s. After then the total output of graduates rose steadily especially after 1963. By the 1970s the flow had risen to about 70 thousand and, although there were definite signs of a slowdown by the end of this decade, it was still rising.

The reasons for this dramatic rise are still not entirely clear. International comparisons by Hecquet et al (1978) and by Cerych and Colton (1980) have demonstrated that this phenomenon is not unique to the United Kingdom. In part it is a consequence of the international baby boom that occurred after the Second World War. This resulted in a demographic bulge gradually working its way through different age groups as the cohort born in the late 1940s and early 1950s aged over time. Demographic factors however provide only part of the story since it is quite clear that a larger and larger proportion of young people have chosen to undertake further non-compulsory education and training. Bosworth and

Figure 4.5

Total Annual Output of First Degree Graduates
(home and overseas full and part time)



Notes: 1. The following types of degree obtained in Great Britain are included:
University degrees (including Open University degrees and external degrees from London University)
Council for National Academic Award (CNAA) degrees (including Diplomas in Technology and Art)

B.Ed. Degrees

2. Over such a long period of time there have inevitably been several changes of basis in collecting the statistics and the figures have been adjusted as far as possible onto a comparable basis.

Sources: Updated from Butler (1978).

Wilson (1983), for example, show that the proportion of 18 year olds obtaining 2 or more 'A' level qualifications rose from 6.3 per cent 1960/61 to 15 per cent by 1979/80. The Department of Education and Science defines what it calls the age participation rate. This is measured as the number of young home initial entrants to full-time sandwich higher education expressed as a percentage of the 18 year old home population. This rose from 7 per cent in 1961/62 to 10.5 per cent in the mid 1960s, to 13.5 per cent by 1969/70 and to a peak of 14 per cent in 1972/73. Since then it has fallen back to around 12.5 per cent in 1979 although there are some signs of recovery since then.

It is not possible to construct a long time series on the total stock of highly qualified persons. Indeed even for such well defined groups as scientists and engineers or doctors this task is quite difficult (see Chapters 5 and 6 below). Nevertheless, it is plain that such dramatic growth in the numbers of new entrants to the labour market qualified at degree or equivalent level must have resulted in a substantial increase in the total stock. According to the Census of Population, between 1966 and 1971 the total stock of economically active persons qualified at this level or above increased by about 25 per cent for Great Britain as a whole. The proportion of such persons of all those economically active increased from just over 3 to just under 4 per cent. Between 1971 and 1981 the GHS suggests a further rise from 4 to 7 per cent. For earlier years some guide to trends can be gained from information on terminal education age of the occupied population. Taking a terminal education age of 21 or more as roughly equivalent to a first degree then the data from the 1951 and 1961 Censuses of Population suggest an increase from 1.9 per cent in 1951 to 2.5

per cent by 1961 (again for Great Britain as a whole). These measures, albeit crude, demonstrate the impact on stock of highly qualified persons available for work.

Newly Qualified Entrants to the Labour Market by Discipline

Even today, some 20 years after the publication of the Robbins Report (Robbins, 1963), it is difficult to obtain a clear idea of the way in which the flow by discipline of newly qualified entrants to the labour market has changed over time from published statistics. Indeed the whole area is a veritable statistical minefield. Although the data collected together in Table 4.2 attempt, as far as possible, to present a consistent picture, various pitfalls remain to trap the unwary. Nevertheless, this information is presented here in the belief that despite various idiosyncracies of the data it provides a broadly correct picture of how such flows have developed for first degree graduates.

More graphic illustrations of these developments are provided in Figures 4.6, 4.7 and 4.8. Figure 4.6 demonstrates the steady rise in the flows of new entrants into the labour market in possession of a degree from less than 20 thousand per annum in 1955/56 to almost 70 thousand by 1980/81. It is clear from this figure that this growth has affected some disciplines more than others. For example, social sciences increased by a factor of almost 8, much more than medical and dental sciences which increased by a factor of 2.5 between 1955/56 and 1980/81. Over the same period the number of arts degrees awarded increased by a factor of about 2.5, pure science degrees by a factor of 3.5 and applied science by a factor of more than 5. The differences between disciplines are also emphasised in Figure 4.7 which shows the numbers of first degrees awarded expressed as indices, with 1955/56=100. From this figure it is clear that the period of most rapid growth was during the 1960s especially for

Table 4.2 Numbers of First Degrees Awarded and Numbers of First Degree Graduates by Selected Disciplines^a

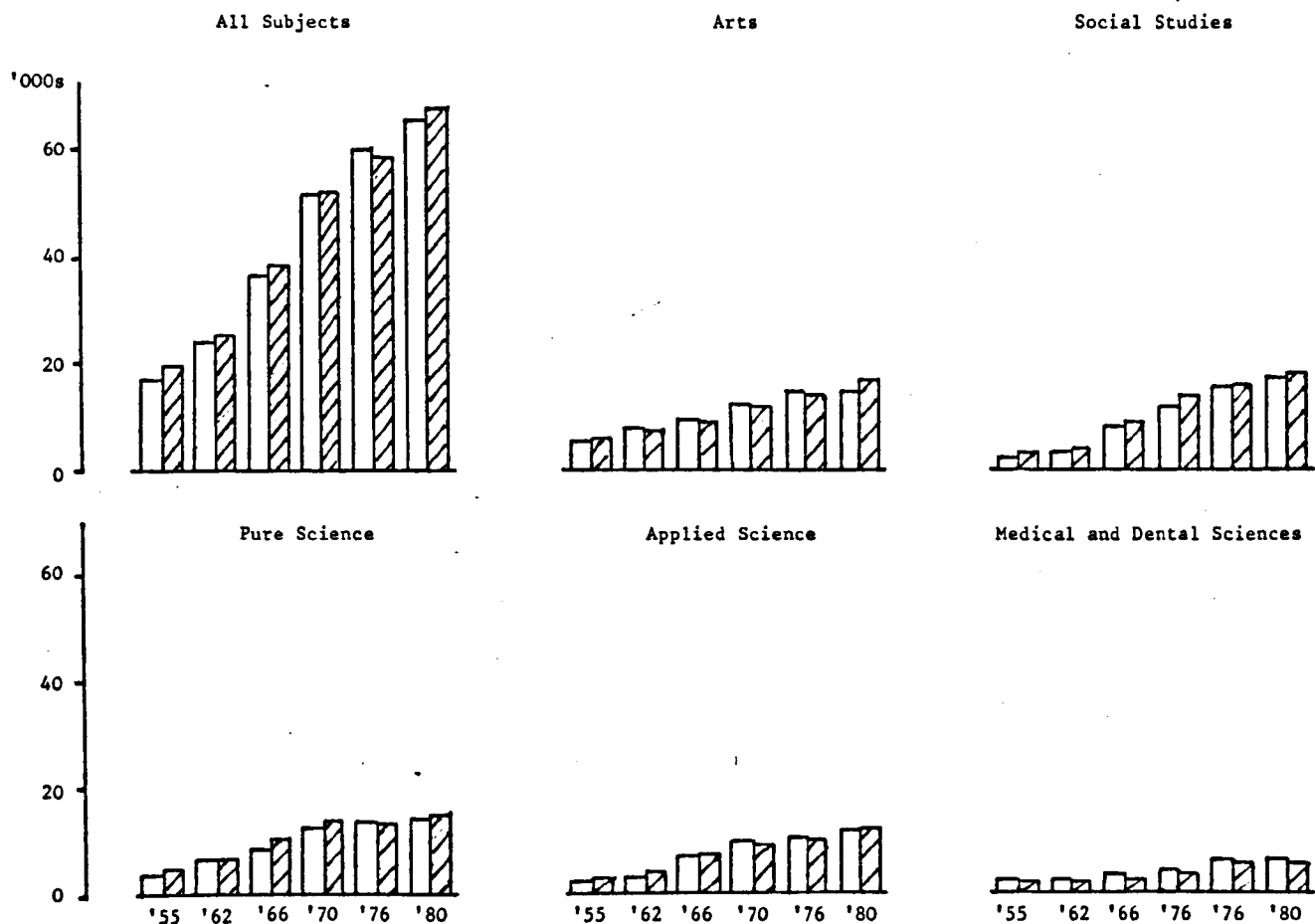
First degrees ^b awarded (U.K.)	All subjects ^{c, i} of which:					of which:			Thousands
	Arts	Social studies ^d	of which Law	Pure Sciences ^d	Applied Sciences ^d	Architecture & Vocational studies	Medical and Dental Sciences		
1955/56 ^f	17258	5863 ^g	836 ^h	4250	2350	73 ^k	2533		
1962/63 ^f	24558	8084	1089 ^h	7184	3530	175 ^k	2644		
1966/67	37168	9772	1610	8733	7082	366	3165		
1970/71	52689	12055	11848	12856	9964	794	3963		
1976/77	60382	14669	15490	13950	10223	1054	6050		
1980/81	66540	14808	3223	14852	11953	1115	6225		
First degree Graduates (G.B.)									
1957/58 ^g	19973	6420	941	5157	3189	84	1908		
1962/63	25376 ⁱ	7664	1223	7258	4083	202 ^j	2315 ^h		
1966/67	39377 ⁱ	8900	1808	11024	7482	422 ^j	2849 ^h		
1970/71	52764 ⁱ	11926	2333	16045	9431	604	3567 ^h		
1976/77 ^l	58553	14620	3354	13563	9771	906	5142		
1980/81 ^l	67888	16621	3552	15549	12167	1047	5446		

Sources: First degrees awarded (U.K.) - 1980/81: University Statistics Vol 1; 1970/71, 1976/77: Statistics of Education Volume 6; 1955/56 1962/63: Returns from Universities and University Colleges in Receipt of Exchequer Grant Academic Years 1955/56 and 1962/63.
First degree graduates (G.B.) - 1980/81: University Statistics Vol 2; 1962/63, 1970/71, 1976/77: First Destinations of University Graduates (various years) 1957/58, Statistics of Education 1965 Part 3 adjusted as described in footnote (g).

- Notes:
- (a) United Kingdom unless elsewhere specified. In 1976/77 the total number of first degrees awarded in the UK was 60,384 compared with 58,861 in Great Britain.
 - (b) Excluding degrees validated by universities but obtained elsewhere.
 - (c) Including Education which is regarded as a separate subject area in the data for 1970/71 onwards.
 - (d) Subject categories are as defined in the various sources. There are some minor inconsistencies from one year to the next.
 - (e) Split between Arts and Social Studies based on split for 1962/63.
 - (f) Estimates for UK scaled up from G.B. estimates.
 - (g) Adjusted on a pro rata basis for comparability with later years across subject breakdown. Adjustment factors based on data for 1962/63.
 - (h) Own estimate based on num. of degrees awarded.
 - (i) Including estimates for medical students as in final column.
 - (j) Own estimate grossed up from U.K. estimate for architecture alone.
 - (k) Own estimates based on numbers of graduates.

Figure 4.6

Output of First Degree Graduates 1955/56-1980/81



Source: Table 4.2



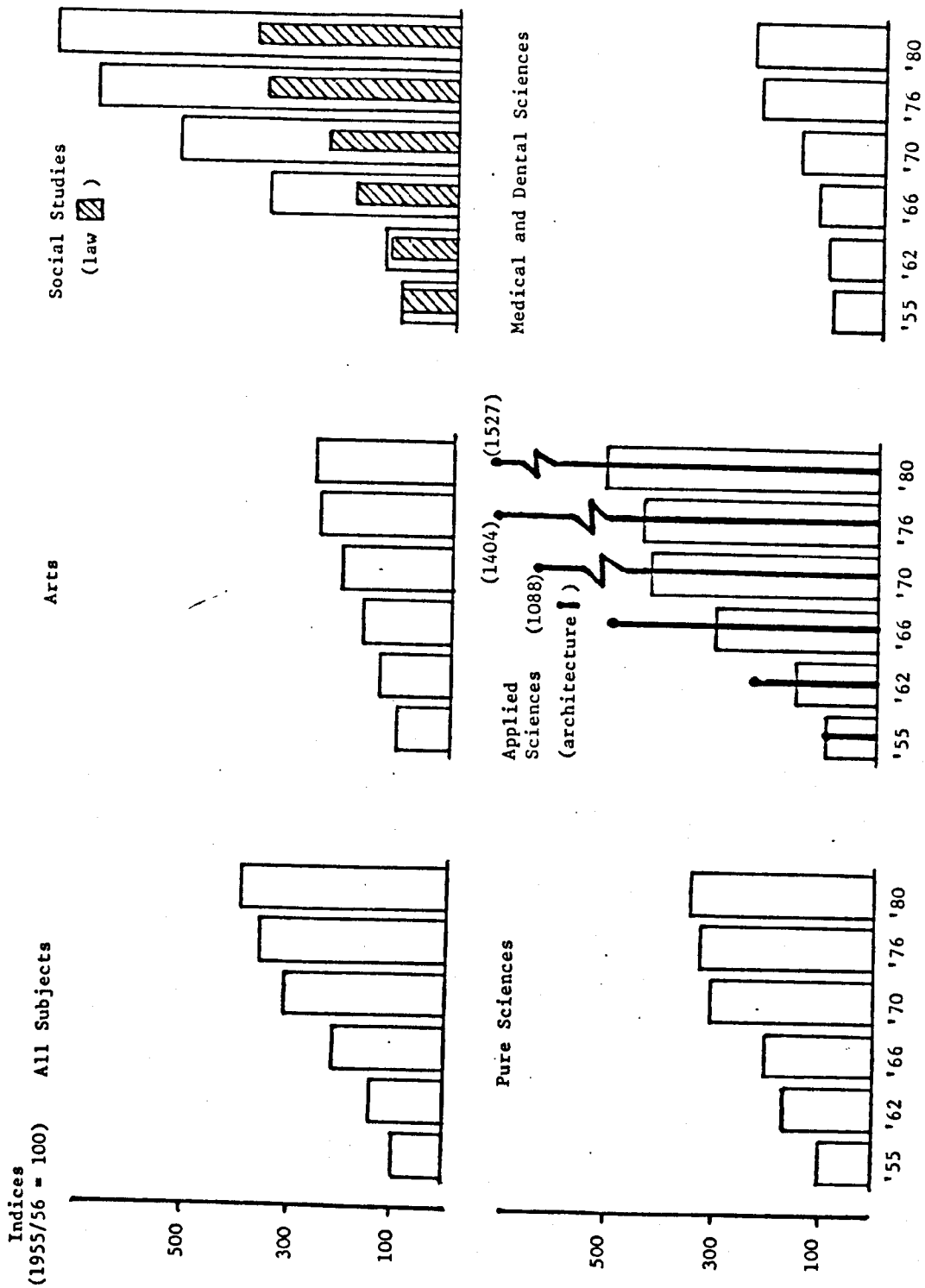
Key:  First degrees awarded, academic year t/t+1
 First degree graduates, academic year t/t+1; '55 value is for the year 1957/58.

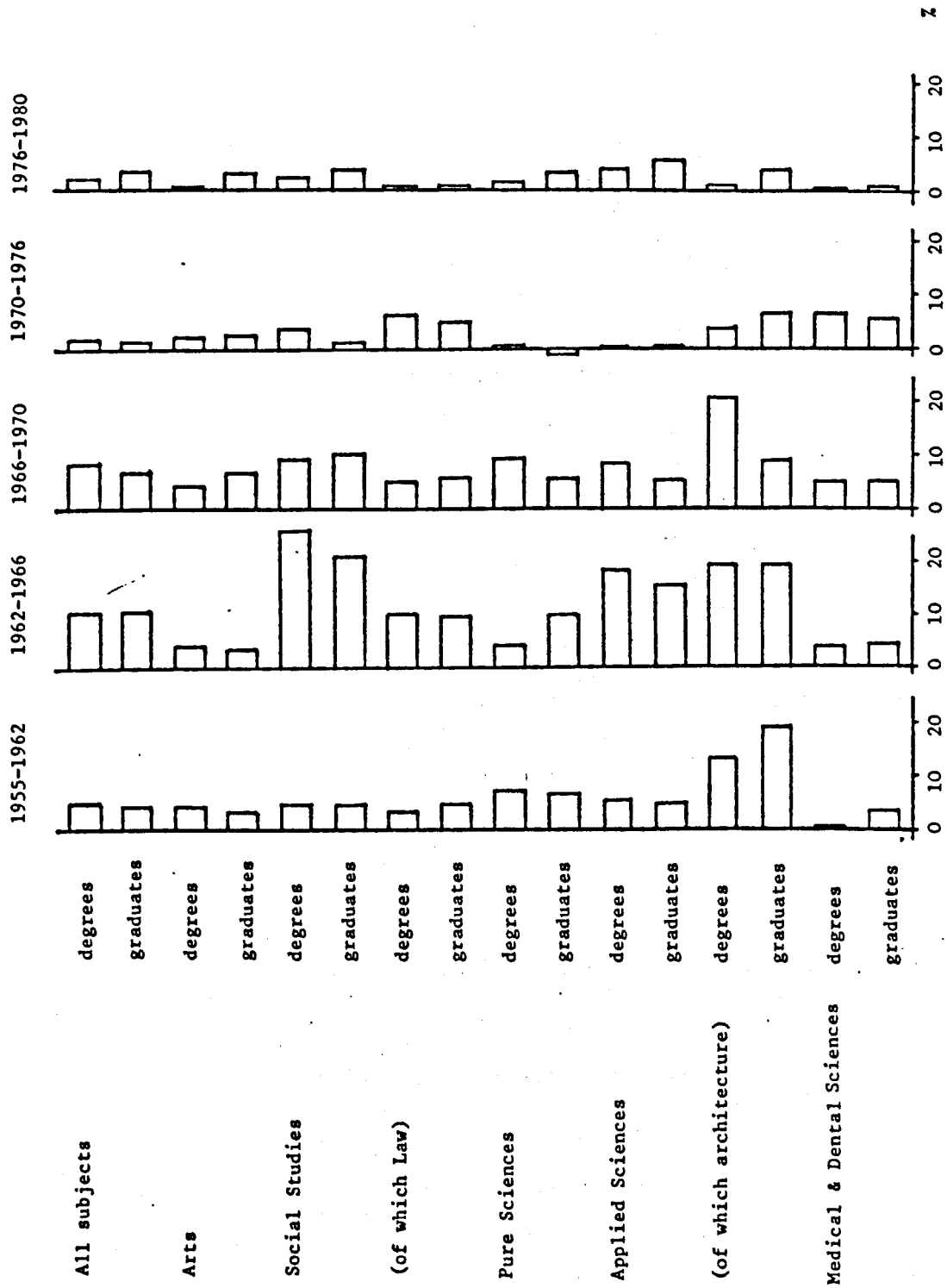
Figure 4.7
Indices of Graduate Output 1955/56 - 1980/81



Source: Table 4.2.

Figure 4.8

Annual Rates of Increase of Output of First Degree Graduates



Source: Table 4.2

social sciences, although applied sciences also expanded rapidly at the start of that decade. The annual growth rates achieved in each sub-period are summarised in Figure 4.8. This figure serves to reinforce the picture of very rapid growth during the 1960s for most disciplines, slowing significantly during the 1970s. In aggregate the annual average rates of growth for the five sub-periods covered were around 5 per cent, 12 per cent, 8.5 per cent, 2 per cent and 3.5 per cent respectively. This figure also clarifies the differences between disciplines as well as giving rates of growth for students of law and architectural and vocational subjects. The growth for the latter was exceptionally high throughout the first three sub-periods averaging over 20 per cent during the 1960s. Social studies achieved even faster growth rates in the first part of that decade but growth for this broad disciplinary group slackened thereafter. The figure also illustrates the relatively rapid growth for pure sciences in the first period and for applied sciences in the second period covered, both of which are consistent with a supply side response to perceived high rates of return, a point to which we will return below.

Employment in Professional Occupations

The data discussed so far provides only one side of the picture. Obtaining measures of demand for highly qualified people is even more problematic. Some indication of the demand-side forces at work can be obtained by examining data on numbers employed in different professions. Obviously these are the results of both demand and supply side forces. They do however provide some clue to the way in which the patterns of demand have altered over time. If employers have not been supply-constrained then such measures provide a rough guide to overall demand movements. For these reasons we provide a brief summary of changes in occupational structure in the British economy over the period covered by the study.

The outstanding feature of developments in occupational structure during the 20th century has been the rise in the proportion of non-manual or white collar occupations. Routh (1980) has argued that there has been a remarkable stability to occupational structure. However, it is clear from census data that very large changes have in fact occurred, albeit very slowly (see Table 4.3). The proportion of non-manual occupations almost doubled between 1911 and 1971. Since 1971 there has been an acceleration of this trend, the proportion rising from 42 per cent in 1971 to 47 per cent by 1980.⁽²⁾ Thus the situation has changed from one of domination of manual occupations, which accounted for over 80 per cent of employment in 1911, to the gradual domination of non-manual jobs.

Within the broad manual and non-manual groups the changes in structure have been even more remarkable. Routh notes that whereas in 1911 a typical gathering of professional people might have included a scientist, two accountants, three (military) officers, three writers, five engineers, five lawyers, seven doctors and dentists and ten churchmen; by 1971 there would be eight scientists, eight accountants, five officers, five writers, four lawyers, eight doctors and dentists, four churchmen and forty four engineers. Similarly dramatic changes have occurred in other parts of the occupational spectrum.

The level of employment in a particular occupation can change for two main reasons; either because the industries in which it is concentrated grow or decline, or because of changes in occupational composition within industries. The former may be termed the industrial effect the latter the occupational effect.⁽³⁾ The so-called

(2) The analysis in this section draws extensively on Wilson (1983a).

(3) The industrial effect is obtained by applying the occupational proportions for each industry in the earlier year (say 1961) to the industrial employment levels in the later year (say 1971). Aggregating across industries the changes in occupational employment implied gives the impact if only industrial structure had altered. The residual between this hypothetical change and that actually observed is termed the occupational effect. This measures the impact of changes in the occupational mix within each industry.

Table 4.3 Percentage of Total Employment in Non-manual Occupations

	per cent	
	Routh	Wilson
1911	19.0	..
1921	21.7	..
1931	21.9	..
1951	27.8	31.8
1961	31.9	36.4
1966	..	39.2
1971	37.4	41.9
1980	..	47.0
1990	..	51.2

Sources: Routh (1980) and Wilson (1983a).

Notes: Both sets of estimates are based upon Census of
Population returns. They adopt somewhat different
definitions of non-manual occupations, in
particular Routh excludes sales occupations.

occupational effect may arise for a number of reasons. Medium-run developments in technology may affect the structure of demand for certain skills. Demand may also change in response to changes in the relative rates of pay associated with certain trades which may in turn be affected by the supply side of the labour market. In the short term the level of employment in each industry may depend upon the cyclical position in which it finds itself. Certain skills may be regarded as 'fixed' rather than 'variable' inputs in the production process for technological reasons. Furthermore, it is apparent that the costs of hiring and firing (that is costs associated with changing the level of employment) differ considerably between occupations. Finally the actual levels of employment observed at any particular time will reflect the balance of supply and demand, shortages for certain skills may result in divergence from the long-run structure of employment desired by firms. This again will be dependent upon current rates of pay, the scope for substitution of one skill for another in the production process and the flexibility of wages.

The main features of developments in occupational employment during the post-war period are summarised in Table 4.4. The rapid growth in employment during the 1950s was almost entirely accounted for by increases in non-manual occupations, manual employment remaining unchanged at least in total. During the 1960s, when employment fell slightly, about 1.3 million manual jobs were lost while at the same time there was a net gain of 1.4 million non-manual jobs (not quite as large an increase as during the 1950s). During the 1970s this pattern continued, with a further loss of almost 900 thousand jobs by 1980 although this was off-set by an increase in non-manual employment of about 1.5 million.

Table 4.4 Employment by Occupation 1951-80

Warwick Occupational Categories	thousands			
	1951	1961	1971	1980
2. Education professions	468	570	752	984
3. Health professions etc.	488	603	767	986
4. Other professions	274	369	461	562
6. Engineers, scientists etc.	209	347	503	576
1-9 Non-manual occupations ^a	7,165	8,864	10,217	11,755
10-18 Manual occupations ^a	15,393	15,473	14,164	13,271
1-18 All occupations ^{a,b}	22,558	24,337	24,380	25,026

Source: Wilson (1983a)

Notes: (a) Components may not sum to totals due to rounding.

(b) Excluding HM Forces.

Changes in the industrial structure of employment have played a major part in these developments. During the 1950s industrial effects were favourable for all except a few occupations tied to the fortunes of specific industries. In the 1960s however 60 per cent of the decline in manual employment can be attributed to unfavourable changes in industrial employment, most notably the falling level of employment in primary and manufacturing industries. For non-manual occupations, in contrast, just under 60 per cent of the increase in employment during this period is attributed to favourable industrial effects, particularly the rise in employment in private and public services. In the 1970s the importance of industrial factors lessened to some extent, contributing approximately 25 per cent to the fall in manual employment for example. Nevertheless, changes in industrial structure were still a major factor in developments in occupational employment during the last decade explaining over 50 per cent of the increased number of non-manual jobs.

Considering the occupational groups in more detail, it is clear that although there are some notable exceptions the broad trends we have noted for the aggregate non-manual category apply to most professional occupations. Education professions experienced strongly unfavourable occupational effects during the 1950s and 1960s. Nevertheless, increased employment in publicly provided education services easily offset the impact of changes in occupational structure within these services in favour of 'dinner ladies' and other ancillary staff. The overall rate of increase accelerated during the 1960s slowing down once more in the 1970s. During the period up to 1980 the occupational effect changed to positive reinforcing further increases in total employment in educational services giving an increase of 230 thousand jobs. Overall, employment in this category has risen by over 500 thousand between 1951 and 1980.

Health professions and other professions experienced a modest growth in employment during the 1950s and 1960s primarily due to favourable industrial effects. This growth accelerated during the 1970s. The expansion of health services, together with a more favourable occupational effect, particularly in miscellaneous services, contributed to the rise for health professions, while in the case of other professions the increased level of employment in insurance, banking and finance and in professional services was the main factor.

In the 1950s the employment of engineers, scientists etc. doubled, giving by far the fastest rate of increase in employment of all categories. Only technicians and draughtsmen with an almost identical increase of 66 per cent between 1951 and 1961 came anywhere near this rate of growth. In the 1960s further increases of almost 45 per cent for scientists and engineers occurred. The major part of this increase was attributed to technological and other factors resulting in rising occupational coefficients although industrial effects were also slightly favourable to these occupations, especially in the 1950s and early 1960s. In the 1970s, the accelerated decline of the manufacturing sector, together with the much less rapid growth of employment in professional services and educational services, resulted in a much smaller industrial effect. The occupational effect remained positive however, albeit less strong than in earlier periods.

Table 4.5 illustrates these developments in more detail. From this information it is clear that teaching professions, especially university teachers, have increased their share of employment more than any other profession. In total their share increased by a factor of almost 2.5 and university teachers saw an increase of over four-fold between 1951 and 1979.

Table 4.5 Shares of Employment in the Professions 1951-1980^b

Profession ^b	Per cent			
	1951	1961	1971	1980 ^a
Health Professions	2.2	2.5	3.1	3.9
of which:				
Medical Practitioners	0.21	0.25	0.26	0.28
Dental Practitioners	0.05	0.06	0.06	0.06
Education Professions	2.1	2.3	3.1	3.9
of which:				
University teachers	0.04	0.06	0.11	0.16
Other teachers	1.54	2.07	2.64	3.54
Engineers, scientists etc.	0.9	1.4	2.1	2.3
of which:				
Civil engineers	0.10	0.14	0.20	0.26
Mechanical engineers	0.09	0.20	0.39	0.32
Electrical and electronic engineers	0.06	0.17	0.27	0.27
Other engineers	0.22	0.36	0.45	0.52
Scientists	0.17	0.22	0.28	0.34
Surveyors and Architects	0.25	0.32	0.41	0.44
Other professions	1.2	1.5	1.9	2.3
of which:				
Accountants	0.34	0.43	0.51	0.65
Legal professions	0.12	0.14	0.15	0.21
Other business professions	0.12	0.17	0.30	n/a

Sources: Own estimates based on Wilson (1983a); Censuses of Population 1951, 1961 and 1971 and Labour Force Survey 1979.

- Notes:
- (a) The estimates for 1980 are based on the Labour Force Survey for 1979 and may not be directly comparable with the data for earlier years.
 - (b) The Warwick Occupational Categories WOCs used as sub-totals correspond to the data in Table 7.3. In some cases these use broader definitions of professional status than are adopted in this study. Health professions for example includes nurses. The WOC figures have been constructed so as to be consistent with DE figures on total employment. The estimates for individual professions are extracted directly from the Census of population or LFS (and in the case of the latter grossed up to correspond with estimates of total employment in 1979).

The only professional groups to show similar rates of increase over this period were certain types of engineers. Electrical and electronic engineers in particular showed a four-fold increase, while mechanical engineers achieved a three-fold rise over the same period. The other engineering occupations and scientists also increased their shares of employment by a factor of 2 or more, architects and surveyors showed a slightly lower increase.

This was in marked contrast to groups such as doctors and dentists who, while they increased their employment shares did so to a much smaller degree than other medical occupations such as nursing and other medical staff. Legal professions showed a similar pattern of growing shares of employment but at a significantly slower rate than that achieved by the teaching professions.

These data are clearly the outcome of both supply and demand side forces and a priori it is difficult to establish whether they represent a situation of equilibrium or one of excess demand or supply. Nevertheless, given other information on the labour markets for these groups, some tentative conclusions can be reached. These issues are tackled for each group separately in Chapters 5 and 6 below. Nevertheless, a broad overview of the market for highly qualified manpower as a whole is given here, drawing where necessary on the more detailed analysis given elsewhere.

Graduate Unemployment

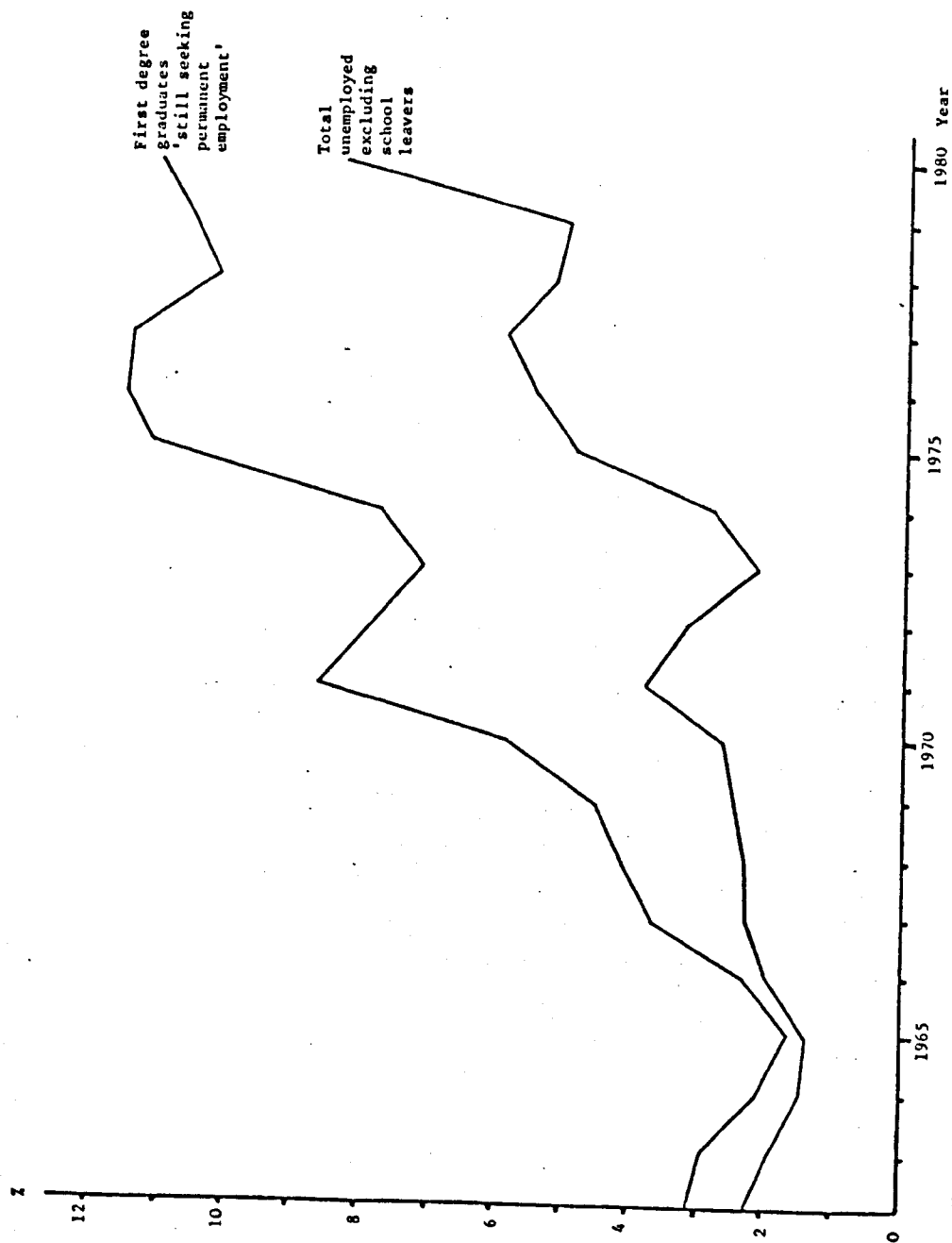
Before discussing the more detailed information available for selected groups it is useful to consider some overall measures of the match between supply and demand such as the numbers and rates of unemployment for the highly qualified. Again there are problems in obtaining comprehensive measures over a long period of time. The Censuses of Population provide a useful but limited guide on

the unemployment of highly qualified persons during the late 1960s. This data suggests that the overall rate of graduate unemployment was around 1.4 per cent in 1966 rising to 2 per cent by 1971. For the same years the total unemployment rate rose from about 2 to 3.5 per cent (see Figure 4.9). Results from the GHS for 1981, reported by the Department of Employment, show the unemployment rate for graduates and professionally qualified persons of about 4 per cent compared with just under 10 per cent for the population as a whole. This result suggests that graduates, not surprisingly, have been less hard hit by the recession than non-graduates.

A further indicator of some value is the measure of graduate unemployment published by the UGC. This is strictly speaking not directly comparable with the more conventional unemployment statistics we have referred to above. The data refer to those still without permanent employment in the December after graduation. Nevertheless, they provide a useful time series indicator. From Figure 4.9 this measure of graduate unemployment was somewhat above the average unemployment rate in the early 1960s. By the late 1960s the gap had widened considerably and by 1975 the UGC measure was over 12 per cent compared to the aggregate unemployment rate of about 5 per cent. It must be stressed, however, that the UGC measure cannot be used as a cardinal measure in comparison to the aggregate unemployment rate and should only be used as a general indicator of the underlying trends.

Considering the experiences of different disciplines it is clear that the UGC measure of unemployment is much higher for graduates in arts and social studies than for those in health, science, technology or vocational subjects (see Figure 4.10). The rankings over time do not alter very significantly. One reason for these discrepancies is probably that people in the second group

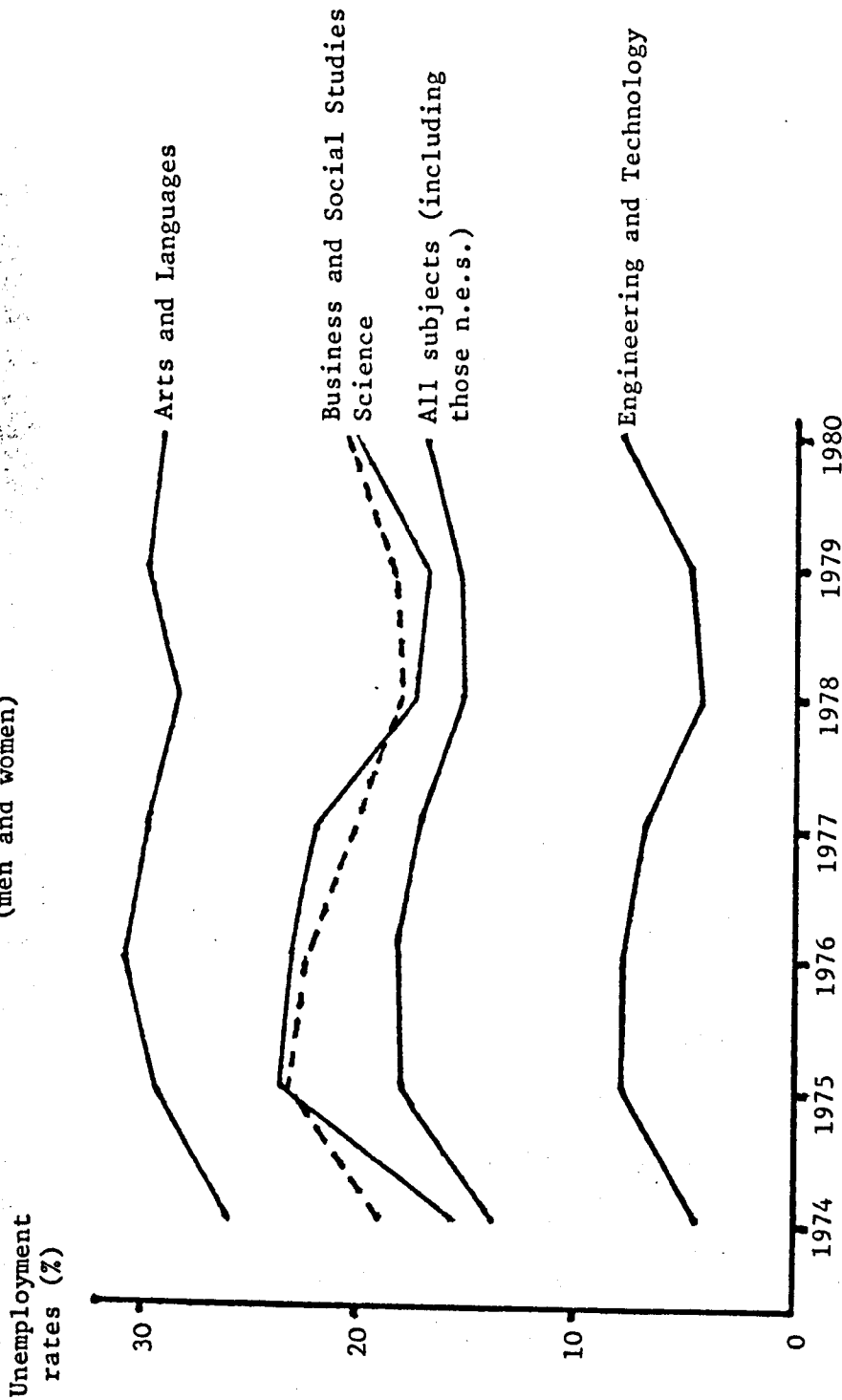
Figure 4.9 First Degree Graduates 'Still Seeking Permanent Employment' and Unemployment Rates (adjusted)



Notes: It needs to be emphasised that the two series graphed here are not comparable indicators. The line 'first-degree graduates' represents only the proportion of new graduates still seeking permanent employment on 31 December of the year in which they graduated. If graduate unemployment were to be compared to the overall unemployment rate, it would need to cover wholly unemployed graduates measured in relation to the total graduate stock.

Sources: Updated from Butler (1978).

Figure 4.10 Unemployment by Discipline:
New First Degree Graduates of UK Universities
 (men and women)



Source: Tarsh (1982).

Notes: The new graduate unemployment rate is defined as the proportion of graduates entering employment or unemployed who were either unemployed or in temporary home employment. Starting in 1980 graduates who were expecting to begin employment within the first 3 months following December of the year they graduated were excluded from the unemployed. Note that this is a broader measure than used in Figure 4.6. This and other discontinuities do not significantly affect the comparisons.

have largely already made a definite career choice and decided on the type of job they require. The former category, on the other hand, may include large numbers of people who are taking time to find the right job. Once again therefore we emphasise the dangers of trying to use the data as cardinal measures of the balance of supply and demand for different types of graduates.

Unemployment by Occupation

A further source of information on unemployment is ^{the} DE's survey of numbers unemployed by occupation. The data is summarised for selected occupational groups in which substantial numbers of highly qualified persons are employed in Table 4.6. This table indicates some marked differences between some of the occupational/professional groups in which we are interested although unfortunately, due to data limitations, it only covers the period from 1972-1979.

Teaching professions all show a sharp increase in unemployment levels (it is not possible to calculate rates of unemployment). All four groups distinguished saw unemployment double or treble between 1972 and 1979. Over the same period aggregate unemployment increased by 70 per cent. Medical practitioners experienced an increase of about 90 per cent while the level of unemployment for dental practitioners more than doubled. Unemployment amongst legal professions (judges, barristers, advocates, solicitors) also more than doubled. For business professions, unemployment of accountants almost doubled while economists, statisticians and actuaries with an increase of about 40 per cent were one of the groups to fare least badly. Amongst professional occupations some of the smallest increases (or indeed in some cases falls) in unemployment were amongst scientists and engineers. This was in

Table 4.6 Unemployment for Selected Occupations

Occupation	000's			
	December 1972	September 1976	December 1979	Index 1979=100
Judges,barristers,advocates and solicitors	237	418	554	233.8
Accountants	1042	1862	2065	198.2
Economists statisticians,actuaries	187	304	263	140.6
University academic staff	659	1169	1901	288.5
Teachers: further education	483	888	1091	225.9
: secondary education	1459	4192	5558	380.9
: primary education	1047	3408	5076	484.8
Medical practitioners	186	212	406	191.5
Dental practitioners	26	47	59	226.9
Biological scientists etc.	645	991	1667	258.4
Chemical scientists	703	725	867	123.3
Physical scientists etc.	512	686	704	137.3
Civil Engineers	268	690	566	211.2
Mechanical Engineers	843	1192	1068	126.7
Electrical engineers etc.	825	1322	1075	130.3
All occupations	705,504	1,202, 512	1,212,334	171.8

Sources: Updated from Butler (1978)

sharp contrast to architects who experienced one of the largest increases of over 200 per cent.

This data is probably a more useful guide to differences in the way in which unemployment has altered over time for different professions. Because it is not possible to convert the absolute numbers into rates it is less useful for comparison at a point in time. As far as it goes the information presented in Table 4.6 tends to support the notion of a gradual worsening of the unemployment situation for most highly qualified professions compared with the average for all workers between 1972 and 1979. The exceptions are groups such as certain business professions and scientists and engineers for whom the results reported in Chapters 5 and 6 indicate a recovery in rates of return in the late 1970s.

A Supply/Demand Explanation

We have already noted the steady rise in educational participation rates for young people. The obverse of this same coin is that the proportion of young people entering the labour force at the minimum school leaving age has fallen. (This was reinforced in 1972/73 when the minimum school leaving age was raised from 15 to 16). A strong case can be made to support the idea that the post-war period (up to around 1969/70) was one of continual excess demand for young people. Merrilees and Wilson (1979) and Wells (1983) both present econometric and other evidence in support of this hypothesis. Such a situation may provide at least a partial explanation of why the relative earnings of young people increased so substantially. (There are undoubtedly other possible explanations, some of which are discussed in the following section). Results presented by these authors suggest that the decision of young people to enter the labour

market responds to the size of the real wage offered. More recently the trend in economic participation rates and their inverse, educational participation rates, have altered. Pissarides (1979) notes the slowing growth in the rise of educational participation rates particularly since the mid 1960s. He has demonstrated that this recent decline in educational participation is associated with the decline in relative earnings of qualified persons. Other authors⁽⁴⁾ have presented a considerable amount of evidence to support the idea that young peoples' decisions regarding education and training and occupational choice are influenced by perceived changes in relative earnings.

Given this evidence a very plausible explanation of the observed changes in rates of return can be developed in terms of young people being encouraged to undertake education and training in response to very high expected returns in the early 1950s. The consequent withdrawal of many young people from the labour market in the face of very buoyant demands, together with various other factors, contributed to a sharp rise in the relative earnings of young people. At the same time, relative earnings of the qualified were forced down due to the increase in supply relative to demand. As a result, the growth in the proportion of young people deciding to undertake this type of investment gradually slackened throughout the late 1960s and early 1970s.

Hunter and Mulvey (1981) have argued that another explanation of the overall decline in relative earnings for professional workers may be that technological changes on the demand side have tended to

(4) E.g. Zabalza (1979), Bosworth and Wilson (1980) and Dolphin (1981) for the UK, and Freeman (1971 and 1976) for the United States.

favour certain unqualified workers, particularly amongst manual occupations. The rapid expansion of mechanised production methods has been associated with the increased demand for semi-skilled and unskilled workers. Of course, the demand for professional and managerial skills has also risen. The crucial question, however, is the relative growth of demand compared with supply. For manual workers the 1950s and 1960s represented a period of unprecedented prosperity. Unemployment rates were very low and often well below what was regarded, even at the time, as the full employment or natural rate of unemployment. Throughout the period there were large flows of immigrants into the UK in response to labour shortages in certain industries, most notably transport and health services. The general picture was therefore one of very tight labour markets for manual workers in general while for professional workers increasing demand was offset by the large influx of newly qualified people.

From the detailed discussions of the experience of specific groups that is given in Chapter 5 and 6 it is clear that the general case that the balance of supply and demand has switched from one of 'shortage' to one of 'surplus' is supported by reference to the experience of such groups as teachers, scientists and engineers, architects and quantity surveyors. These professions constitute the majority of graduates in professional employment (almost 70 per cent in 1971). The main exceptions to the general pattern are doctors, lawyers and certain business professions. In the case of the first of these groups there is some, albeit tentative, evidence to suggest supply has been deliberately constrained to maintain income levels and keep the growth in demand ahead of supply. For lawyers the case for restriction on entry is not so clear cut. It is clear however that the high costs and length of training must dissuade many from entering a career in this profession. However it seems likely that the

main factor here, as for business professions, has simply been that demand has grown very rapidly relative to supply and this maintained the relative income levels of these groups.

4.3 Alternative Explanations

Inflation and Incomes Policies

An alternative explanation of falling differentials has been offered by Routh (1980). He argues that periods of compression of wage relatives have generally been associated with periods of rapid inflation. Brown (1976) has presented evidence in support of this hypothesis for skilled groups in the engineering industry. Rapid inflation it is argued results in narrowing differentials first, because it is regarded as hitting lower incomes hardest and so higher percentage increases are justified for lower paid groups. Second, because more skilled workers suffer from a form of money illusion and that pay differentials are perceived in absolute terms.

Referring back to Figure 4.2 it is clear that the period of rapid inflation did not really begin until the early 1970s. Whether the average rate of increase between 1964 and 1973 of 6 per cent in prices and 9 per cent in earnings constitutes rapid inflation is, of course, a matter of judgement but, as we have seen, it was during this period that the real compression of professional differentials took place. After 1973, when inflation really took off, differentials appeared to stabilize. Even during the earlier period it is difficult to imagine that professional groups could have suffered from sustained money illusion over a period of 10 to 20 years.

Brown (1976) also considered the impact of incomes policies on skilled differentials. Perhaps surprisingly he concluded that they did not play an important part for the groups he was concerned with (skilled engineering craftsmen). No comparable analysis has been

undertaken for professional groups. During the late 1960s and early 1970s various types of incomes policies were in force. However, even if these had a temporary effect on differentials one would have expected that in the intervening period market forces could have rectified any distortions to wage structures that may have resulted. It therefore does not appear that such policies offer a serious alternative explanation of falling relative incomes over a long period of time.

Status and Credentialism

A more general sociological explanation of falling differentials is given by Hunter and Mulvey (1981). This is based on the idea that the narrowing of income differentials reflects significant alterations in the status of different occupational groups in society. The expansion of the educational system can be held to have played an important part in effecting such a change, both by altering the social valuation of different types of work and by breaking down barriers to social mobility. This, it can be argued, has changed the balance of social structure in favour of the lower skilled and against professional workers. A quotation by Phelps-Brown (1977, p.144) provides an economist's rebuttal:

"Although the monetary valuation set upon work usually agrees with the status accorded to the worker, that value is not derived from the status, but is formed independently, according ultimately to the willingness of the public to pay for the services of the worker."

Related to the question of status are various other hypotheses which start from the assumption that since the output produced by graduates is often intangible, earnings cannot be used as a proxy for marginal productivity. Movements in rates of return cannot therefore be regarded as a guide to the balance of supply and demand but rather as a reflection of institutional and other non-market forces.

Psacharopoulos (1981) provides a useful review of such hypotheses. Regarding the issue of whether education has a social value he points to the impact of general education on the productivity of farmers as reported by Jamieson and Lau (1978). Where the output is less directly tangible the objections to the use of the rate of return concept can be discussed under two general headings. Again following Psacharopoulos (1981), these are 'screening or certification' and 'bumping or job competition'.

The screening or certification hypothesis regards educational qualifications as merely devices to label individuals as high or low ability (productivity). As progressively more and more individuals obtain the requisite labels their value is diminished and so the earnings associated with them fall. In essence this last point is little different from the supply/demand explanation. The underlying theory has very different implications for educational policy however. If qualifications are simply used as labels there may be some more efficient way of distinguishing ability (productivity); for example, by use of IQ tests. More detailed analysis suggests that this type of hypothesis has been overstated however.

Psacharopoulos (1975) and Griliches (1979) provide evidence which suggests that education is the main determinant of earnings rather than ability, the implication being that education has an independent effect on productivity. This is supported by work by Hartog (1983). If employers take educational qualifications as an indication of productivity (a function of both native ability and education and training undertaken to achieve these qualifications) then this has a social informational value. Furthermore, there is considerable evidence (eg. Psacharopoulos (1979)) that while firms do use qualifications as an initial screening device they do not continue to pay employees earnings disproportionate to their productivity. Hartog (1983) also presents evidence that graduation

does effect earnings for individuals taking a first degree, but this effect is merely commensurate with the skill augmentation predicted by the standard human capital model and that therefore the possession of the degree does not simply act as a screening device. The results of this review suggest that screening or certification cannot therefore provide an independent explanation of falling rates of return.

The bumping or job competition hypothesis regards workers as competing for jobs rather than wages and holds that more qualified people will displace the lesser qualified in lower paid jobs. As a result the average earnings of the higher qualified may fall relative to non-qualified. Undoubtedly this type of phenomena does occur, particularly during a recession when the hypothesis is analagous to Reder's model of cyclical changes in hiring standards for manual workers. The results presented here are generally standardised for occupation however, so there is no reason to believe that this type of hypothesis can be of value in explaining declining returns to education and training. In addition, as pointed out by Psacharopoulos (1981) there is considerable micro level evidence to suggest that better educated and more qualified persons are more productive (earn relatively more) even after standardisation for occupation.

Monopoly and Monopsony

Union and professional organisations may also be expected to have an important influence on relative wages. The extent to which the B.M.A., for example, may have been able to restrict entry to the medical professions and thus maintain the relative income levels of doctors above the market clearing level is discussed in Chapter 5. Changes in the degree of monopoly power over time may therefore affect rates of return. For example, the increase in supply of young entrants to the medical professions may have lead to a weakening

of any such monopoly power and thus can provide some explanation for declining rates of return.

More generally, unions covering manual workers and lower skilled non-manual occupations can be expected to attempt to raise the earnings of their members relative to non-members. The evidence on the size of the differentials that might be achieved is rather contradictory (Hunter and Mulvey, 1981, Chapter 15). However, given a substantial increase in union memberships during the 1960s and 1970s it is to be expected that this may have contributed at least in part to the decline in overall differentials between manual and professional workers.

Turner (1952) has argued that by absorbing smaller skilled unions the larger manual unions have caused differentials between skilled and unskilled workers to narrow due to their gradual domination by the more numerous lower skilled workers. It seems unlikely that this particular hypothesis can offer an explanation for the decline in the differentials between professional and non-professional groups since the former have generally maintained their independent status. Indeed, one would have expected that the various professional unions and associations would have done their best to maintain their position in the wage ladder and to resist any attempt by manual workers to narrow differentials.

The converse situation of monopsony power may have also played a part in the labour market for certain professions. The government is the major employer of both medical and teaching professions and is thereby in a position to exert an influence on wages by its own actions. In addition it has control of the sources of new entrants to both professions via its control of the size of intake to medical schools and teacher training establishments. Pay negotiations are, as noted by Dahlby (1981) for teachers, very centralised and cover

the vast majority of members of each profession.

Strictly speaking the situation for both teaching and medical professions is one of bilateral monopoly. In contrast to doctors, however, the employee side in the labour market for teachers, e.g. the 'Teachers Panel' of the Burnham Committee, is very weak, due both to their ambivalent attitude to the use of strikes and other militant tactics in wage negotiations and to dissension amongst members of the teachers' associations regarding salary structure (see Dahlby, 1981, p.305). The position of teachers in higher education is rather similar and more akin to that of nursing staff amongst health professions than ^{that} of doctors and dentists. In contrast, the B.M.A. has been in a much stronger position. In addition, as noted in Chapter 5, the setting up of a permanent 'Review Body' covering the medical profession has had the effect of protecting the interests of this group since such bodies tend to adopt a paternalistic attitude towards their 'charges'.

The effect of monopsony or bilateral monopoly on secular changes in rates of return will obviously depend upon whether the degree of monopsony or monopoly power varies over time. In addition, however, external forces which shift the demand and supply functions over time will still operate to alter the equilibrium wage level even if monopsony or monopoly does exist. (Although their existence may affect the speed with which adjustment of earnings takes place). Certainly the demographic changes that have affected the requirements for teachers will have altered the balance of power between employers and employees in the labour market for teachers. First, up to the early and mid 1960s, in favour of the employees and then gradually in favour of the employers. The timing of this change will have affected primary and secondary teachers before those in higher education. The evidence presented in Chapter 5 suggests that this

is the pattern we observe.

Other Institutional Factors Affecting Wages

Apart from incomes policies and the influence of unions and employers on the market clearing wage there are various other institutional factors which may have influenced wage levels particularly for young people. The most important of these were; the ending of national service in the 1960s which had previously depressed the average age of young people in employment and hence their average earnings; the changing age of majority in 1969 and the associated change in the age for which adult rates were paid; and finally, the change in school leaving arrangements in 1963 and 1972 both of which tended to raise the average age of young people in employment. Wells (1983) shows that all of these factors had a significant impact on the earnings of young people and thus on income foregone for prospective professionals. All these factors tended to reinforce market forces which, as noted above, were tending to drive up the relative wages of young people during the 1950s and 1960s.

The Raising of the School Leaving Age (ROSLA) in 1972/73 is a special case because of its rather artificial impact on income foregone. Between 1972 and 1973 the minimum age at which a child was allowed to leave school was increased from 15 to 16. Since schooling then became compulsory for those aged less than 16 this, in a sense, removes one part of the cost to the individual of undertaking education beyond the age of 15. Leaving school at 15 was no longer an option and so income could not be foregone. Both from an individual and social viewpoint income is still foregone but because of legislative dictum rather than personal choice. In order to avoid this factor affecting the comparisons of rates of return over time in the results we have presented so far, we have ignored ROSLA.

The main effect of ROSLA as far as rates of return are concerned is that there is no longer any income foregone by those staying on at school up to the age of 16. Roughly speaking this reduces the income foregone of the 15-19 age group by about a fifth.⁽⁵⁾ Ceteris paribus on a rate of return estimate of, say, 10 per cent (post 1972/73), taking this into account will raise the estimated rate of return by 1 per cent.

This however is almost certainly an over-estimate of the impact. This is because ROSLA also had the effect of raising the average income level of those aged less than 20. Firstly because of the fact that earnings varies positively with age for young people and that therefore in 1972, for example, the average earnings of those aged 16-19 was significantly higher than for those aged 15-19 (by about 5 per cent). Secondly, because there is some evidence that as a result of the restriction of the numbers of young people available for work after ROSLA their earnings were forced up relative to adults. Taking all these caveats into account the overall impact of ROSLA on income foregone of those aged 15-19 seems unlikely to be much more than a tenth. This would have the effect of increasing an estimated rate of return of, say, 10 per cent by less than 0.5 of a percentage point. However, as already noted, in order to avoid the artificial impact that such an adjustment would have on changes in rates of return over time, the results presented in previous chapters assume income is foregone from age 15 plus for the whole period covered.

4.4 Conclusions

In this chapter we have considered a number of explanations for the observed secular decline in rates of return. Although various institutional factors may have contributed to this phenomena, a considerable amount of evidence has been assembled which suggests the hypothesis that, primarily, it reflects changes in the balance of supply and demand for the highly qualified. The explanation offered here revolves around the long-run adjustment of the labour market to the expansion of the supply of graduates. At the start of the period we have covered, rates of return for obtaining professional status were generally very high compared with the return to physical capital. In many areas there were recognised shortages of qualified manpower (eg. doctors, dentists, teachers and engineers). The expansion of capacity in the higher education system, together with improved access for a significant part of the population via the increased availability of maintenance grants and higher incomes in general, provided a scenario in which an unprecedented number of individuals were able to choose to invest in themselves in order to reap the rewards clearly associated with the attainment of professional status.

In doing this it was inevitable that unless demand also changed at the same or faster rate, this would tend to drive down relative earnings as increasing numbers of individuals entered the labour market with a degree or equivalent qualification. The obverse of the same coin was that as an increasing proportion of young people opted out of the labour market and into the educational system this resulted in a shortage of less well qualified young people. This has probably been one important factor in driving up their relative earnings (although there are undoubtedly other institutional factors at work here as well).

As demonstrated above, this increase in the relative earnings of young people has increased the foregone income cost of investment in degree level training and explains a significant part of the decline in rates of return. Technological factors have probably favoured the less skilled and manual workers and this has also contributed to the decline in relative earnings for the highly qualified in the 1950s, 1960s and early 1970s. In recent years the world-wide recession has hit young people and manual workers particularly hard and there is clearly no longer an excess demand for these groups. (The analysis by Merrilees and Wilson (1978) in fact suggests that the period around 1969/70 represented a significant turning point in the labour market for young people with a switch in regime from one of excess demand to one of excess supply). The rate of growth of the production of qualified young entrants to the professional labour market has also slowed substantially. Together these factors have tended to halt or at least slow the decline in rates of return during the latter half of the 1970s. Even for such groups as doctors where there is no strong evidence that supply has outpaced demand, rates of return have been forced down by the rising levels of income foregone. The effects of the expansion of supply of highly qualified people in general and the consequent reduction in the supply of unqualified young people has had an indirect effect on the returns estimated for all groups including medical professions.

This general conclusion is at odds with that reached by Routh (1980). In his study of changes in occupational structure and earnings in the British economy over more than a century he concluded that the evidence did not support the classical notion of wage relatives moving in such a way as to bring supply and

demand into balance. The results discussed in this and later chapters support the hypothesis that such movements have occurred in the labour market for highly qualified professionals in the UK.

5. Rate of Return Calculations for Other Professions

Using results from the follow up surveys to the 1966 and 1971 censuses it is possible to compare the estimates of rates of return made for scientists and engineers with other professions. In addition, for certain groups, professional institutions or other bodies have collected data on earnings by age from which it is possible to assess how rates of return have developed in the 1960s and the 1970s. Generally, the latter are broadly comparable to the various surveys we have considered so far, including those carried out for scientific and engineering institutions. The various sources, their advantages and limitations are described in detail in the following chapter. Here we begin by discussing some of the problems involved in making comparisons of rates of return for different professions. For example, different careers may involve different amounts of investment in human capital in terms of the duration of the education and training period. Many professions are self-employed. This introduces various differences compared with salaried employees which need to be taken into account in the rate of return calculations. A different but connected issue is whether earnings reflect competitive market forces or are influenced by agents with monopolistic or monopsonistic power. These and various other problems are discussed in Section 5.1. A broad comparison of the results for different professions including scientists and engineers is made in Section 5.2. This is based on the more detailed results presented in Chapter 6. A corresponding analysis of social rates of return is given in Chapter 7.

5.1 General Problems in Extending the Analysis to Other Professions

Various problems arise in extending the analysis of expected rates of return to other professions. These range from purely

practical problems of, for example, how to interpret the available data in order to make meaningful comparisons across professions, to general theoretical issues concerning the determination of relative incomes in different occupations.

Career profiles

A difficulty with some of the earlier surveys is that the data relates to only the most senior members of a profession, for example, hospital consultants or qualified actuaries. People who achieve senior posts at an early age are clearly exceptional and rates of return calculated on the basis of age earnings profiles for such groups will tend to exaggerate the average return to a career in such professions.

To avoid the problem it is necessary to construct a more typical career profile. Ideally this would be done by averaging the earnings profiles for different grades of a profession using as weights the probability of reaching such grades. Occasionally we have to make do with more limited information. For example, in the case of hospital doctors we have utilised information on salary scales to construct complete career profiles. Comparison with survey data suggests that this is not as outrageous as it might first appear and that such data can, within limits, prove a useful supplement to survey information.

Length of course

A second practical issue is the need to recognise that the duration of the period of investment in education and training varies significantly for different professions. Some indication of the variation in length of course can be judged from the data presented in Table 5.1. The table shows for first degree students in different disciplines the percentage on courses of different lengths. From this data it is clear that the mean and modal course durations are

Table 5.1
Length of university first degree courses for different disciplines

Discipline	per cent			
	Length of course			
	3 years	4 years	5 years	6 years
Education	41	52	7	-
Medical and health	15	6	52	27
Engineering and technology	56	42	2	-
Science ^a	79	21	-	-
Social studies	88	12	-	-
Vocational studies ^b	30	30	27	13
Languages	63	36	1	-
Arts	68	22	7	3

Source: Statistics of Education 1972 Vol. 6, Table 9.

Notes: (a) Excluding agricultural science

(b) Primarily achitecture

considerably higher for medical and health studies than for most other subjects. Vocational studies (primarily architecture) is also well above average. Engineers typically follow a longer course than scientists. Social scientists follow the shortest course on average. This tells only a part of the story however. Graduate school teachers, for example, at least since 1974, have been obliged to obtain a Post-Graduate Certificate in Education (PGCE) if they wish to teach within the state system. Even prior to 1974 such a qualification was commonly obtained by graduates before entering teaching. Similarly, for university lecturers, a Ph.D has become increasingly common as a necessary qualification for entry to the profession.

Both these examples raise a further issue which is that entry requirements into a profession may alter over time and this can have a significant effect on the overall return expected to someone contemplating such a career. The particular patterns common to each different profession are described in the subsequent sections. In what follows we have attempted to calculate expected rates of return to a typical package of education and training necessary to attain professional status in different areas.

It might be argued that since the overall investment package can vary in size it would be preferable to concentrate upon the present values of different lifetime career incomes using a common discount factor. This approach is rejected here. There is no consensus on an appropriate discount rate to adopt. Individuals preferring different careers may well have different attitudes towards risk and different subjective rates of discount. The use of the internal rate of return approach side-steps this difficulty.

Shultz (1967) concludes that the alleged advantages of present values (PV) as opposed to internal rates of return (IRR) in comparing

different investments in human capital is questionable in theory. Both measures have their merits. Bailey (1959) demonstrated that Hirschleifer's (1958) conclusion that PV was generally preferable to IRR was unjustified in any but the most simple cases. Bailey shows that in the multiperiod case of full generality it can be formally demonstrated that neither measure is unequivocally the better, and that the final decision depends on tastes and the future profile of interest rates. The advantage of PV only applies if there is unlimited borrowing and lending possible at known interest rates (Bailey, op cit. p.487). This is in addition to Hirschleifer's own recognition that PV is only preferable to IRR when all investments are independent and when perfect capital markets exist. None of these conditions apply in the market for human capital. Generally speaking, individuals face a mutually exclusive choice of career profiles; having adopted one course it is usually quite difficult to switch to a very different one. Investments are therefore not independent since individuals can in general only follow one career.

Consider the following example. Suppose the expected internal rate of return to becoming a professional scientist (3 years on a first degree course) is just equal at 15 per cent to the internal rate of return to becoming a doctor (5 year course). At a test discount rate of 15 per cent individuals might be expected to be indifferent on economic grounds between the two professions, whether one considers the internal rate of return or the present value rule. (Both present values being zero by definition). At a test discount rate less than 15 per cent the present values attached to the two decisions would be different. One would therefore expect the individual not to be indifferent to the two choices if the present value rule is adopted. The decision facing the individual however is whether to go for a 3

year investment (return 15 per cent) or a 5 year investment (return 15 per cent) this choice will depend on his preference for a quick return as opposed to a longer period of waiting. The relevant present values associated with the two careers depend crucially on the time discount rate used by the individual making the career choice. For someone with a high discount rate, the career as a scientist will appear more attractive than that as a doctor (*ceteris paribus*). Conversely someone prepared to wait will prefer the latter career. No choice of discount rate can avoid this problem. For our purpose therefore the internal rate of return measure seems the more appropriate criteria for comparing the costs and benefits associated with different career choices. It therefore seems the most useful measure of each career's relative financial merits.⁽¹⁾ We therefore prefer the IRR as a parsimonious measure of the relative costs and benefits of different career choices. This does not imply however that a particular individual will be indifferent from an economic viewpoint when faced by equal values for the internal rate of return to career investment packages of different duration. The sensitivity of the results to assumptions about length of course is discussed further in Chapter 8.

Self-employment

A number of the professions contain within their ranks a significant proportion of self-employed persons. When comparing the incomes of such people with salaried employees it is important to bear in mind various important differences between these two categories. Some of these can be quantified to some extent; others, although important, are very difficult to translate into purely financial terms. The following are some of the most important differences.

Pensions

Whereas most professional employees are now provided with a pension by their employer (with or without some employee contribution), self-employed persons must make their own arrangements for retirement. An annuity can be purchased out of profits from self-employment. In order to make a correct comparison with employees therefore, some deduction must be made from self-employment incomes in order to provide a comparable pension arrangement for the self-employed person, otherwise the measure of total income would exaggerate the income differential in favour of the latter. On average the value of superannuation and national insurance contributions paid by employers is around 14 per cent of gross salaries for salaried professionals. In the various calculations below, an adjustment is therefore made to reflect the provision of a corresponding annuity for self-employed persons financed from current income.

Capital outlay

Most self-employed people will have to make a considerable investment in physical as well as human capital before they can commence their business. Often this takes the form of buying a share in the assets of an existing partnership. In addition to the physical equipment this may also include payments for 'goodwill' although these are now much less common. The effect of this is that the income from self-employment must be regarded as, in part, being a return to capital investment. Some adjustment is therefore necessary to distinguish this from the return to the human investment with which we are concerned here. Two sources of information

Table 5.2 Deduction for Capital Outlay of Principals 1955/56

	Capital	Outlay	Share of assets			%
	Buildings	Equipment	goodwill	Total	Interest ^a	share of gross income ^b
General medical practitioners	1483	317	1540	3340	167	8
General dental practitioners	1385	1205	701	3291	165	8
Practitioners consultants	1052	221	-	1273	64	2
Solicitors (England and Wales)		3844		3844	192	9
Solicitors (Scotland)		3299		3299	165	10
Architects		1995		1995	100	6

Source: RCDDR (1960) Appendix V and own estimates. /

Notes: (a) Assuming an interest rate equal to the minimum lending rate; total annual outlay.

(b) Interest as a percentage of annual gross income.

are available which provide at least a broad guide as to the size of the adjustment required. The RCDDR (1960) collected information on the capital outlay associated with various professions. This covered the year 1955/56. A more recent analysis was conducted by the RCLS (1979). From these sources a rough measure of the outlay for capital can be derived. Table 5.2 provides a summary of the data and our calculations. These percentage deductions from income have been assumed to remain roughly constant over time. One exception to this rule is the case of solicitors, where the RCLS provided its own estimates. These amounted to 13 per cent of gross income for solicitors in England and Wales in 1976/77 and a similar figure for solicitors in Scotland in 1977/78.

Taxation

There are differences in the way in which self-employed and employees are assessed for tax. These are not very important from our viewpoint and no special treatment is adopted here.

Self-employment and fringe benefits

Many employees receive various fringe benefits in addition to their salary. As far as such benefits accrue to self-employed persons they should already be included in their total income. In making comparisons between employed and self-employed, fringe benefits should be included for the former where possible.

Unquantified differences

The main differences to be included here arise as a result of the entrepreneurial function a self-employed person

adopts and the associated risks involved. One would expect that incomes would need to be higher in order to persuade people to take this additional risk. The entrepreneurial role involved includes the responsibility for employment of others; the lack of security of employment, putting at risk the capital investment in both human and physical assets; the lack of any sickness provision (although a self-employed person can insure himself against such an eventuality); and finally, the liability for claims and damages if, as a result of his employment, a client incurs a loss. Again the latter can in theory be insured against, at least in a purely financial sense. Professional reputations are, however, more easily lost than won.

Differences in hours worked

If certain professions work significantly longer or shorter hours than average, then this should be taken into account in comparing estimated rates of return.⁽²⁾ The two most often quoted examples are medical professions (especially hospital doctors) who are generally regarded as working exceptionally long hours, and teaching professions for whom the opposite is true. The evidence for making an adjustment in the case of doctors seems strong.⁽²⁾ The RBDDR suggests that on

(2) The question of whether it is appropriate to adjust for hours worked in assessing rates of return for medical professions and, if so, the size of the appropriate adjustment, has been discussed at length in relation to estimates for the United States (see the exchange between Sloan and Lindsay (1976)). The basic conclusion reached by Lindsay is that his original adjustment for hours for medical professions (assuming a differential of as much as 20 hours) was in fact probably an overestimate. Sloan suggests an adjustment of 5-12 hours. Lindsay, however, demonstrates that even this adjustment has a significant impact on net present values of discounted lifetime incomes. Our basic assumption is of a differential of around 10 hours for hospital doctors. This is based on information published by the RBDDR (1980). However, data from other sources (e.g. the 1971 Census of Population) suggests that this may be an overestimate. The sensitivity of the results for medical professions to this adjustment is discussed below.

average young hospital doctors supplement their income by about a third by working longer hours. For teachers the evidence of lower than average hours seems very weak. A survey quoted by the Clegg Commission found that once preparation time was taken into account, secondary teachers work a significantly longer average week than non-manual workers in general. In the results discussed here an adjustment is therefore included for hospital doctors but not for teachers. Complete details may be found in Chapter 6. Further discussion on this topic will be found in Chapter 8 where the sensitivity of the results for engineers to different assumptions is examined.

Differences in supplementary income and fringe benefits

Although fringe benefits of both pecuniary and non-pecuniary kind are generally regarded as having become of increasing importance in recent years, there is very little firm data to confirm this. To the extent that self-employed persons included all income in answering the relevant questionnaire, such benefits should already be included for them. For employees most surveys have not explicitly asked for such benefits to be included. Some information is available for groups such as engineers. Results discussed in Chapter 8 below suggest that the inclusion of such benefits might raise the estimated rate of return for engineers from around 9 per cent to about 10 per cent in the mid-seventies. Regrettably there is no comparable information for all our other groups so no real account can be taken of this factor both in comparing different professions or in comparing changes over time.

On the other hand, there is considerable evidence that certain groups such as university lecturers are able to supplement their basic incomes by income from consultancy, books etc. It is possible to adjust the relevant age earnings profile for this

group to include this income. The estimates discussed in the following section are so adjusted. Again complete details may be found in Chapter 6.

Differences in ability

The question of whether and by how much age earnings profiles should be adjusted to reflect differences in ability has received much attention in the literature. The topic is discussed in detail in Chapter 8. For the present the relevant question is whether differential adjustments are appropriate for different professional groups. From a theoretical point of view there would seem to be a strong case for such an adjustment if such differentials do exist. If, for example, the higher return observed for doctors reflects greater average ability, then the estimates obtained for medical professions will be biased upwards since the appropriate C_t profile should also reflect higher ability. On the other hand, if there is no reason to suspect a difference in average ability in different professions, one would expect a priori that competitive forces would in the long run tend to result in equal rates of return for all professions (ceteris paribus). Therefore any differential in rates of return in favour of a particular group may be indicative of market imperfections.

There is a great deal of ad hoc evidence on, for example, 'A' level scores, entry requirements to university and so on, which suggest that some groups such as medical professions are of higher quality than say engineers (see Bosworth and Wilson, 1983). However, it is very difficult, if not impossible, to convert such scores into a cardinal measure of ability on which to base differential ability adjustments to the age earnings profile of the sort described in Chapter 8 below. Rather than attempt any ad hoc adjustments, we therefore prefer to present the estimates unadjusted.

Some idea of the impact on estimated rates of return of different assumptions about the effect of ability on age earnings profiles are given in Chapter 8. On the basis of such results, one can reach some tentative conclusions about the extent to which observed differences in estimated rates of return might be affected by differences in ability.

Different prospects for employment and economic activity

Generally speaking, the probability of finding employment and being economically active appear to be equally good for most professional groups as indicated by data from the Census of Population. There is, however, little information on how such probabilities may have altered over time. Data on the proportion of newly qualified graduates still searching for work in the December following graduation have been published since the mid 1960s. These suggest a general slackening of the labour market for graduates as a whole with certain groups such as those qualified in engineering being affected much less than the average. (See Chapter 4, Figures 4.9 and 4.10 for further details). There are numerous conceptual and practical problems with this data such as inconsistency over time, limited coverage of new graduates only and poor matching with our occupational categories. We therefore take a similar approach to that adopted in the case of differences in ability, that it is better to present results before any differential adjustments for the probability of finding employment and to then assess the size of the observed differences in the light of what tentative information we may have. Some sensitivity tests are done in Chapter 8.

Differences in risk associated with each professions

Not entirely unrelated to the previous issue is the question of the risks attached to different professions. These, however, may be much wider than as measured by probability of being unemployed. Such

considerations affect in particular the self-employed and they have already been discussed above. Generally speaking, they are unquantifiable and again we prefer not to attempt any prior adjustment.

There is, however, one other aspect of this question which deserves some comment. This concerns the use of different measures of "average" income. The most commonly used measures are the mode, the median and the mean. When considering any particular career, an individual may well be concerned about the range of incomes associated with it. A risk-averse individual may prefer a career with a smaller return but one with a smaller range of earnings that makes it more likely he will actually achieve that earnings profile. Such an individual might be more interested in the median (or indeed modal) earnings profile and on the dispersion around the median therefore rather than the mean. In principal, the rates of return based on median and mean profiles should not be expected to give radically different results (see the discussion in Chapter 3, page 3.10 above). In practice, however, while on the one hand we have found that for certain groups such as school teachers there is very little difference between the mean and median age earnings profile, on the other hand, the comparison income profiles are very different due to the skewed nature of the income distribution for all workers. The use of mean earnings data in such cases therefore results in an estimated rate of return as much as 2 percentage points below that obtained using median earnings. This difference grossly exaggerates any adjustment that should be made to the results presented for teachers however. The estimates based on mean earnings (say y per cent) represent an accurate measure of the average rate of return to be expected for all individuals. For an individual who expects to achieve median income levels, a result based on median age earnings

profiles would suggest a higher return (say x per cent). However, faced with two otherwise identical career choices, the individual would presumably prefer that with the higher mean income even if rates of return based on median profiles were identical. Therefore, a value of x per cent for the rate of return to becoming a teacher based on the median comparison income profile would exaggerate the benefit of teaching relative to other professions where the income distribution is more typically skewed and the rate of return based on median earnings was also x per cent. A priori it does not seem possible to decide on the precise value between y and x that would be appropriate for comparison with other professions. We therefore prefer to use the estimates for teachers based on mean earnings profiles without further adjustment. For other professions this problem does not appear to arise and, where both mean and median earnings profiles are used for different points in time, no bias has occurred.

The more general question about the degree of dispersion of earnings within each age group is discussed in Chapter 8 where the return to those achieving various highest and lowest percentiles of the age earnings profile are compared.

Other reasons for wage differentials between the professions

Adam Smith in the 'Wealth of Nations' distinguished five circumstances which explain differences in the pecuniary gain associated with different employments (Smith, 1970, pp.202-210):

"First the agreeableness or disagreeableness of the employments themselves; secondly, the easiness and cheapness, or the difficulty and expense of learning them; thirdly the constancy or inconstancy of employment in them; fourthly the small or great trust which must be reposed in those who exercise them and fifthly the possibility or improbability of success in them."

This assumes a society in which things were "left to their natural course". In practice, it is possible to envisage various market imperfections which might interfere with the operation of the labour market. A sixth factor can therefore be added to Smith's list - the existence or absence of imperfections in the labour market which may result in the incomes for particular employments being greater than or less than the marginal product associated with the employment.

The calculation of internal rates of return is intended to explicitly allow for the difficulty and expense of entering a profession. The question of constancy of employment has already been referred to above and can be dealt with by making adjustments to reflect the probability of becoming unemployed in each profession. The remaining factors represent different reasons for expecting relative earnings and hence expected rates of return to vary between different careers.

Clearly for most people a professional career is more agreeable than a job as a dustman or coal miner. At first glance it might appear that all professional jobs are equally agreeable and that Smith's first circumstance is irrelevant when comparing different professions. On closer examination it is apparent that there may be important differences. For example, although doctors may be highly respected, many people would find various aspects of their job distasteful. Similar remarks apply to dentists. There may be other examples, although often these degenerate to differences in individual tastes rather than any clear absolute measure of "disagreeability".

As an example of his fourth point, Smith refers to the wages of goldsmiths and jewellers being relatively high on account of the precious materials with which they are entrusted. Doctors are entrusted with our health and lawyers on occasion with people's

lives and reputations. For both professions, incomes may therefore be expected to be higher as a result.

As an example of his fifth point, Smith quotes the counsellor at law who at the age of forty finally begins to receive a considerable income in recompense for not only his own but also the education and training of others who have failed to achieve the very highest levels of the profession. This consideration clearly applies to the results presented for advocates and barristers below.

Market imperfections

The final issue is that of market imperfections. This has various aspects. It may be argued, as was done in Chapter 3, that there are various non-pecuniary benefits associated with education and training that, because of market imperfections, will not be reflected in age earnings profiles associated with different professions. There is no reason to suppose that these will be equal for all professions. There is, however, little hope of quantifying such differences. More important in the present context is the possibility of monopolistic or monopsonistic influences on the setting of wages. Although from an individual viewpoint it is probably irrelevant if the private rate of return we calculate results in part from such imperfections, this is not the case for the social calculation. The meaning of social rates of return is dependent upon the assumption that earnings reflect marginal products. If this is not the case, such measures will be a misleading guide as to where further investment in human capital is desirable.

Ceteris paribus, if the cost of producing the last person who enters a profession differs from their earnings this is prima facie evidence of the existence of monopoly income or monopsony rent.

This does not necessarily imply a discrepancy between the social

marginal product of professional services and the wage rate. However, the existence of monopoly incomes implies costs in the form of misallocation of resources and an inequalitarian income distribution. Equally the exploitation of a position of monopsony power will result in similar serious costs in terms of misallocation of resources.

Considering the case of monopoly, a positive divergence between the wage and social marginal product implies an above average rate of return both from a private and social viewpoint. Note however that rates of return above average represent a necessary but not sufficient condition for the existence of monopoly income. Doctors, for example, may be drawn from a more able population than the average, so high incomes may reflect native ability as well as returns to education and training. It is therefore important to make certain that all other causes of variation in incomes are taken into account before attributing differences in rates of return to monopoly income.

A number of studies for the United States, such as those by Lindsay (1973 and 1975) have demonstrated that once costs of training and other factors are taken into account the very large differentials in favour of groups such as doctors are, in spite of intuitive feelings to the contrary, not excessive. Psacharopoulos (1975) in a review of the work on this subject, concludes that although the existence of monopoly incomes for groups such as doctors in the United States cannot be dismissed, the evidence from rate of return calculations, once costs of training and hours are taken into account, suggests these are not as important as a simplistic comparison of relative incomes suggests.

Siebert (1977) has argued that there is some evidence, both for the medical and legal profession in the UK, that entry is restricted through occupational licencing, and that members of these

professions receive monopoly rent. He supports this argument by presenting some estimates of rates of return which are high relative to other groups. No allowance is made for most of the factors mentioned here however. In the analysis of the results for these professions below we reconsider this question. A counter example is that of school teachers. Dahlby (1981) has argued that the labour market for school teachers in England and Wales exhibits many features of monopsony. This hypothesis is also examined in more detail below.

5.2 Rates of Return in Different Professions Compared

This section brings together a selection of the results from the detailed estimates presented in the next chapter. These have been chosen as far as possible to ensure comparability both over time and between different categories, bearing in mind the considerations outlined in the previous discussion. The outstanding feature of the results is the secular decline in estimated rates of return from an average value of around 17-18 per cent in 1955/56 to around 15 per cent in the mid sixties and to below 10 per cent by the mid seventies. Although some of the causes of this secular decline are touched upon in this chapter, its main objective is to draw together on a consistent basis the results presented in the following chapter. The reasons for the falling return have been discussed more fully in Chapter 4.

Before presenting the results for each of the main professional groups it is helpful to consider the way in which rates of return have changed over time for graduates in general. The results are based on three main sources and are summarised in Table 5.3. The estimate of 17.5 per cent obtained for 1955/56 is based on earnings profiles for all graduates in industry and is taken from a survey

Table 5.3 Average Private Rates of Return : Different Professions Compared^a

	Chemists	Physicians	Engineers	Architects ^{b,e}	Quantity Surveyors ^{b,e}	Consultants ^{b,c,d}	High Fliers ^{b,c,d}	Hospital Doctors ^{c,d}	Low Fliers ^{c,d}
	20.0	-	14.5	13.5	16.0	21.0	22.0	19.0	13.0
1955/56	20.0	-	-	-	-	-	-	-	-
1956/57	-	20.0	-	-	-	-	-	-	-
1957/58	-	-	-	-	-	-	-	-	-
1958/59	18.0	-	-	-	-	-	-	-	-
1959/60	-	-	17.0	-	-	-	-	-	-
1960/61	-	19.5	-	-	-	-	-	-	-
1961/62	16.5	-	-	-	-	-	-	-	-
1962/63	-	-	17.0	-	-	-	-	-	-
1963/64	-	-	-	-	-	-	-	-	-
1964/65	16.5	18.5	-	-	-	-	-	-	-
1965/66	-	-	14.5	-	-	-	-	-	-
1966/67	-	-	-	16.0	17.0	-	-	-	-
1967/68	14.5	15.5	14.5	17.5	-	-	-	-	-
1968/69	-	-	-	-	-	-	-	-	-
1969/70	-	-	-	-	-	15.5	16.0	14.5	10.5
1970/71	12.5	13.5	13.0	13.5	-	-	-	-	-
1971/72	-	-	-	13.0	15.0	-	-	-	-
1972/73	-	-	10.5	-	-	-	-	-	-
1973/74	9.0	10.0	-	11.5	-	-	-	-	-
1974/75	-	-	10.5	-	-	-	-	-	-
1975/76	-	-	-	9.0	-	-	-	-	-
1976/77	9.5	10.0	9.5	9.0	-	-	-	-	-
1977/78	-	-	-	9.0	-	-	-	-	-
1978/79	-	-	9.5	7.0	-	-	-	-	-
1979/80	9.0	10.0	-	6.5	-	-	-	-	-
1980/81	-	-	-	7.0	5.5	12.5	12.5	12.0	7.5

- Notes:
- (a) Three year course of study unless elsewhere specified.
 - (b) Adjusted for pensions and capital outlay for self-employed persons as appropriate.
 - (c) Adjusted for hours worked.
 - (d) Five year course.
 - (e) Four year courses.

Table 5.3 (continued)

per cent												
Year	CPs ^{a, d}		Solicitors ^b	Barristers ^b	Primary Teachers		Secondary Teachers		P.R. ^c	University		All Graduates
	CPs ^a	CPs ^d			Teachers	Teachers	Lecturers	Accountants				
1955/56	35.0	14.0	10.0	-	-	-	20.5	-	-	16.0	17.5	-
1956/57	-	-	-	-	-	-	-	-	-	-	-	-
1957/58	-	-	-	-	-	-	-	-	-	-	-	-
1958/59	-	-	-	-	-	-	-	-	-	-	-	-
1959/60	-	-	-	-	-	-	-	-	-	-	-	-
1960/61	-	-	-	-	-	-	-	-	-	-	-	-
1961/62	-	-	-	6.0	10.5	15.0	15.0	-	-	-	-	-
1962/63	-	-	-	-	-	-	-	-	-	-	-	-
1963/64	-	-	-	-	-	-	17.5	18.5	-	-	-	-
1964/65	-	-	-	-	-	-	-	-	-	-	-	-
1965/66	-	-	-	4.5	9.5	13.0	-	-	-	15.0	15.0	-
1966/67	-	-	-	-	-	-	-	-	21.0	-	-	-
1967/68	-	-	-	-	-	-	14.5	-	-	-	-	-
1968/69	-	-	-	-	-	-	-	20.5	19.5	-	-	-
1969/70	24.5	-	-	4.0	8.0	11.0	-	22.5	-	-	-	-
1970/71	-	-	-	-	-	-	13.0	-	22.0	-	12.5	-
1971/72	-	-	-	-	-	-	-	-	-	16.0	11.0	-
1972/73	-	-	-	0.5	4.5	6.5	12.0	19.0	-	-	10.0	-
1973/74	-	-	-	-	-	-	-	-	-	-	10.0	-
1974/75	-	-	-	-	-	-	-	16.5	-	-	10.0	-
1975/76	-	-	-	4.0	6.0	8.0	11.0	-	-	-	8.5	-
1976/77	-	11.5	10.0	-	-	-	-	-	-	-	8.5	-
1977/78	-	-	-	-	-	-	-	-	12.0	-	7.5	-
1978/79	-	-	-	1.0	3.0	5.5	10.5	-	-	-	9.0	-
1979/80	-	-	-	-	-	-	-	16.0	-	-	9.0	-
1980/81	17.5	-	-	(-ve)	1.5	4.0	-	-	-	13.5	-	-

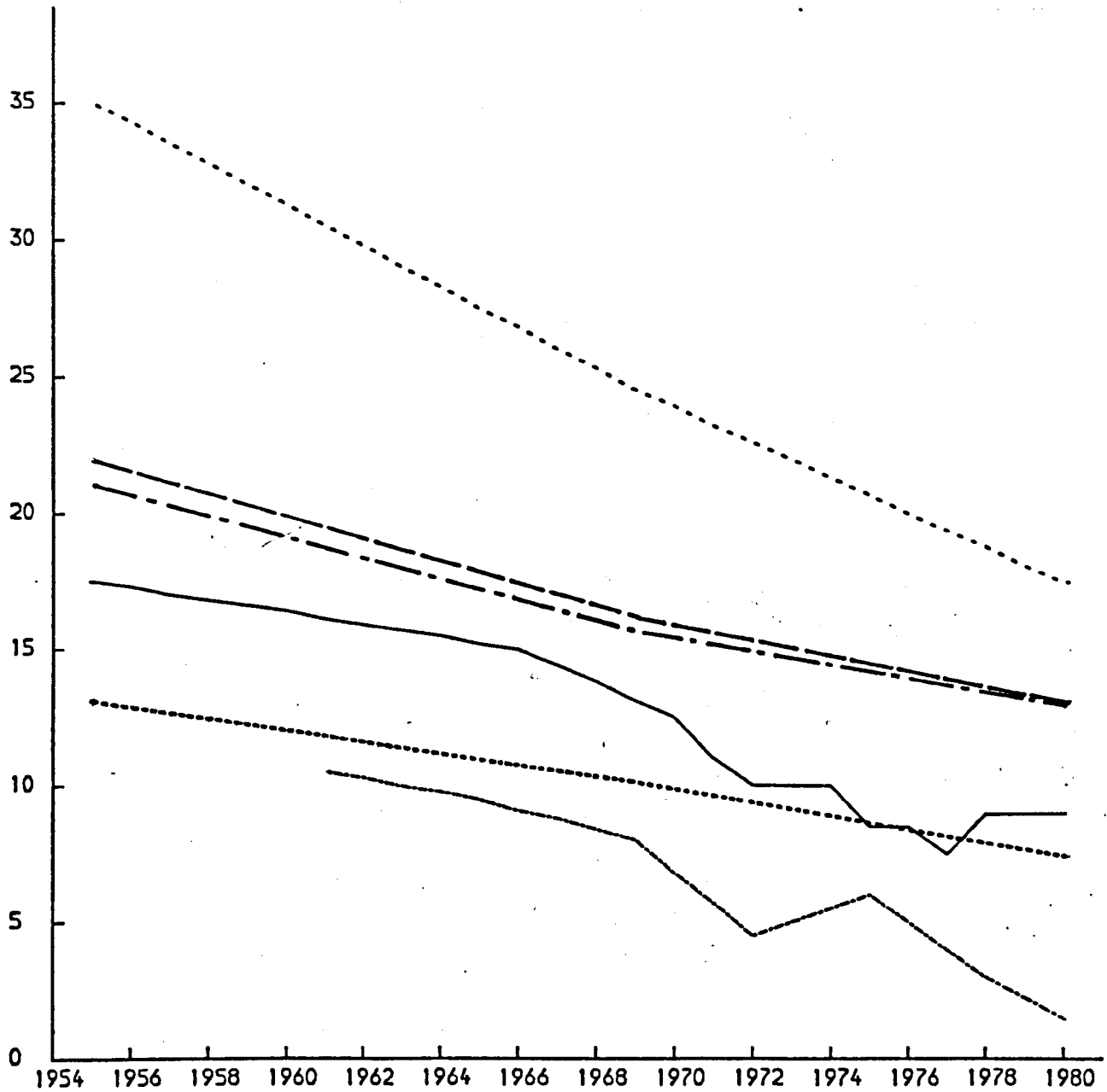
undertaken by the Royal Commission on Doctor's and Dentist's Remuneration (1960). Although not directly comparable with the more comprehensive data based on the Census of Population and General Household Surveys used for later years, this result provides a useful comparison with estimates for other groups in 1955/56. By 1966/67 the estimated return for all graduates was 15 per cent. A fairly steady fall is then apparent to a value of 7.5 per cent by 1977/78 before a recovery to 9 per cent at the end of the 1970s.

These results provide a yardstick against which to compare the estimates for other professions to which we now turn. The results considered in this chapter are limited to a few basic estimates for each professional group. More detailed analysis is provided in the next chapter. These selected estimates of the average private rate of return for various professional groups between 1955/56 and 1980/81 are summarised in Table 5.3 and in Figures 5.1 to 5.5.

Medical Professions

In Figure 5.1 rates of return for medical professions are compared with graduates as a whole and with secondary school teachers. The average private return for medical professions, even after making necessary adjustments for self-employment income and hours, were generally well above average in 1955/56. General Medical Practitioners (GMPs) and Consultants achieved rates of return about 3.5 or 4.5 per centage points above that for all graduates. This differential was maintained up to the late 1960s. Since then rates of return have continued to decline more or less in line with those for graduates as a whole. The differential by the late 1970s appears to have narrowed slightly to around 3 to 3.5 percentage points.

Figure 5.1 Rates of Return for Medical Professions, 1955-1980



Key:

- General medical practitioners
- Hospital doctors (low fliers)
- . - . - . Consultants
- General dental practitioners
- _____ All graduates
- . . - . . Secondary teachers (1961-1980 only)

Note: For details of estimates see notes to Table 5.3.

For General Dental Practitioners (GDPs) the differential in 1955/56 was considerably wider, in fact an enormous 17.5 percentage points. By the late 1960s this differential had been eroded to around 11 percentage points and by the late 1970s to about 8. Nevertheless this is still a considerable difference and provides at least tentative evidence of some exertion of monopoly power as suggested by Siebert (1977).

Siebert's results did not include an adjustment for hours worked. The size of the necessary adjustment to earnings is subject to a great deal of uncertainty as noted in Chapter 8. In the case of junior hospital doctors an adjustment to exclude the effect of extra income earned by working outside the normal 40 hour week (which adds 33 per cent to income) reduces rates of return by about 4 percentage points in 1980/81. Without the adjustments for hours the decline in rates of return for doctors would therefore be much less marked. This is because the average hours for groups other than doctors have declined quite rapidly whereas those of doctors have not. For GMPs, Consultants and 'high fliers' amongst hospital doctors, returns of around 14.5 per cent would be obtained for 1980/81 while the estimates for 1955/56 would be virtually unaltered without adjustments for hours. (See Section 6.2 for full details).

The return for hospital doctors ('low fliers'), once adjustment is made for their long hours of work, was some 4.5 percentage points below the average for all graduates in 1955/56. By 1969/70 this differential appears to have narrowed slightly and by the late seventies/early eighties it was reduced to around 1.5 percentage points.

The overall picture for medical professions therefore is of a decline in estimated rates of return, over the period 1955/56-

1980/81, very much in line with the average for all graduates. For GPs the decline has probably been even faster but they began with a much higher return and still maintain a substantial positive differential at the end of the period considered. All the medical professions considered experienced rates of return considerably larger than those for secondary school teachers.

The fact that, even after appropriate adjustments for training costs, hours of work and capital outlays, a significant differential in rates of return compared with most other professions still exists, cannot be taken by itself as evidence of the exertion of monopolistic power by the British Medical Association (BMA). There are various other compensating factors that have so far not been taken into account.

The inherent unpleasantness of various aspects of their work may justify higher earnings for doctors and dentists in many people's eyes. Undoubtedly there is a great deal of job satisfaction connected with the practice of medicine but there are also many very unpleasant tasks that necessarily go in tandem with the more rewarding parts.

Another factor that has not been fully taken into account is the stress and strain connected with the very heavy workload of many doctors. Although adjustments have been made to take account of the direct effect that working long hours has on incomes it is much more difficult to assess the physical and mental strain imposed by average periods on duty of over 80 hours per week which is the rule for junior doctors. A recent article in the Guardian (June 1983) demonstrates that suicides are much more common amongst doctors than any other profession. As well as long hours, doctors (especially GPs) may face a great deal of disruption to their home life from out of hours calls and (for doctors in general) night

work. These are obviously only very crude indicators but do demonstrate the potential importance of considering aspects of different professions which are very difficult to quantify.

A further factor that may explain higher relative incomes (and hence rates of return) is that doctors appear to be drawn from a pool of individuals who are on average more able than is the case for most other professions (see Chapter 8). On average, the 'A' level scores of those students entering medical schools are around 12.5 for medicine compared with 9.5 for all disciplines (DE, 1980, Table 3). Consequently, the return to entering the medical profession must be regarded, in part at least, as representing a return to above average ability. Related issues are that doctors are entrusted with lives which, following Smith's argument regarding greater trust required, implies a justification for higher incomes. The fact that an error by a doctor can very easily and directly result in loss of life has generally been accepted as justifying stringent regulations on the right to practise medicine and thereby to ensure minimum levels of ability. For similar reasons a relatively lengthy period of education and training is regarded as a necessary prerequisite to entry to the profession.

An above average rate of return may be necessary to compensate for the long period that must elapse before any financial returns accrue to a prospective entrant to the medical profession. Although we can directly account for the purely financial costs of the extra income foregone in undertaking a 5 or 6 year course of training as opposed to a 3 year one, they represent quite different investments. The individual faced by a choice between two careers with equal returns associated with them will make his choice (the financial element at least) in the light of how risk averse he is. Ceteris paribus the more risk averse individual will prefer a more immediate

return, i.e. a shorter course of study. A higher rate of return may therefore be necessary to persuade people to undertake the longer investment (for further discussion see Chapter 8).

In practice, it is very difficult to distinguish between restriction of entry for monopolistic gain and regulation of entry for the sake of public safety. The extent to which it is necessary to attract the most able students and to train them for such a long period of time is largely a matter of judgement. One of the difficulties is that, in many respects, it is the medical profession who are the best placed to make these kind of judgements. Unfortunately, it is clear that they also have a vested interest in the outcome. As noted above, Siebert (1977) attempts to devise tests to discriminate between the regulation and restricted entry hypotheses. He finds opposition to re-licensure (i.e. to imposing higher standards on existing doctors as well as on new entrants), in addition to nepotism in selection of entrants to medical schools, both of which suggest some use of licensing rules to pursue sectional interests.

He also presents evidence on rates of return in support of his argument which, given that he did not make many of the adjustments undertaken here, cannot be regarded as proving his case however. His results show that equating the present values of earnings for those in General Medical Practice with those of all first degree holders results in an internal rate of return of 12 per cent (after adjustment for taxation). It seems to the present author more useful to compute comparable rates of return for each profession using as a benchmark the earnings of all workers in the economy (as a proxy for the income foregone). Siebert's results are not adjusted for hours or capital outlays both of which significantly

affect incomes. He also fails to take into account any of the other factors mentioned above - the question of trust; the ability of the average member of the profession; the degree of unpleasantness associated with being a doctor or dentist; and, finally, the large absolute size of the investment of time and income foregone required to enter the medical profession compared with other occupations, all of which are extremely difficult to quantify. Our results suggest that once account is taken of the various non-wage compensatory factors, rate of return estimates can no longer provide clear-cut evidence of the existence of monopoly rents. Unless it can be clearly demonstrated that compensating factors such as those discussed here may not reasonably be held to justify the size of the remaining differentials in rates of return over and above the return to obtaining a first degree in general, then such differentials cannot be cited as unequivocal evidence of the existence of monopoly rents.

Reasons for declining returns to entering the medical profession

The observed secular decline in rates of return for medical professions is common to most professional occupations. In the discussion in Chapter 4 we argued the case for regarding this phenomena as reflecting shifts in the broad balance of supply and demand. To what extent can this explanation be applied to the case of medical professions? We have noted in Chapter 4 that although medical professions have increased both the absolute size and their relative share of employment this growth has been much less marked than for say the teaching professions and indeed much slower than for employment in health services in general. The flow of newly qualified entrants into the medical profession has also risen less rapidly than the flow of first degree graduates as a whole (see Figure 4.7).

In common with teaching professions we face the problem that the output produced by the medical professions is very difficult to measure. This difficulty is exacerbated within a predominantly publicly run health service, since no measures of market valuation of physicians' services are available. It is therefore not possible to obtain a clear notion of the economic concept of 'demand' for doctors and dentists. As noted in the discussion of teachers below, the notional staffing levels that might be regarded as desirable by administrators may not be achievable in practice, given average pay levels and an independently fixed budget constraint.

There have over the years been a series of official commissions and committees intended to monitor the situation. Throughout the post-war period the BMA has (not surprisingly) been consistently concerned with the possibility of over supply of doctors and the consequent risk that this might drive down the relative pay of the medical profession. (Although in putting forward its case the BMA has always emphasised the problem of doctors finding jobs rather than the pay question).

During the immediate post-war period there was a 'flood of applications' to enter the profession (RCDDR, 1960, p.52). Indeed, throughout the period the number of applicants for places in medical schools has far outweighed the number accepted. In 1975, for example, UCCA statistics show that only a quarter of those applying obtained places in medical subjects. This compared with over a half for all disciplines and 80-90 per cent for pure sciences. Places have been rationed by imposing very high entry standards, with the average 'A' level score of those accepted for medical sciences significantly above that for all disciplines (12.5 compared with 9.5).

Despite this, the general view of the BMA was that in the early 1950s there was a surplus of doctors who were having problems in finding jobs. An interdepartmental committee, set up to examine the problem, concluded that while there was no evidence of over-supply in the past, there was a danger of this occurring in the future. Consequently it recommended a reduction in the intake to medical schools (Willink, 1957). In practice, the committee's projections were soon shown to be in error and consequently the government recommended all medical schools to increase their intake in order to meet the additional demands created by the expansion of the NHS and by demographic factors. A further Royal Commission chaired by Lord Todd (1968) reported that substantial increases in numbers were required and recommended the doubling of intake to medical schools over the next 20 years. Immediate shortages during the 1960s and 1970s were met by immigration and reductions of target doctor population ratios. More recently entry requirements have been tightened which has reduced the importance of this supplement to domestic supply. The recent DHSS green paper, 'Medical Manpower: the next twenty years' concluded that "Since the inception of the Health Service in 1948 there has never been a stage when the supply of UK trained doctors has exceeded the overall demand." Overall, the situation can therefore be characterised as one of demand increasing steadily and probably outpacing supply. The BMA has had a vested interest in restricting supply and has tended to consistently underestimate the growth in demand. Administrators planning for the future and recognising the large training investment involved have also tended to underestimate the growth in requirements, the risk of overprovision, and the immediately obvious costs thereof, outweighing the less quantifiable costs of underprovision. In addition, the RBDDR which was set up to examine the

appropriate level of pay in medical professions has probably acted in a paternalistic manner with regard to its 'charges' as noted by Clegg (1980). However, there is other evidence that suggests that such commissions/bodies may have the opposite effect. For example, the Pilkington Commission RCDDR (1960) in its final recommendation stated that although it was generally recognised that shortages existed, it was inappropriate to raise relative earnings on this account as the capacity of the educational system to provide newly qualified entrants was (at least in the short run) fixed.

The relative earnings of medical professions have declined less over the period 1955-1980 than for graduates in general and so although rates of return have fallen they have done so less rapidly especially during the 1970s. As noted in Chapter 4, the obverse of the explosion of numbers participating in higher education has been the consequent shortage of young people entering the labour market at the minimum school leaving age. This, together with other institutional changes, has forced up the earnings foregone by all students whatever their discipline. Together with other factors described in Chapter 4, this has meant that the C_t profile has risen relative to the B_t profile for all professions over the long term, and consequently estimated rates of return have declined. For medical professions buoyant demand plus tight control of the numbers of new entrants has therefore resulted in a relatively modest fall in rates of return compared with many other groups.

Whether this constraint on new supply represents restriction or regulation remains a moot point. The results presented here and in Chapter 6 show that once proper allowance is made for length of education and training, hours worked and capital outlay, the differences in rates of return compared with other professions

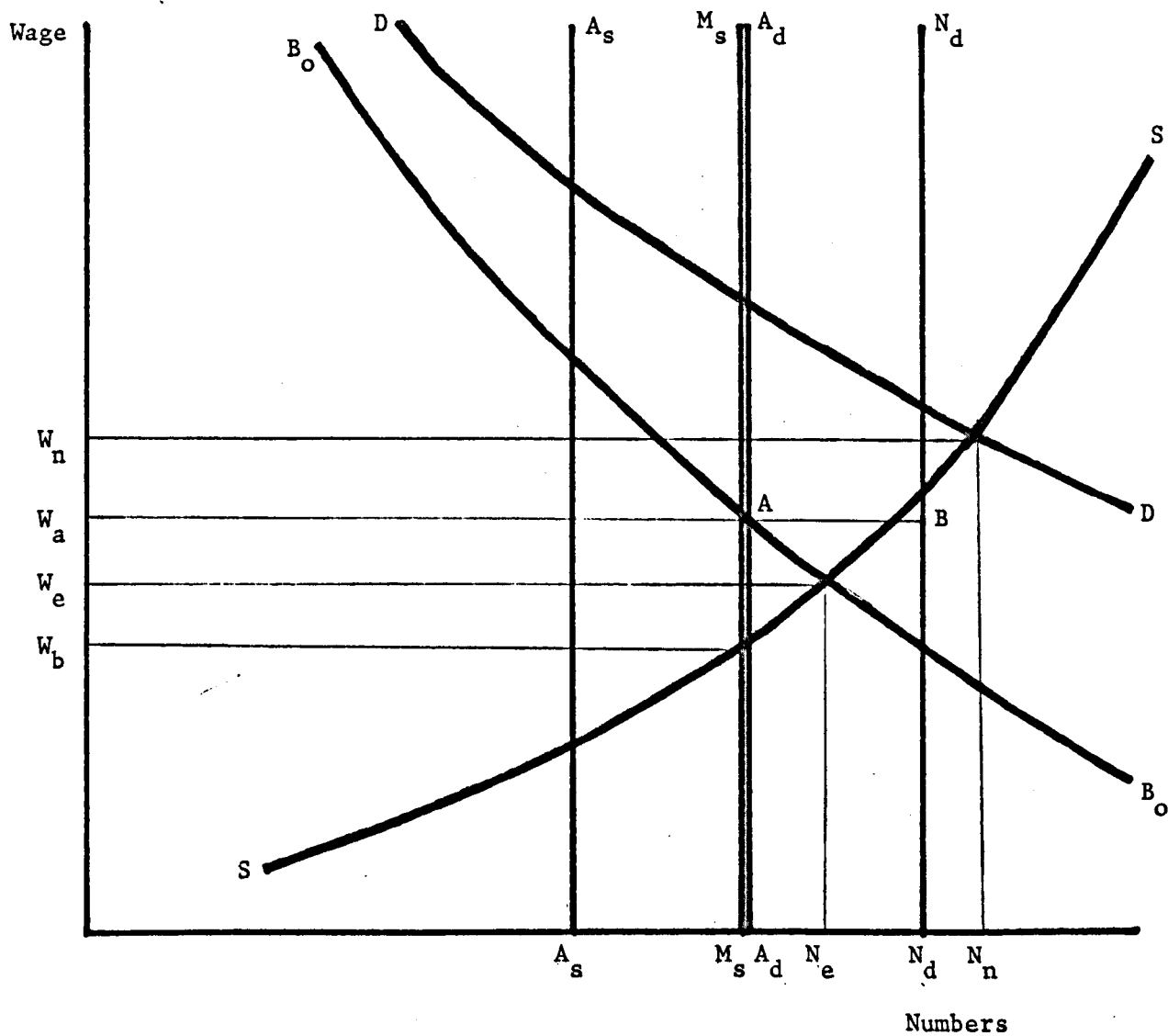
are significantly reduced. The other non-wage compensatory factors discussed above go in the right direction but whether they are sufficient to justify the remaining differences is unclear. A significant part of the difference may be attributable to ability. Even if this is the case, however, the question of whether such tight restrictions on the entry to medical studies, based on such criterion as 'A' level scores, is in the public interest remains. The demand for medical care is, in aggregate, highly income elastic. The 'need' for medical services is therefore probably well in excess of the actual level of provision. This implies that given the public finance, the number of doctors could be increased very substantially before there would be a surplus in the sense of numbers in 'excess of social needs'. Undoubtedly, given the number of applications to medical schools this could be achieved with expansion of provision of places albeit with some reduction in the average level of ability as measured by 'A' level scores.⁽³⁾

This can be illustrated using the classic supply-demand diagram as in Figure 5.2. Conventional supply and demand schedules can be represented by curves such as SS and DD respectively. In a labour market such as that for medical staff where the level of supply is constrained by the capacity of the medical schools (and applications far exceed the number of places available), and where the level of demand is fixed by reference to general measures of need such as the doctor population ratio, neither demand or supply schedule will in practice respond to changes in wages. The latter are fixed by a process of bargaining between employers and

(3) Note that 'A' level scores provide only a crude measure of ability. There is also considerable evidence that they correlate very poorly with the outcome in terms of final degree results.

Figure 5.2

Concepts of Supply and Demand in the
Labour Market for Medical Professions



Source: Developed from a similar diagram dealing with the labour market for teachers in Zabalza et al. (1979).

employees under the auspices of the official review body, and reflect the overall budget constraint faced by the employers.

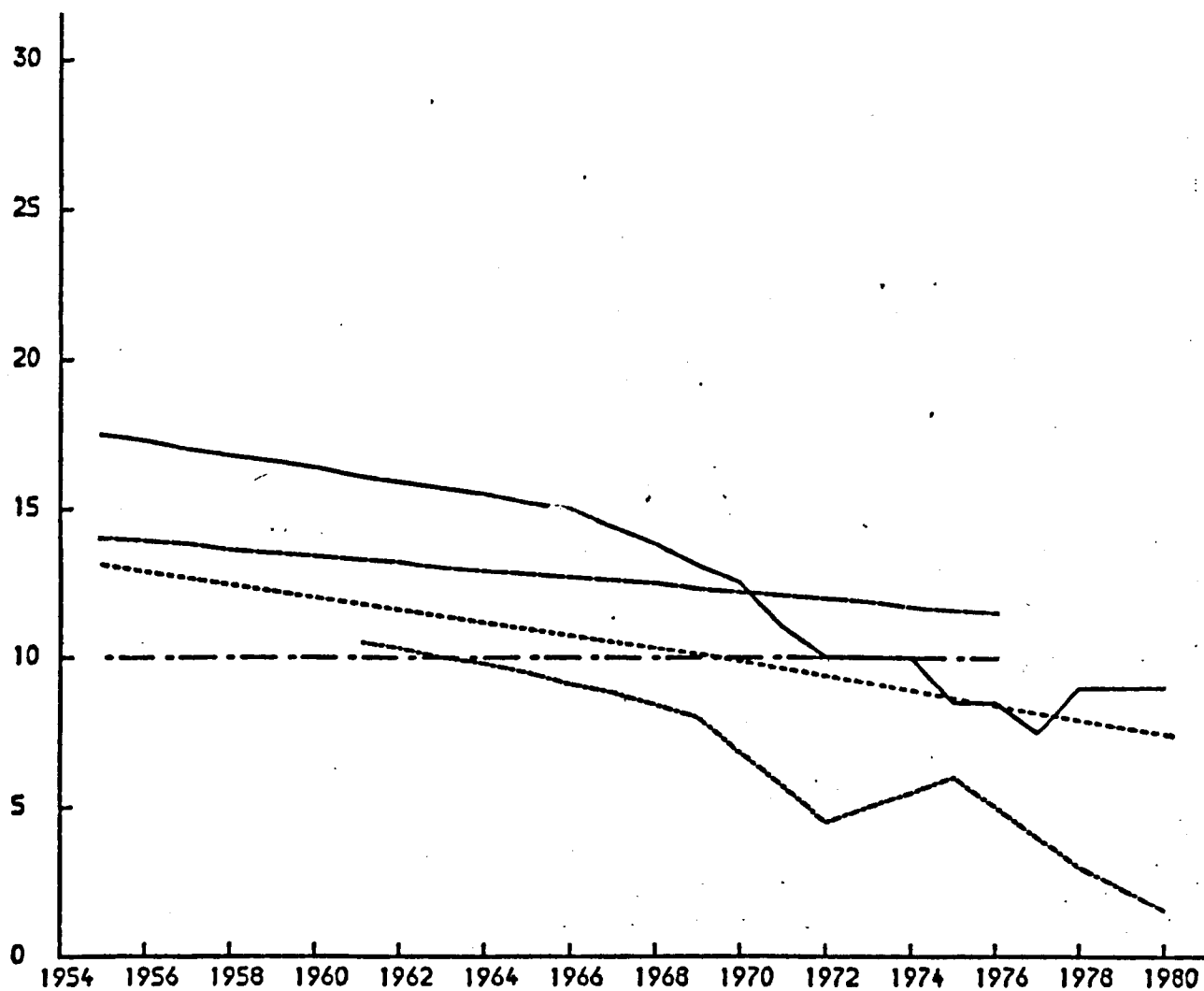
The actual supply and demand schedules can therefore best be represented by the vertical lines As and Ad. Total supply may be supplemented by net immigration giving the curve MS while the notional level of need can be represented by a further vertical line Nd. The budget constraint is represented by the iso-budget curve BoBo. Administrators attempt to ensure that the budget constraint is just exhausted at the administratively fixed wage W_a when Ad and Ms coincide. At this wage there is an administrative shortage, represented by AB, between number available and those desired based on needs (Nd). Also at this wage it is clear from information on applications to medical schools etc. that the unrestricted supply curve (SS) lies to the right of the point A. If the iso-budget curve accurately represented society's derived demand curve for medical practitioners then the equilibrium wage would lie below W_a (at W_e) and the equilibrium number of doctors would be say N_e . We therefore have a situation of restricted supply reducing numbers below desired levels and raising wages above equilibrium levels. Maintaining the same policies on numbers, the NHS could in fact reduce its budget by reducing the average wage to W_b . If the BoBo curve exaggerates society's demand, the equilibrium wage would be even lower. Conversely if the NHS is failing to reflect society's demand (e.g. if the true demand schedule were DD) then both the equilibrium wage and employment levels may be higher than under the present system.

Legal Professions

Returns for legal professions (after adjustment to self-employment incomes) are compared with other professions in Figure 5.3. The results for the early period 1955/56 are immediately striking, the returns for both solicitors and barristers being well below average, particularly for the latter. By 1976/77 returns had fallen for solicitors from 14 to 11.5 per cent but for barristers remained unchanged at 10 per cent. This compares with the fall of 9 percentage points for all graduates over the same period. The result of this stability is that by 1976/77 the return to entering the legal profession was above average, (11.5 per cent for solicitors) compared with 8.5 per cent for graduates as a whole.

As for medical professions, the data reported in Table 4.5 shows that legal professions increased their share of employment between 1951 and 1980 but at a slower rate than other professional groups. The RCLS (1979) presented a considerable amount of information on the relatively recent expansion of the numbers of solicitors and barristers. Between 1960 and 1978 the number of barristers in private practice rose by 122 per cent while the number of solicitors with practising certificates increased by 76 per cent (RCLS, 1979, Annx 2.3). This reflected the large flows of new entrants noted in Chapter 4. Measures of demand are more difficult to assemble, but the RCLS presented data to show that (especially during the 1960s) there was a substantial increase in the number of court proceedings, particularly of criminal cases. In addition, there has been an increasing tendency for lawyers to be employed in industry and commerce reflecting the increasing complexities of business life. The main growth in supply took place in the period after 1969 so that the period of the 1960s can probably be characterised as one of excess demand followed in the 1970s by a

Figure 5.3 Rates of Return for Legal Professions, 1955-1980



Key:

- All solicitors
- All barristers
- All graduates
- - - - - Secondary teachers (1961-1980 only)
- Hospital doctors (low fliers)

Notes: For details of estimates see notes to Table 5.3

situation when supply has gradually responded leading perhaps to a reversal of the overall balance.

Regrettably there is insufficient information to compute general measures of returns to the legal profession for years in between 1955/56 and 1976/77. Nevertheless, the partial information available (see Chapter 6) suggests that returns probably rose between the mid 1950s and the mid 1960s before falling over the next decade. The recent expansion of supply may well have made some contribution to this fall but the evidence is far too weak for firm conclusions.

Siebert (1977) has argued that, like the medical profession, the legal profession has, over the years, developed various restrictions on entry to maintain relative earnings and hence rates of return at high levels. Our results do not support this thesis. In common with Mulvey's (1980) analysis for Scotland they suggest that once training costs and foregone income are fully accounted for (as well as some of the less obvious costs connected with being self-employed) then returns are not excessive. Furthermore, the detailed analysis in Chapter 6 suggests that lawyers employed in industry achieve equally high returns. This suggests that market forces are responsible for the high earnings achieved by lawyers in general and that this reflects the costs of training to become a member of that profession and the overall balance of supply and demand. This conclusion is reinforced by the fact that the estimated returns for 1955/56 were in fact well below the average value obtained for other professions.

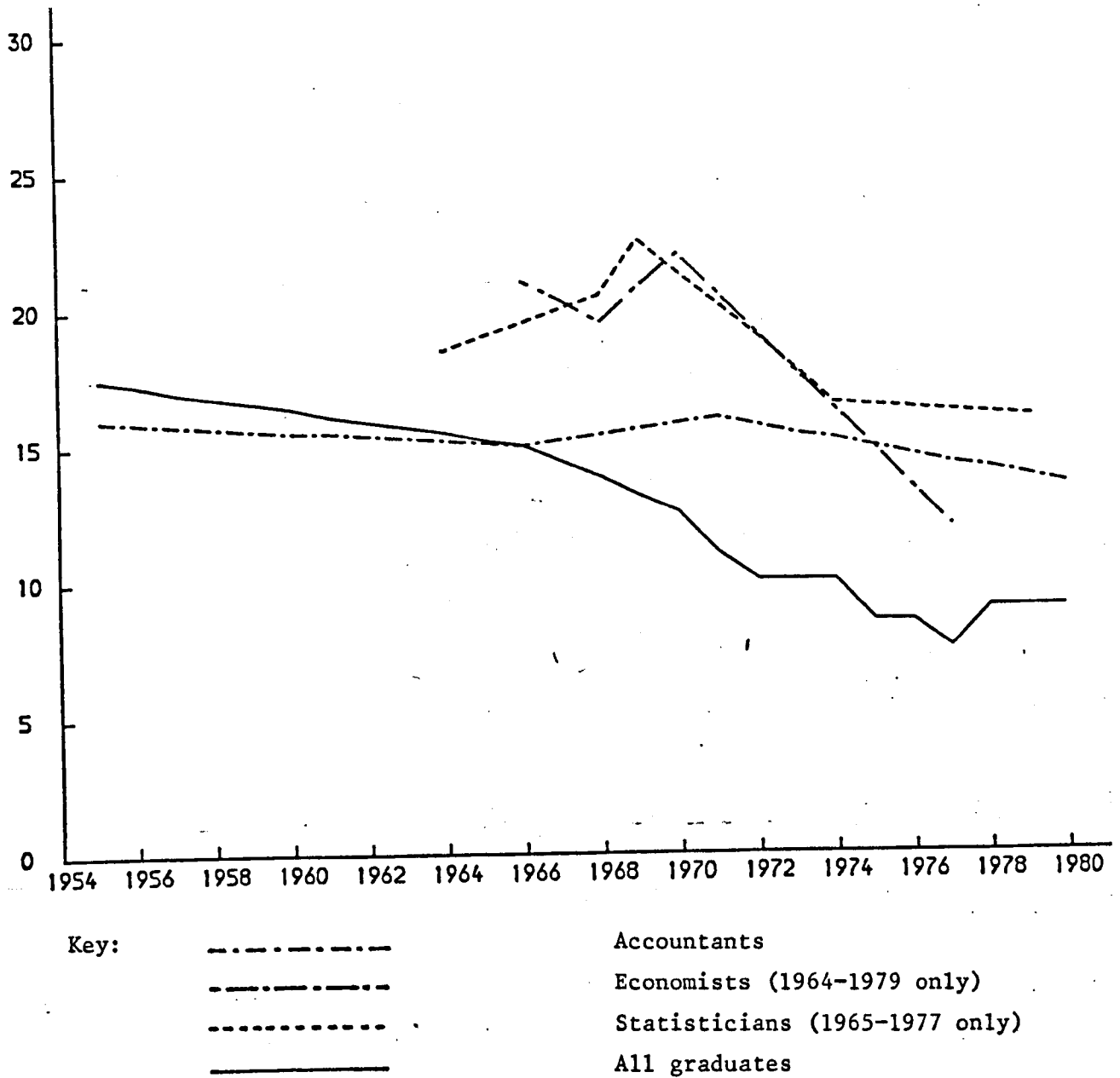
A case could probably be made that demand, presently and for some time, has exceeded supply (or at least kept pace with it). The growing complexity of commercial life has meant an increasing demand for legal services. In the past two decades legal services have been one of the areas of most rapid expansion of employment.

Given the absence of any clear-cut evidence on the existence of unreasonable barriers to entry it therefore seems more likely that the situation represents what Arrow and Capron (1959) have called a dynamic shortage rather than one of exploitation of monopolistic power. Undoubtedly there are restrictions on entry of the kind associated with examinations and general ability requirements, but most people would probably agree that, as for medical professions, such limits are in the public interest. Again however, as for medical professions the precise position of the dividing line between appropriate regulation and unfair restriction is difficult to assess. A considerable portion of legal incomes accrue from relatively routine matters connected with conveyancing. There are undoubtedly a number of obstacles placed in the way of persons other than lawyers who attempt to carry out such work, although there is not a strict monopoly. Our results do not however suggest that, for the period we have covered, the earnings of lawyers are excessive, once allowance is made for costs of training and for some of the less obvious costs associated with being self-employed.

Business Professions

The estimates for business professions are summarised in Figure 5.4. It is clear that, for most of the period considered, returns for this group have been well in excess of those for graduates as a whole. Economists experienced rising returns in the late 1960s before reaching a peak of 22 per cent in 1969/70. There was then a decline to 15 per cent by 1974/75 with a recovery to 16.5 per cent in 1979/80. Returns for statisticians were also very high in the late 1960s at around 20 per cent, falling to

Figure 5.4 Rates of Return for Business Professions, 1955-1980



Notes: For details of estimates see notes for Table 5.3.

12 per cent in the late 1970s. In contrast, the estimates for accountants show little variation over time around an average value of about 15 per cent.

There are no obvious non-wage compensatory factors that might explain the relatively high returns for certain occupations within this group such as economists. The main explanation for these differentials and for the observed changes over time seems to lie in broad changes in the balance of supply and demand. Booth and Coats (1978) note that throughout the post-war period there has been a sustained high level of demand for economists and the like. Between 1954/55 and 1962/63 the annual number of first degrees awarded in economics increased by 150 per cent. Between 1962/63 and 1974/75 the annual output of first degree graduates in this discipline rose by a further 200 per cent. At the same time, however, demand for economists was rising even more rapidly especially in government and business. (Booth and Coats op cit. p.445). This expansion of demand was most notable during the 1960s when returns for both economists and accountants rose. Since then demand has probably been sustained by the growing demand for business services of all kinds which would explain why returns have fallen less sharply for these professions than for graduates in general.

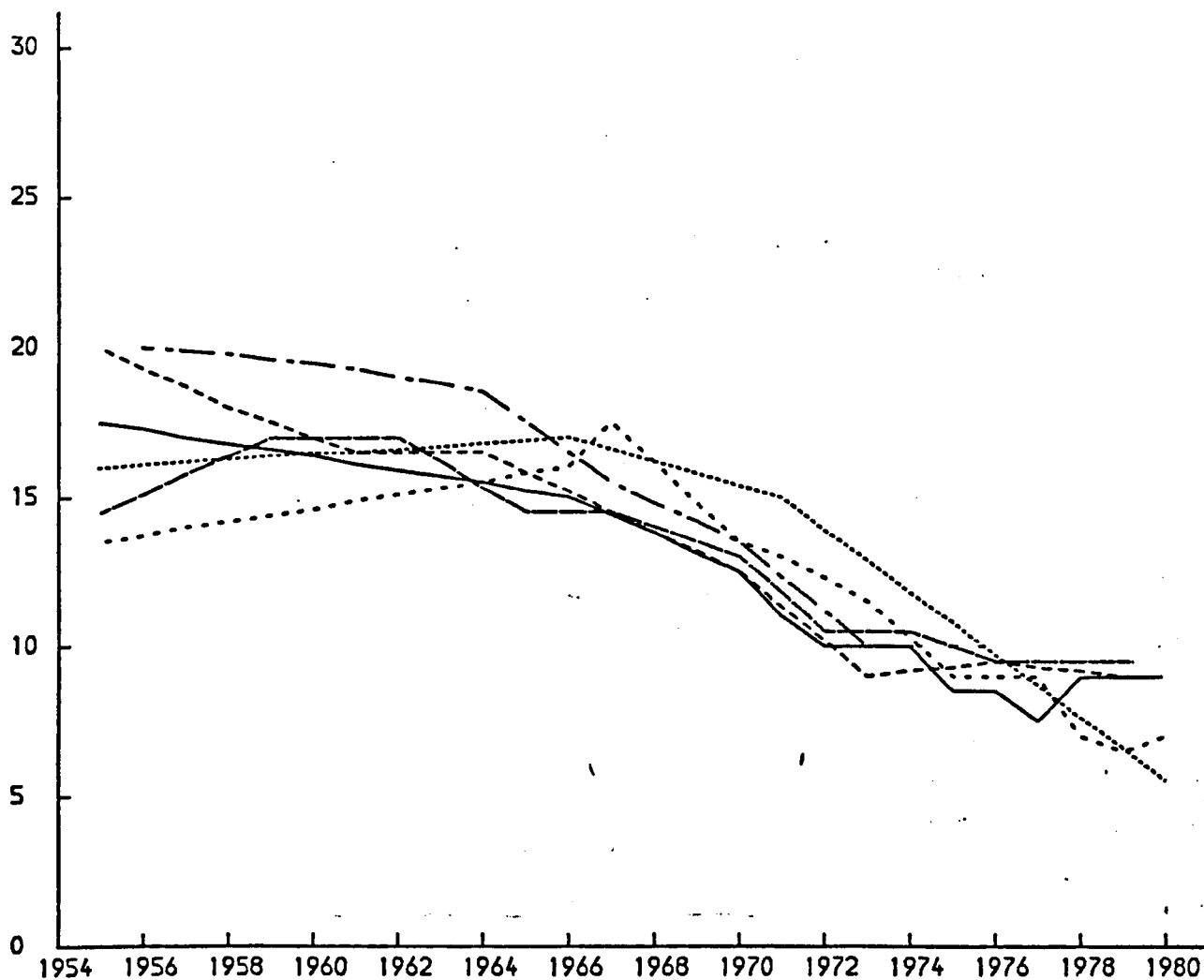
The results for accountants make an interesting comparison with those for legal professions. The higher overall level for the former largely reflects the assumption of just a 3 year degree course as the typical entry requirement, compared with 4 years plus articles etc. for the legal professions. The estimates for accountants do not include any allowances for costs of training other than obtaining a first degree and this may bias them upwards compared with other groups. The stability over time in returns for

both groups suggests that although, compared with other professions, they were relatively poorly paid in the 1950s they have been able to improve their relative position over time. Also, as for legal professions, it is difficult to attribute the differential in rates of return for accountants to restrictions on entry. The much higher returns observed for economists, for whom the only entry requirement is an appropriate first degree, suggests that it would be unreasonable to regard the relatively high returns for accountants during the 1970s as the result of the existence of monopoly rents. Furthermore, it would be impossible to explain the relatively low returns during the 1950s in these terms. A more plausible explanation is that the high returns are a reflection of the expansion in demand for business services in the face of the growing complexities of the legal and economic system.

Scientists, Engineers etc.

The estimates of rates of return for scientists and engineers have been presented in detail in Chapter 2. The discussion here is therefore confined to providing an explanation for the changes observed over time and comparing the results for these professions with other groups including architects and surveyors. A glance at Figure 5.5 shows that in 1955/56 there was a considerable variation in rates of return for these professions centred around the average value of 17.5 per cent obtained for all graduates. Chemists and physicists were well above average while engineers and architects were well below. Up to the mid 1960s the main feature of the results was the 'regression' towards the mean value but from then onwards the returns for all categories fell sharply in line with those for graduates as a whole. By the 1970s returns for physicists, chemists and engineers were within one or two percentage points of

Figure 5.5 Rates of Return for Scientists, Engineers, etc., 1955-1980



Key:

-----	Chemists
- - - - -	Physicists
—————	Engineers
.....	Architects
— · — · —	Quantity surveyors
—————	All graduates

Note: For details of estimates see notes to Table 5.3.

the estimate of about 9 per cent obtained for graduates as a whole. The position for architects and quantity surveyors was one of a much more precipitous decline, from around 17-18 per cent in 1966/67 to about 7 per cent by the end of the 1970s.

To begin to provide an answer to the question of why rates of return have declined for scientists and engineers it is useful to disentangle the changes over time in the various components of the age earnings profiles that form the basis for our estimates. This was done in Chapter 4. The results presented there show that the main factors responsible for the decline are the decline in the starting salaries of qualified persons compared with the earnings of young people who leave school without taking 'A' levels and to a lesser extent the decline in the earnings of qualified people in general compared with the earnings of the workforce as a whole.

As for some of the other groups already discussed, the main factor influencing this decline appears to be the dramatic expansion of the output from the higher educational system during the 1960s and early 1970s. Bosworth and Wilson (1980) have argued that the very substantial growth in total supply of qualified scientists and engineers has at least kept pace with demand over this period and indeed most of the evidence suggests it has led to a growing surplus especially for scientists and architects. For example, the data collected together and discussed in Chapter 4 suggests that the number of jobs in the occupational categories scientists, engineers or architects have grown much less rapidly than professional jobs in general and much less rapidly than the increase in the total stock of those persons qualified at degree level in science and technology resulting from the influx of new entrants.

According to figures published by the DTI (1977), the total stock of qualified scientists and engineers increased from 255 thousand in 1959 to 437 thousand in 1970. By 1976 it had risen to an estimated 585 thousand. This more than doubling of the total stock was primarily the result of a very large inflow of newly qualified persons. Given such increases in supply, it is to be expected that relative earnings and hence rates of return would decline unless demand has kept pace with this increase. The evidence suggests (IMS, 1975) that although there has been an increasing tendency for firms to employ graduates of all disciplines in jobs previously done by non-graduates they have had difficulty keeping pace with supply. The results of the study by Bosworth and Wilson (1980) also suggest that the demand for such manpower (as measured using simple labour demand functions) has failed to keep pace with supply over this period (especially for scientists) and indeed that the gap is likely to increase over the next 10 years. Between 1961 and 1979 the total stock of qualified scientists and engineers rose by about 76 per cent while over the same period the number of jobs in scientific or engineering occupations requiring a degree increased by just 60 per cent. Therefore a widening gap appears to have emerged over this period resulting in an increasing number of graduates being employed in tasks not directly requiring the precise qualifications they have obtained (both in terms of the discipline and level of qualification). Their results suggest that although 'localised' shortages may occur for particular qualifications or very able persons, the general picture in this labour market is one of increasing excess supply.

This contrasts with the widely held view that we need to increase the supply of engineers in particular. The Finniston Report (1980) advocates a substantial increase in the private incentive to undertake engineering courses in order to increase

the number of new entrants. By carrying out a simulation exercise we can obtain a rough idea of the size of increases in starting salaries or additional increments to the grant necessary to restore rates of return to their 1967/68 levels. As a rough rule of thumb this would involve a 250 per cent increase in student grants, a 100 per cent rise in starting salaries, or an average increase of 25 per cent in the earnings of qualified scientists or engineers of all ages. Against this background the £500 bonus for engineering students suggested by Finniston (amounting to less than 50 per cent of the basic student grant in 1979/80) looks rather modest.

However, given the estimates of social rates of return of around 5 per cent (see Chapter 3) the case for such a policy appears to be rather weak. Only if there are substantial external benefits to society of producing more engineers or if for some reason the market wage for this group seriously under-estimates their value to society could such a policy be wholeheartedly recommended. This conclusion is reinforced by the fact that we are dealing here with the average rate of return rather than returns to ^{the} marginal student which are almost certainly smaller. The Finniston Committee took the view that there are substantial external social benefits to be obtained by expanding the supply of well qualified engineers. However, the evidence in support of this position remains tentative. On the other hand, one may have some sympathy for the view that Britain's investment in R & D is both too small and misallocated. It has however been argued elsewhere (Bosworth and Wilson (1981)) that it will only be worthwhile taking measures to increase the supply of qualified scientists or engineers if policy measures are also introduced to increase demand, for example by increasing support for R & D expenditure.

The position in the late 1960s and early 1970s contrasts quite sharply with that observed during the 1950s and early 1960s. It is notable that in the period from 1955/56 to 1962/63 the most rapid expansion of graduates occurred in scientific disciplines, while in the 1960s applied sciences, especially engineering, were one of the fastest areas of growth in graduate output (see Figure 4.8 in Chapter 4). Given the evidence reported in Bosworth and Wilson (1980) and elsewhere that decisions to enter courses of education and training respond to relative economic rewards, these changes are not surprising in view of the very high returns for pure sciences at the start of our period (1955/56) and for applied sciences in the early 1960s. These high returns may well have been indicative of shortages at these times. As supply responded to the market signals and caught up with, and in general outpaced, demand one would expect relative earnings, and hence rates of return, to fall and this indeed is what we observe during the period from mid 1960s to the 1970s. During the late 1970s returns stabilized. Again this can be given a supply/demand interpretation. On the one hand the numbers of new entrants was slowing substantially (see Chapter 4) while on the other hand there was some evidence of growing demand for engineers in particular.

The rather special experience of architects and quantity surveyors can probably also be interpreted as reflecting broad movements in supply and demand. Much less detailed information has been collected together for these occupations but there are many indicators that similar forces have been at work. The number of jobs in architecture or surveying rose by 32 per cent between 1951 and 1961, by 36 per cent between 1961 and 1971 but by less than 5 per cent between 1971 and 1979. Regrettably detailed time series data is not available to pinpoint the precise timing

of the end of the very rapid growth of the 1950s and 1960s but its correspondance with the steady rise in rates of return up to 1967/68 period is certainly suggestive of a period of rapid expansion in demand outpacing supply and resulting in rising relative earnings. The data presented in Chapter 4 suggests that supply responded to rising returns during the 1950s and early 1960s by expanding at an exceptionally high rate. Between 1955/56 and 1970/71 the number of first degrees awarded in architectural and vocational studies rose by almost 1000 per cent. In 'classic' cobweb pattern the growth of students obtaining degrees in this area only began to slow down after rates of return had already declined.

Undoubtedly part of the reason for the rapid rise in returns in the first period up to the late 1960s was the state of the construction sector buoyed up first by post-war reconstruction, and later by the speculative property boom. With the much less rapid expansion in this sector, especially since 1973, and the restriction on government capital spending in recent years, the growth in demand for services of architects has probably slowed substantially. Combined with the lagged response of new supply the precipitous decline in rates of return since 1967/68 is probably not very surprising.

In conclusion it is clear that the private rate of return to undertaking degree level course in all scientific disciplines has decline significantly, especially between the mid 1960s and mid 1970s. Compared with graduates as a whole the decline has been at least as rapid for those taking pure sciences and especially rapid for architects. The age earnings profiles upon which the results are based are of course the result of demand and supply

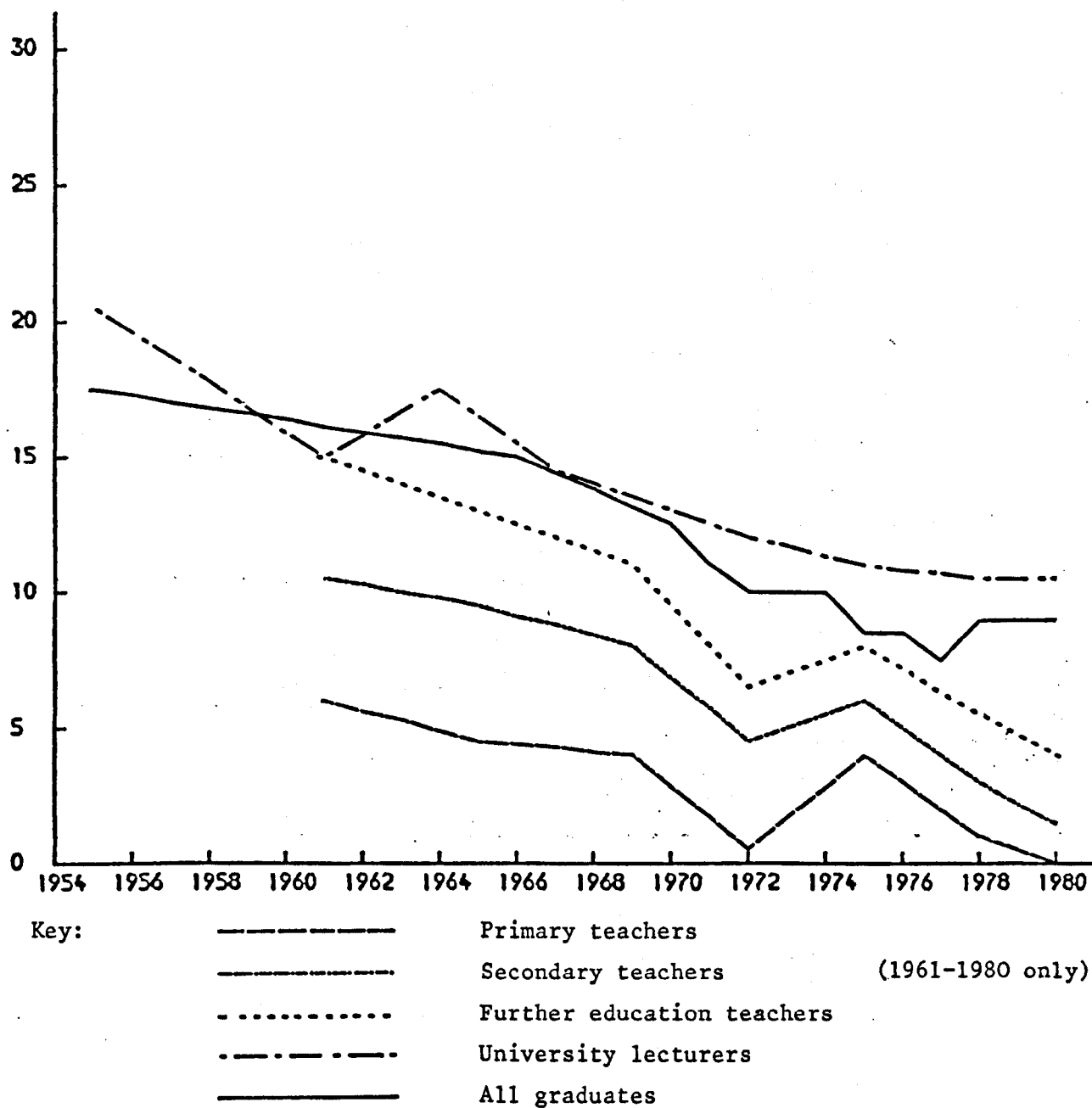
side pressures in the labour market at that point in time. However, consideration of other factors such as the rapid expansion in the number of young persons undertaking courses in science and engineering etc. suggests that the most likely cause of the decline in the rates of return observed is that supply has outpaced demand over the period as a whole. This contrasts with the widely held view that there are shortages of this type of manpower, although our results are not inconsistent with the possibility of shortages of very able persons in particular disciplines existing within a situation of overall surplus. To the extent that individuals may receive only very broad information about relative incomes, this situation could be exacerbated in the future if people are persuaded to follow alternative career patterns, given the overall decline in the rate of return to obtaining higher qualifications or professional status in scientific and engineering disciplines.

Teaching Professions

The results for teaching professions are summarised in Figure 5.6. From this it is clear that with the exception of university lecturers entrants to the teaching professions have faced rates of return below those for graduates in general. The ranking between teachers in primary, secondary and further education is also quite clear.

University lecturers (assuming a 4 year course of study) have seen rates of return fall from 20.5 per cent in 1955 to 10.5 per cent by 1979, although there was a sharp rise in the early 1960s. For teachers in further education, rates of return have fallen from 15 per cent in 1961 to 4 per cent by 1980. For those in secondary education the fall is from 10.5 to 1.5 per cent between the same years, while for primary

Figure 5.6 Rates of Return for Teaching Professions, 1955-1980



Note: For details of estimates see notes to Table 5.3.

teachers the modest return of 6 per cent in 1961 becomes negative by 1980.

Although for various reasons (that are fully discussed in Chapter 2 and 6), the absolute values of the rates of return estimated here must be treated with a certain degree of circumspection, the overall pattern of the results for teachers is quite clear. Since the beginning of the 1960s there has been an almost continuous decline in the average private rate of return to becoming a school teacher. This pattern of decline is also apparent for teachers in further education and, at least since the mid 1960s, for university lecturers.

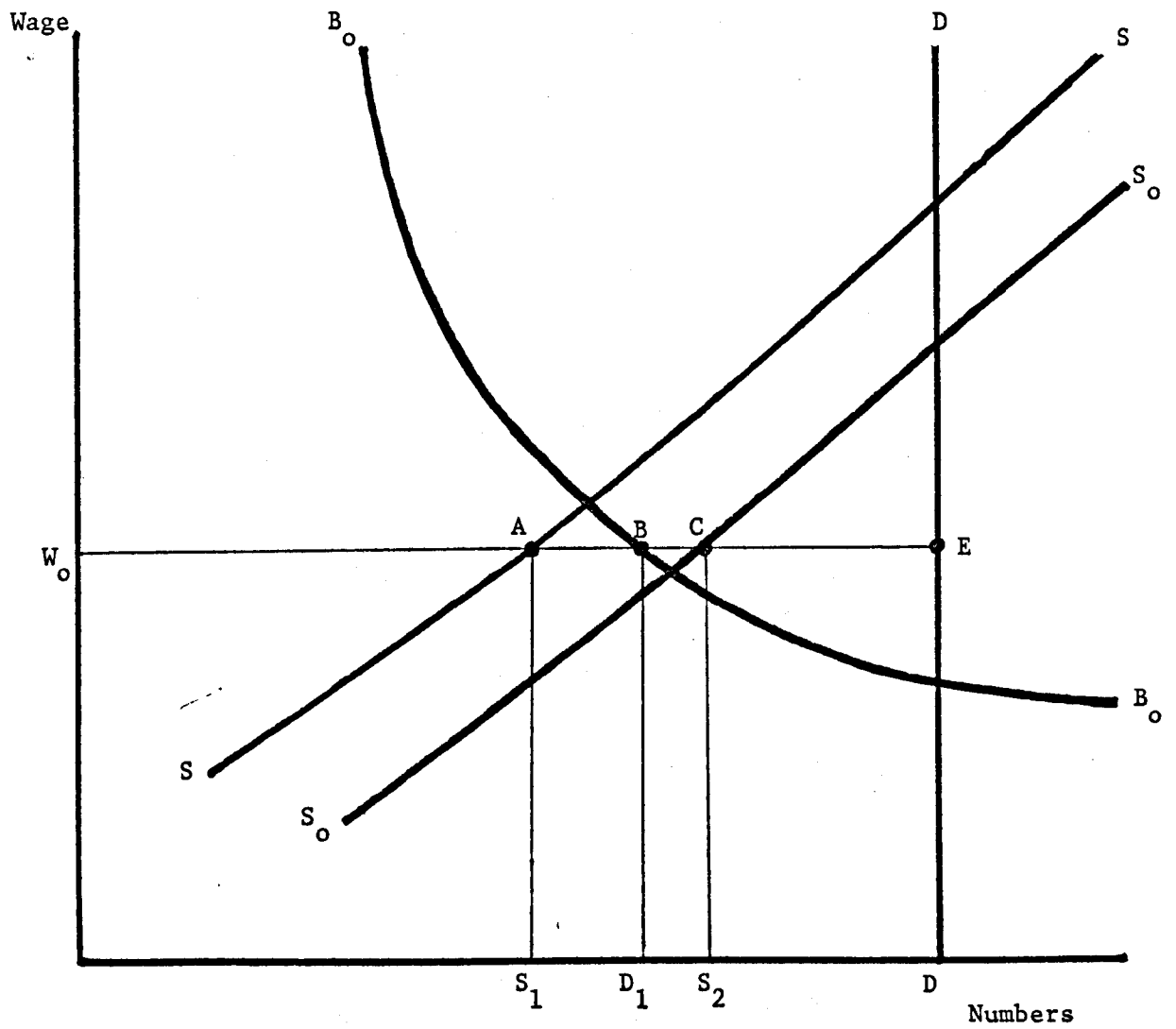
Compared with the results for other professions presented in the previous figures, the data in Figure 5.6 illustrates that the pattern of decline since the beginning of the 1960s is similar to that for professions such as scientists and engineers. Since the mid 1970s, rates of return have shown signs of leveling out or indeed recovering for these other groups. The decline for teachers between 1976 and 1979 however, represents a continuation of the previous trend. In explaining the secular decline in rates of return for scientists and engineers we have pointed to the dramatic expansion of the further education system during the late 1960s as leading to a significant increase in supply of graduates relative to demand. When considering teachers, however, this argument is clearly too simplistic. Expansion of higher education, initially at least, will result in an increased demand for the services of teaching staff. This appears to be consistent with the rising rate of return found for university lecturers in the early 1960s. Thereafter, as the higher education system began to supply itself with more and more potential teachers,

this upward trend was reversed. The universities clearly played a key role in this process and this is probably a very important factor in explaining why lecturers' incomes, and hence rates of return, held up when other teachers were beginning to lose ground.

For school teachers the situation in the 1960s is generally believed to have been one of shortages or at least balance in supply of and demand for teachers. Demographic factors and rising educational participation rates increased the demand for teachers during this period, while on the supply side the buoyant state of the economy and competition for graduate labour from other sectors meant that school teaching was not necessarily regarded as the most attractive option for many graduates. As noted by Catto et al. (1981) the main problem facing the educational system was how to expand the facilities for teacher training quickly enough to meet the demand. The effect of Robbins (1963) and the recommendation of the National Advisory Council on the Training and Supply of Teachers (1965) to accelerate the production of teachers, eventually resulted in a reversal of this problem as, more recently, demographic and other factors have tipped the balance towards excess supply, although there are still problems in particular disciplines.

Zabalza et al. (1979, pp.17-19) maintain that even up to the early 1970s there were in fact shortages of school teachers in the sense that the preference of government, as expressed by its staffing goals and salaries offered, was for more teachers than were available given that level of relative salaries. This is illustrated in Figure 5.7. The curve SS represents a conventional supply schedule. The vertical line DD is the relationship between wages and the demand for teachers based on the desired staffing pupil ratio. The curve BB represents alternative mixes of teachers

Figure 5.7 The Concept of Shortage in the Labour Market for Teachers



Source: Based on a diagram from Zabalza et al. (1979).

and wage rates possible, given a fixed budget constraint. Zabalza et al. (1979) characterise the position in England and Wales during the 1960s as one where the budget allocated to teachers' salaries (represented by BB) was insufficient to cover the wage bill at the institutionally fixed wage W_0 and to also employ the number of teachers represented by DD. A staffing goal's shortage arose (represented by AE in the figure). During the latter half of the 1970s as the numbers flowing out of training colleges responded to earlier policy changes this situation was reversed. This concept of shortages exaggerates the shortfall between the numbers employed and the numbers that administrators would like to employ given their budget constraint (which is given by AB in the figure). Thus although it is easy to demonstrate that a 'staffing goal' type of shortage existed up until 1973 (Zabalza et al. op cit. p.21) it is not possible to assess whether the second type of shortage (which we may regard as more akin to the economic measure of shortage) applied in the period up to this date. As Zabalza et al. recognised, the total supply of teachers increased particularly dramatically at the end of the 1960s and early 1970s. Between 1960 and 1973 the supply of teachers on their definitions increased by almost 50 per cent while demand as measured by staffing goals rose by about 25 per cent. Over the same period over 3/4 of the increase in supply occurred after 1967. The implied 'staffing goals' shortages of teachers therefore diminished substantially over this period. The economic measures of shortage AB will have been reduced in corresponding fashion and, in aggregate at least, probably turned into a surplus well before 1973 (e.g. as shown by the shift to curve SoSo in the figure). For further discussion on this question the reader is referred to Thomas and Deaton

(1977), Zabalza (1979a) and Zabalza et al. (1979).

For university lecturers, labour market developments up to the end of the 1970s are analysed in Williams et al. (1974). They conclude (op cit. p.210) that despite the fact that universities do not behave as costs minimisers (at least in the short run), the labour market has behaved as would be predicted by competitive market theory for any sector producing its own 'capital'. During the 1960s the rapid expansion of higher education resulted in upward pressure on the relative salaries of faculty. As the system began producing its own future staff the situation has changed as for school teachers to one of excess supply rather than excess demand.

Conventional market forces can therefore be expected to have played an important part in reducing the relative pay of teachers of all kinds. This has various aspects, on the one hand it may affect the overall levels of pay scales negotiated between unions and employers. On the other hand it may affect the prospects for promotion and career development. The first hypothesis is supported by the evidence of Thomas and Deaton for school teachers (op cit. p.123) while there were by 1979 numerous indicators of promotion blockages and the like. Various authors, including Thomas and Deaton, have argued, however, that there are important imperfections in the workings of the labour market and especially in the way in which pay is determined. For example, Dahlby (1981) argues that the Department of Education and Science is in a position to exploit monopsony power. This might explain why rates of return have fallen so rapidly and, for males at least, to such low levels.

As noted in Chapter 6, the situation for teachers is probably best characterised as one of bi-lateral monopoly. The relative strengths of employers versus employees can however be

expected to be closely related to the overall market situation. In the early 1960s the balance of supply and demand favoured the employee side and relative earnings were such as to imply quite high rates of return. By the 1970s the balance had shifted to one of excess supply and this has been used by the employer side to squeeze teachers salaries in order to maximise the numbers of teachers available for any given budget.

The very substantial growth in the total stock of teachers has been much greater than various other professional groups as noted in Chapter 4. Medical and legal professions have (whether by choice or design) managed to restrict numbers and thereby maintain positions of market power and hence relative earnings and rates of return. For other groups such as engineers and scientists, supply has expanded very rapidly but in all probability this has not lead to such a clear overshooting of the long-run equilibrium position as has occurred for teachers. One possibility is that there are many non-wage compensating factors which tend to offset the lower relative earnings and hence rates of return that we observed for teaching professions. Such compensatory factors are discussed in detail for university lecturers by Williams et al. (1974). Some of the most important of these are very difficult to quantify such as the advantages of an academic work/life style, tenure, job interest and status. Others such as holidays and hours of work (which may be supposed to benefit teachers in general) are, in principle at least, possible to quantify. In practice, as noted in Chapter 6, the supposed short working year of teachers is not easy to demonstrate. In fact some evidence reported in that chapter suggests that teachers work as many hours, if not more (including their long holidays) than most other professionals.

It is not therefore possible to explain away the observed differentials by compensatory differences in hours worked.

Despite the factor that supply and demand are to a substantial degree directly controlled by the government for both medical and teaching professions, there are a number of contrasts in the labour market for the two groups. The relative strength of employers versus employees appears to be much higher in the case of teaching professions. This reflects the much less unified position of the teaching unions, both in terms of the number of bodies involved and the aims, objectives and methods they adopt. The setting up of a permanent review body for doctors (see Chapter 6) has probably favoured medical professions compared with teachers due to the tendency of such bodies to adopt a rather paternalistic attitude towards the group whose pay they are reviewing (see Clegg, 1980 for further discussion). A final important difference is that it is less easy for teaching professions to justify restrictions on entry based, for example, on arguments concerned with public safety.

What are the implications of the observed decline in rates of return for teachers? Many might argue that it is unrealistic to believe that young people's decisions to enter teaching as a career are influenced to any significant degree by such considerations. Certainly, one would not expect economic factors to be the sole determining factor. Nevertheless, evidence from various studies for both the UK and other countries suggests that even if students do not explicitly carry out complex comparisons of the return to be expected in different careers they do act as if they were influenced by such factors. Williams and Gordon (1981) showed that students' perceptions of expected rates of return to different courses of study was quite accurate, while results by the present author (reported in Bosworth and Wilson (1980)) and by

others (for example, Pissarides (1982) and Zabalza (1979a)) suggest that young people's occupational choices are, at the margin, responsive to changes in the perceived rewards associated with various careers. If the absolute rates of return for male graduates in school teaching are approaching zero, as suggested by the results discussed here, this will undoubtedly result in serious problems of recruitment of able young teachers. The situation at present is clouded by the overall recession and uncertain prospects for graduate employment in general. Also the scaling down of the school teaching profession in response to demographic factors has probably prevented recruitment problems from becoming too severe. As the economy recovers from the recession and, as the next demographic bulge appears, this situation could soon change. Any further deterioration in the relative pay of teachers could therefore cause very severe difficulties. If one accepts that the historically observed differentials in rates of return between school teachers, teachers in further education and university lecturers do reflect quality, then similar remarks apply to both the latter groups.

Conclusions

As long ago as 1964 the National Incomes Commission in a report dealing with university lecturers considered the question of comparing the earnings of different professional groups. It concluded that, "Similarity is not to be looked for in the functional content of (their) work but in the competition between the relevant occupations for the recruitment and retention of staff drawn from the same source of supply" (NIC, 1964, p.25, parenthesis added). The Clegg Commission struggled with essentially the same problem of making comparisons between different occupations. The difficulty

is that without clear thinking on these issues by bodies charged with the making decisions regarding such matters as the future output of graduate teachers or medical students, or the appropriate relative salaries for such persons, then serious problems of shortages (e.g. doctors) or surpluses (e.g. teachers) may arise because of the long training lags involved.

The obvious criterion by which to judge the way in which the market situation is moving is by closely examining relative salaries. It is however crucial to take into account the costs of education and training and it is for this reason that the rate of return concept is so important. Other compensatory factors such as hours worked, adjustments for risks of self-employment etc. can easily be incorporated within this general framework as shown by the analysis presented in this thesis. The only data requirement is basic earnings information which, in principle, could be collected quite cheaply using existing surveys as a basis. The case for regular monitoring of rates of return in the manner described in this research seems overwhelming.

6. Detailed results for other professions

Introduction

In the previous chapter the estimates of private rates of return for scientists and engineers were compared with those for other professions. As well as giving a detailed discussion of the theoretical and methodological issues involved a summary of the results for each profession was presented. In this chapter the detailed results upon which these summary measures were based are discussed. Various problems which arise in producing comparable results for each group are considered within the relevant section. These include: the treatment of self-employment incomes; differences in length of course; adjustments for hours worked; market imperfection (monopoly and monopsony); differences in fringe benefits and supplementary income; differences in ability; and differences in the risks of various kinds associated with each profession. Section 6.1 begins by providing a summary of the results for graduates in general. Medical professions are considered in Section 6.2 followed by legal professions in Section 6.3. The next two sections deal with business professions and architects and surveyors. Finally, teachers (including university lecturers are considered in Section 6.6).

6.1 Graduates in general

We have already presented in Chapter 3 some results for all graduates based on the follow-up surveys to the 1966 and 1971 censuses. In this section the analysis is extended to cover the period 1955/56 to 1979/80. Furthermore we also examine the rate of return for some subject categories not covered in the earlier chapter using the post-censal data.

The RCDDR published information on the earnings by age of "all graduates in industry". While not as comprehensive as the data for 1966/7 and 1971/2 this provides a rough benchmark against which to set the results for more recent years. The source of this data was a rather ad hoc type of survey conducted by the Royal Commission itself which approached the heads of 21 large industrial and commercial undertakings. The number of graduates about whom information was obtained was 7466.

Assuming that the Royal Commission was correct in regarding this data as representative of graduates employed in industry, then the main groups excluded are those such as legal professions, medical professions and university teachers who are largely speaking covered by separate surveys. Probably the main gap is that teachers in schools and further education are not covered by this or any of the other surveys. It is interesting that the rate of return computed using this data appears to represent approximately the average position for all other professions considered.

For more recent years we are fortunate in having the results from the General Household Survey (GHS). The GHS is a continuous interview survey based on a sample of the general population resident in private (ie non-institutional) households in Great Britain and has been running since 1971. From the beginning it has asked questions about education, qualifications and income. The

information is collected throughout the year on a sample of about 15,000 households. Since 1975 a two stage rotating sample design has been used, based on electoral wards. The sampling frame is stratified by region, area type and other factors. Response has generally been good with around 75 per cent of households giving complete co-operation. Generally less than 15 per cent of households either refused to co-operate or could not be contacted.

The information on income and education of those in full-time employment typically covers about 15000 individual males of which perhaps 1000 are qualified at first degree level or equivalent. This source provides the data for calculation of rates of return for graduates in general since 1971.¹

Clearly the sample size is very small and the possibility of sample error is high. Indeed it is apparent from a cursory examination of the data that peculiarities do appear to arise. For example, the data for 1971/2 results in a lower age earnings profile for qualified persons than in 1970/71 which appears to be unlikely. Other less dramatic effects arise in other years. Nevertheless, it is hoped that this data set will provide a broad guide to events during the 1970s. The estimated rates of return obtained do not fluctuate alarmingly from year to year and, indeed, appear to show a fairly consistent path over time, which tends to suggest this hope is not in vain.

(1) The published information only gives median income and for many years did not distinguish age. However, the author has obtained data on mean income from employment via the Department of Education and Science to whom he is most grateful.

In order to make comparisons with our other results we have chosen to use the NES based estimate of C_t rather than to use the income profile for all persons given in the GHS itself. However, a comparison is made using the latter below. The use of the NES profile introduces a slight problem of timing. Because of the continuous nature of the GHS the question on earnings implies that the average income figure is centred not on the year t but on December 31st $t-1$ /January 1st t .² In order to make the C_t profile comparable it is therefore necessary to adjust it for timing as described in earlier chapters, using information on month to month movements in the index of average earnings.³

Rates of return for graduates in general

The results of carrying out rate of return calculations for all graduates are summarised in Table 6.1. These results all assume a course length of 3 years and represent average private rates of return as defined in Chapter 2.

The basic pattern of the results appears to follow that observed for scientists and engineers. In 1955/56 the estimate for all graduates in industry is 17.5 per cent. By the mid-sixties there is indication of a slight fall, but since the estimate for 1966/67 (and all subsequent years) covers the whole graduate population not

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- (2) The question on income asks what was the average level of income in the 12 months prior to the interview.
 - (3) During an inflationary period this adjustment is of some importance. A five per cent increase in the C_t profile may reduce the estimated rate of return by 1 percentage point. See Chapter 8 for further discussion.

just those in industry, these figures are not directly comparable. The estimates for subsequent years are comparable however, and these indicate a significant decline between 1966/67 and the late seventies. We have already noted the problem with the B_t profile from the GHS survey for 1971/72. The average earnings of those graduates less than 35 years of age were all lower in 1971/72 than in 1970/71 according to the GHS results. This seems implausible and almost certainly explains a major part of the difference between the estimate for this year based on GHS data and that based on the post censal survey. In addition the post-censal data is not adjusted for the probability of unemployment or activity as is the GHS data. As noted in Chapter 3 (page 3.15), since the C_t profile is not so adjusted in the case of the GHS result this could explain between 0.5 and 1.0 percentage points of the difference. In earlier chapters some doubts have also been expressed about the reliability of the post censal data for 1971/72. There is therefore some uncertainty regarding the precise profile of the expected rate of return over time. Nevertheless, the results do strongly suggest that over the decade from 1966/67 there was a very significant fall in rates of return from around 15 per cent to well below 10.

In the last couple of years there are signs of a recovery, the estimated return rising from 7.5 per cent in 1977/78 to 9 per cent by 1979/80. A halt to the decline in the previous decade would not be unexpected given the results obtained for scientists and engineers. However, changes from one year to the next based on a sample as small as that on which the GHS is based are probably subject to quite a high margin of error. Until evidence for subsequent years is available to confirm this recovery these estimates should therefore be regarded with some circumspection.

Finally, it is of interest to compare the results for 1971/72 with an estimate produced by Psacharopoulos and Layard (1979). Allowing for 2 per cent per annum to account for the expected secular growth in real incomes they come up with an estimate of around 10 per cent. This figure, while based on the same data set as we have used, is obtained using a quite different methodological approach involving estimating an earnings equation in which years of education is an explanatory variable. It is therefore quite reassuring to find the estimate is quite close to our own figure of 11 per cent.

Table 6.1

Rates of Return for Graduates in General^c

	<u>per cent</u>
1955/56 ^a	17.5
1966/67 ^b	15.0
1970/71	12.5
1971/72 ^b	13.5
1971/72	11.0
1972/73	10.0
1973/74	10.0
1974/75	10.0
1975/76	8.5
1976/77	8.5
1977/78	7.5
1978/79	9.0
1979/80	9.0

Source and notes: (a) RCDDR (1960). "All graduates in industry".

(b) Post censal earnings surveys.

(c) All based on GHS data unless elsewhere specified.

Estimates for different disciplines

In Chapter 3 results for those studying science and engineering were presented. In Table 6.2 this analysis is extended to cover medical sciences, social sciences, vocational subjects, languages and arts. The calculations for vocational subjects assume a four year course while those for medical subjects assume a five year course. Results for science and engineering and vocational subjects are also reproduced in the table for completeness. ⁴

In 1966/67 the return to medical sciences and social sciences at around 16.5 per cent were both above average. The former however involves a much more substantial investment (a minimum of a 5 year course). Languages and arts on the other hand were below average at 12.5 and 14.0 per cent respectively. Between 1966/67 and 1971/72 the estimated rate of return fell for all these groups especially for arts subjects. The smallest decline was for social sciences and languages. The basic ranking observed in 1966/67 is not disturbed by these slight differences however.

(4) The sample sizes on which the results for different disciplines are based are very small in some cases, especially for 1971/72. The results should therefore be regarded as no more than illustrative of broad differences between disciplines.

Table 6.2

Rate of Return Estimates for Different Disciplines (males)

	per cent	
	1966/67	1971/72
Science	14.0	12.5
Engineering and technology	14.5	13.0
Vocational subjects ^a	14.0	10.5
Medical sciences ^b	16.5	15.0
Social sciences	16.5	15.5
Languages	12.5	12.0
Arts	14.0	10.5
All subjects	15.0	13.5

Notes: (a) Assuming a 4 year course.

(b) Assuming a 5 year course.

6.2 Medical Professions

Apart from a very crude calculation carried out by Siebert (1977) there have been no calculations of the rate of return to becoming a member of the medical professions. The availability of data collected on behalf of the Royal Commission on Doctors and Dentists Remuneration (RCDDR, 1960) and of the Review Body on Doctors and Dentists Remuneration (RBDDR, 1972 and 1981), together with material from the post censal surveys already referred to, enable estimates to be made covering the period 1955/56 to 1980/81.

The RCDDR conducted a series of surveys covering the incomes of medical professions in England and Wales and Scotland for the year 1955/56. Stratified samples of the known population were taken for General Medical Practitioners (GMPs) and their assistants, Medical Consultants, Senior Hospital Medical Officers and General Dental Practitioners. A summary of the sample sizes and response rates is given in Table 6.3. From this analysis it can be seen that a satisfactory response rate was obtained for doctors at around 75-80 per cent. For dentists the response rate was somewhat lower at 63 per cent. These surveys, particularly for consultants, cover the earnings of those who have "succeeded" in their chosen professions. The RCDDR also collected further information from "other sources" to "overcome these defects" (RCDDR, 1960, part II para 111). No further information is given on this data but profiles are presented for doctors in "general medical services", for "hospital doctors" and for those in "general dental services" which reflect the earnings of those who by the age of 30 have not achieved establishment. (General medical services covers those in private practice including GMPs and their assistants.)

In 1971 the Review Body on Doctors and Dentists Remuneration was set up to carry on the work begun by the RCDDR.⁵ In 1972 the RBDDR published

(5) Following the RCDDR report a standing Review Body was set up under the chairmanship of Lord Kindersley. This produced various reports between 1963 and 1970. It's 12th report (1970, Cmnd 4352) was not accepted in full by the then government and all members of the Review Body resigned. With the election of a new government a new independent body was set up in 1971.

Table 6.3 Response to RCDDR Survey

	Number in sample	Effective Sample ^a	Response rate (%)
General Medical Practitioners (GMPs)	6576	6228	73.8
Assistant General Medical Practitioners	1586	1275	82.0
Senior Hospital Medical Officers	785	737	76.9
Medical Consultants	2693	2631	79.6
General Dental Practitioners (GDPs)	4673	3946	63.0

Source: RCDDR(1960 Appendix III p.258).

Notes: (a) Excludes replies indicating a good reason for not completing the questionnaire, (e.g. retired, sick, deceased or address unknown).

a report on developments in the earnings of medical professions since 1955/56. In order to make comparisons over time, use was made of a special inquiry conducted by the Inland Revenue. The data from this source is not entirely comparable with 1955/56 for consultants, due to the inclusion of Senior Hospital Medical Officers with allowances. However, the number of the latter, according to the Review body, is quite small and therefore does not materially affect the comparison over time. The Inland Revenue inquiry for GMPs covers income under schedules D and E, the schedule D income being adjusted to an earnings basis by allowing for the late payment of "pool balances" and arrears. For GDPs the data relate to schedule D income only, but salaried earnings are negligible for this group. No further details are given of the size or nature of this inquiry. Age earnings profiles based on this data were published in the Review Body's report covering 1969/70. These profiles, together with further information on salary scales, provides material for a direct comparison with the data collected by the Royal Commission for 1955/56.

In 1981 the RBDDR published further estimates of the age earnings profiles of typical doctors together with information on salary scales which enable the analysis to be extended up to the tax year 1980/81 (RBDDR 1981). The age-earnings profiles published by the RBDDR do not cover all hospital doctors. Information on salary scales has been used to fill this gap assuming a typical career profile (see Table 6.4 below).

Adjustments to the basic age earnings profiles

The data available from the various surveys referred to above can be used to construct basic age earnings profiles for various groups of medical occupations. Three fundamental problems arise when using this data to make rate of return calculations for comparison with other professions. All affect the analysis of the data for 1955/56. It is therefore helpful to discuss in detail the solutions adopted in terms of this example.

Table 6.4 Typical career profiles assumed for medical professions

Age	General Medical Practitioner	Consultant	Other Hospital Doctor	General Dental Practitioner
up to 23	Student	Student	Student	Student
24, 25	House Officer	House Officer	House Officer	Assistant
26, 27	Senior house officer/ assistant/ trainee	Senior house officer		General Dental Practitioners
28, 29	Registrar/ assistant/ trainee	Registrar	Senior house officer	
30	General Medical Practitioners			
31		Senior Registrar	Registrar	
37		Consultant		
49		C award	Senior Registrar	

Notes: In 1970 the percentage of Hospital doctors in various grades were as follows: Consultants 38.6; Senior Registrars, 6.2; Registrars, 18.9; Senior House Officers, 18.7; House Officers, 10.2; others, 7.4.

Table 6.5 Adjustments to the age earnings profiles for medical
professions (1955/56)

Age	<u>GMPs</u>		<u>Consultants</u>		<u>GDPs</u>	
	Original profile	Adjusted profile ^a	Original profile	Adjusted profile ^a	Original profile	Adjusted profile ^a
20-24	950	366	1386	366	1520	685
25-29	1330	1000	1745	1023	2000	2000
30-34	1710	1710	2104	1594	2263	2263
35-39	2116	2116	2463	2463	2497	2497
40-44	2263	2263	3110	3110	2576	2576
45-49	2455	2455	3380	3380	2380	2380
50-54	2455	2455	3511	3511	2220	2220
55-59	2275	2275	3629	3629	1710	1710
50-64	2093	2093	3303	3303	1400	1400
65+	1675	1675	3303	3303	1400	1400

Source: RCDDR (1960) and own estimates.

Notes: (a) Adjusted to reflect 'career' profiles. Does not include adjustments for capital outlay or hours worked. See text for details.

The data collected in the RCDDR surveys primarily concerns the earnings of those above the age of 30 and in some cases concentrates upon "high fliers" rather than an average individual. For example, the earnings of consultants and senior medical officers are reported for those aged below 30. These estimates can hardly be regarded as representative of the earnings to be expected by a typical doctor. The first problem therefore is to ensure that in making comparisons between professions and over time, one is not comparing the earnings profile of 'high fliers' with a more run of the mill average profile for a different profession or at a later date. In addition suitable adjustments have to be made to reflect typical training/employment profiles. The age earnings profiles for 1955/56 have therefore been adjusted to reflect a typical career rather than an exceptional one.

The basic profiles for GMPs, Consultants and GDPs are shown in Table 6.5. The estimates for those aged less than 30 are then adjusted to reflect the typical education/training/employment profiles illustrated in Table 6.4. Up to the age of 23 all three professions are assumed to receive the normal student maintenance grant. Consultants are then assumed to receive the earnings as indicated by the salary scales assuming a typical progression through the grade of house officer/senior house officer/registrar up to the age of 35. GMPs are assumed to follow a similar career profile. Here we also have information on the earnings of assistant/trainee GMPs from the RCDDR surveys. The assumed profile for GDPs is similar again except that they become practitioners in their own right about 5 years earlier than doctors. The adjusted profiles for 1955/56 are also shown in Table 6.5. Similar adjustments are made to the profiles for 1969/70 and 1980/81.

In addition we have also constructed age earnings profiles using salary scales for all hospital doctors, both a typical 'high flier' who becomes a consultant and a 'low flier' who does not. These career profiles are based on the average age of promotion and on the proportion of doctors attaining certain grades and merit awards. The 'high flier' profile is that shown in Table 6.6 as 'consultants', that for 'low fliers' is headed 'other hospital doctor'.

Using the profile for a 'high flier' to compute rates of return results in an estimate very similar to that based on survey data on the income of consultants in all years. Therefore, although they are not based on as firm a foundation as the results estimated from survey data, we would argue that the profiles constructed in part or entirely from salary scales can provide a useful adjunct to the information from surveys of earnings and incomes.

The second major difficulty concerns the problem of comparing the incomes of self-employed and employees in employment. As noted in the previous chapter, there are various differences between these two groups. Many of these may be expected to affect incomes although only some are quantifiable. The two factors most amenable to empirical analysis are the provision of pensions and the capital outlay associated with setting up as a self-employed professional. Given an estimate of the proportionate addition to income necessary to cover such expenses, the B_t profiles can be adjusted to take them into account. In respect of pensions, no deduction is necessary for medical professions, however, since the NHS makes provision for all doctors and dentists.

The capital outlay necessary to set up in private practice or to join a partnership can be treated in an analogous manner. The results presented in Chapter 5 (Table 5.2 above) indicate the size of the necessary deduction from gross income for various professions

in 1955/56. Some recent estimates reported by RCLS (1980 Vol.II para 20-63) for legal professions suggest that the size of such outlays can be taken as roughly constant over time. If anything, the later survey suggests a slight increase in the necessary deduction as a proportion of income for legal professions (from 10 per cent in 1955/56 to 13 per cent by 1976/77). By deducting an appropriate percentage from gross incomes we can therefore make at least a crude allowance for capital expenditure.

The final problem concerns hours worked. The long and unsocial hours worked, in particular, by hospital doctors are well known. It seems appropriate therefore to attempt to adjust the rates of return for this group to allow for this. On average the income of junior hospital doctors (up to the age of about 35) is significantly boosted by the payment of Class A/B supplements for hours worked in excess of 40 per week. The typical addition to income is one third of the basic salary, (this proportion is based on evidence cited by the RCLS (1980) and the RBDDR (1981 para 79). The premium paid for 'overtime' hours is 30 per cent (RBDDR, 1981 p.8). The $\frac{1}{3}$ addition to income is therefore equivalent to about 10 hours per week ($40 \times \frac{1}{3} \div 1.3$) in addition to the normal basic hours of 40 per week. In constructing the age earnings profiles for hospital doctors we have added this amount to the basic salaries of those below the consultant grade (typically less than 37 years of age). Deducting this amount effectively adjusts the profile for having to work overtime in order to achieve that level of income.

However, this implicitly assumes that the foregone income profile is also adjusted on to a comparable 40 hour week basis. In practice, the average level of hours worked per week to obtain the income levels used in the C_t profile is significantly greater than 40. For example, average weekly hours for manual men were around 49 in 1955, 46.2 in 1969 and 43.2 in 1980, while those for non-manual men were 44, 40.4 and 39 respectively (Wilson 1982,

p. 15). Regrettably, information on hours worked by doctors is very sketchy and it is not clear whether the average hours of hospital doctors implied by the $\frac{1}{3}$ addition to basic salary have been constant for many years or whether the hours of doctors have also fallen in line with other workers. NES data on the distribution of 'normal basic hours (data on average weekly hours is not published for these occupations) suggests little change between 1972 and 1980. Calculating mean hours from the published distribution for men aged 21 and over gives values of 37.6 in 1972 compared with 37.9 in 1980. Over the same period the mean figure for all men fell from 38.8 to 38.3. The RBDDR in its 13th Report estimated that the average number of hours worked by junior doctors was 55.3 per week. The hours spent on duty, including periods when on call, averaged 83.8 (RBDDR, 1983, Appendix, Table 2, p.67). This can be compared with two roughly comparable surveys for 1968 and 1975 which gave the average number of hours on duty as around 88 and 86 respectively. In discussing these results the RBDDR (1975) concluded that, given differences in the surveys, the overall position was probably that hours worked had altered very little over this period. For dentists there was a survey carried out by the RCDDR (1960) covering 1956 which estimated total hours at between 2100 and 2200 per year. Further surveys in 1963 and 1966 suggested annual hours of 2100 and 2000 respectively. It does therefore appear that dentists have seen a reduction in hours in line with other groups.

For other professions such as scientists and engineers we have not made any adjustments for differences in hours worked. In the case of medical practitioners some adjustment does however seem appropriate. In order to allow for the fact that hours in general

have exceeded 40 per week for most workers it is necessary to also adjust the C_t profile for hours. This was done by assuming that to earn the C_t profile in 1955, 1969 and 1980 the individual would have to work 47, 44 and 42 hours respectively. Assuming an overtime premium of 1.3 this translates into an addition to basic earnings for a 40 hour week of 22.75, 13 and 6.5 per cent. This is regarded as included in the C_t profile. In order to adjust for hours on to a comparable 40 hour week basis the C_t profile was therefore multiplied by the reciprocal of the corresponding proportions (e.g. 0.815, 0.885 and 0.939). This adjustment was made to the results for doctors only.

The results for dentists in common with other professions are not so adjusted. Many other professions (e.g. lawyers) also claim to work excessively long hours, while yet others (such as teachers) are regarded by many as working very short hours. The general question of adjustments for hours is discussed in further detail in Chapter 8. For the present, adjustments are made just for doctors. These adjusted results are regarded as constituting the most appropriate measures for comparison with other professions.

Table 6.6

Earnings Profiles Based on Salary Scales

	1955/56		1969/70		1980/81	
	Consultant	Hospital doctor	Consultant	Hospital doctor	Consultant	Hospital doctor
23-24	568	568	1670	1670	7214	7214
25-29	1005	779	2188	1951	9309	8310
30-34	1594	1116	2991	2568	12398	10779
35-39	2083	1388	3641	3074	15825	12764
40-44	2725	1844	4470	3651	19652	14859
45-49	3100	1870	5434	3687	20576	14990
50-54	3500	1870	7355	3687	26936	14990
55-59	3600	1870	7625	3687	27820	14990
60-64	3600	1870	7625	3687	27820	14990

Notes: Based on career patterns as outlined in Table 6.4 . The figures include Class A/B supplements paid for hours contracted in excess of 40 per week.

Source: RCDDR and RBDDR reports for various years.

Results for Medical Professions

Table 6.7 summarises the estimates of rates of return for medical professions. In 1955/56 the estimates of rates of return were relatively high for all groups compared with those obtained for scientists and engineers. For hospital doctors in general, a rate of return of about 20 per cent is obtained. For general medical practitioners and those who become consultants the expected returns are higher at 21-22 per cent. The really plumb investment however was in dentistry. The average private return to becoming a general dental practitioner being 35 per cent, significantly greater than for other medical professions and a much larger figure than is obtained for any other group. The age earnings profiles for dentists are unlike those for any other profession. The initial part of the profile is exceptionally steep, dental practitioners very quickly achieving a very high income level. Most dentists are at the age of 30 earning as much, if not more than, the peak lifetime earnings of many other professions. Thereafter the profile is usually fairly flat and then declines at a comparatively early age.

Upon making an allowance for necessary capital outlay in setting up in practice, the estimated rates of return are reduced by 0.5-1.0 percentage points. They remain at a relatively high level. For consultants, whose capital outlay is on average only a fifth of that for GMPs, the effect is insignificant. The apparently insignificant effect for GDPs in 1955/56 is due to rounding, the impact being less than 0.5 per cent.

By 1969/70 the rates of return for all the groups considered show a substantial decline. For hospital doctors the expected private rate of return falls from 19 per cent to 16 per cent for 'high flying' hospital doctors and from 15.0 to 13.0 per cent for 'low fliers'. Consultants and GMPs experienced a decline of around 4.0 percentage points to 17.0 and 17.5 per cent respectively and dentists an even sharper fall from 35 to 25.5 per cent. Adjustments for capital outlay

Table 6.7 Rates of Return for Medical Professions

		per cent		
	1955/56 ^a	1969/70 ^b	1980/81 ^c	
Basic estimates				
General medical practitioners	21.0	17.5	15.0	
General Dental practitioners	35.0	25.5	18.5	
Consultants	21.5	17.0	14.5	
Hospital doctors:				
'high fliers'	19.0	16.0	14.5	
'low fliers'	14.0	13.5	11.5	
Including adjustments for capital outlay:				
General medical practitioners	20.5	16.5	14.5	
General dental practitioners	34.0	24.5	17.5	
Consultants	21.5	17.0	14.5	
After adjustments for capital outlay and for hours worked^d				
General medical practitioners	21.0	15.5	12.5	
Consultants	22.0	16.0	12.5	
Hospital doctors:				
'high fliers'	19.0	14.5	12.0	
'low fliers'	13.0	10.5	7.5	

Sources and notes: (a) RCDDR (1960)

(b) RBDDR (1972)

(c) RBDDR (1981)

(d) No adjustment for capital outlay is included for 'hospital doctors'

do not alter these trends to any significant degree.

Over the next decade the decline continued but at a rather slower rate. For hospital doctors the figure for 1980/81 was 14.5 per cent. This represents a further decline of 2-2½ percentage points over the decade. For GMPs and consultants the decline was also around 2.5 percentage points. The fall for dentists was considerably larger (about 7 percentage points). Even so the return for this group remains very high at almost 20 per cent after adjustment for capital outlay. These results appear to provide some support for Siebert's contention that restrictive practice may have been used to maintain the earnings of some medical professions, in particular dentists, above that which might prevail in a free market. This issue is discussed in detail in Chapter 5 above where detailed comparison is made of the results for all professional groups.

One important refinement which is considered here however is the need to make an adjustment for the very long hours worked by most doctors. Adjusting the profile for hours worked, as described above, has a very significant impact on the estimated rate of return, especially for 'low fliers'. In this case the return is reduced by 4 percentage points taking it well below the estimates obtained for scientists in 1980. A corresponding adjustment can also be made for consultants and GMPs. The impact here is very much in line with the 2-3 percentage points reduction obtained for high fliers in 1980. For all these categories the reductions made are less in 1969/70 and in some cases returns are increased in 1955/56. This reflects the fact that in the earlier years hours were much higher for all workers therefore the assumed differential between medical professions and the rest was not so large or indeed on average negative in 1955/56.

The results discussed in this section may be summarised in three main points:

- (i) There has been a substantial decline in average private rates of return for all medical professions between 1955/56 and 1980/81, the rates of return in the latter year being between two thirds and a half of the values estimated for 1955/56.
- (ii) Nevertheless the expected returns are still high relative to most other professions so far considered, especially for dentists.
- (iii) The adjustments for capital outlay and for hours worked both reduce the estimated rates of return significantly, especially the latter. After these adjustments the differential compared with other groups such as scientists and engineers is greatly reduced. Furthermore, the adjustment for hours tends to reinforce the downward trend in rates of return, since average hours for doctors have not fallen in line with those of the rest of the population.

6.3 Legal Professions

As far as the author is aware there has been only one serious attempt to estimate the rate of return to the legal profession in the United Kingdom. This was the study by Mulvey (1980a) carried out as part of the RCLS's analysis for Scotland in 1977/78.⁶ No comparable analysis was conducted for the remainder of the United Kingdom. The present section repairs this omission and extends the analysis backward in time using the results of various surveys carried out during the post war period.

The first of these was the set of surveys commissioned by the RCDDR (1960) for making comparisons with the medical profession. The Royal Commission surveyed the earnings of Barristers and Solicitors in England and Wales and Advocates and Solicitors in Scotland. The samples of barristers and advocates are necessarily small (above 500 in total for each). Nevertheless the data on earnings by age appears to be reasonable when compared with solicitors and other occupations. For solicitors a one in ten sample of the names on the Admission Roll of Solicitors was taken for England and Wales and a one in six sample of practising members of the Law Society of Scotland. Response rates to these surveys were around 60 per cent.

A survey of solicitors working in industry and commerce was undertaken by the National Board for Prices and Incomes (NBPI, 1968) in 1967/8 from which a crude age earnings profile can be computed. The Bar Association for Commerce, Finance and Industry has conducted various surveys of its members' earnings since 1967. We have been able to obtain this data for 1970/71 and 1980/81. This again is a small sample (about 3-400). There is no way of forming a clear judgment of how representative these surveys are. However, as will be seen from the results presented below, they suggest a pattern of expected rates of return consistent with data from various other sources.

(6) Siebert (1977) reports a very rudimentary calculation based on census data.

Another important source of information is the follow-up to the 1966 Census.⁷ Regrettably this provides little detail however. All one can obtain is an overall age earnings profile for the whole legal profession, (judges, barristers, advocates and solicitors) for England and Wales.

Much more useful is the series of surveys conducted under the auspices of the Royal Commission on Legal Services (RCLS) for both England and Wales and Scotland. The former reports various earnings surveys covering the tax year 1976/77 (RCLS, 1979 Volume II, Sections 16-20). The second gives corresponding results for Scotland covering the tax year 1977/78 (RCLS (Scotland) 1980 Volume II Appendices Part B numbers 7-12). Both these reports include detailed information on earnings by age for lawyers practising as self-employed and for employees in private practice or industry and commerce.

For England and Wales four surveys were conducted by the Law Society, The Bar Council and the Bar Association for Commerce, Finance and Industry on behalf of the Royal Commission. The first deals with the earnings of Solicitors and their staff in private practice. The questionnaire was sent to all firms on the Law Society's records. A response rate of 66 per cent was achieved (4,230 replies in total). Sole practitioners are marginally under-represented in the sample. Where possible the data was adjusted by the RCLS consultants to allow for any bias, although necessary adjustments were found to be small. As well as questions on earnings by age, the survey also provides information on net profits for self-employed principals.

The second survey covered the earnings of solicitors and their staff in Commerce and industry. The Law Society carried out a survey of the members of its Commerce and Industry Group for this purpose. In 1977 these numbered 1150. A substantial number of solicitors employed in industry and commerce are not members. However, the Law Society regards the sample as representative of those practising law in this area. The response rate to this survey was low, 38 per cent of the organisations approached replied, giving information on 563 solicitors. Nonetheless, the

(7) The follow up to the 1971 census provides too small a sample for analysis.

results were regarded by the Royal Commission as giving a useful illustration of the earnings of solicitors employed as legal advisors in industry and commerce. This survey did not actually collect information by age but a reasonable approximation is given by years of admission (see RCLS (1979) Vol II Annex 17.3).

The survey of income at the Bar covered all barristers in practice during 1976/77. Over 4000 barristers were approached and an overall response rate of about 55 per cent was achieved. The RCLS concluded that, although the response was uneven between seniority categories, "this did not distort the overall results to a material degree" (RCLS 1979 Vol II para 18.13). The survey of barristers employed in industry and commerce was, as for solicitors relatively small, but is regarded by the RCLS as fairly representative.

A similar set of surveys was also conducted on behalf of RCLS (Scotland); in this case covering the tax year 1977/78. Of necessity the sample sizes for the Scottish surveys are considerably smaller than those for England and Wales. The data are regarded by the RCLS (Scotland) as of good quality and representative of the profession. This information has already been used by Mulvey (1980) to undertake rate of return calculations.

Adjustments to the basic age earnings profiles for legal professions

As described above for medical professions it is necessary to adjust the basic age earnings profiles for legal professions to:

- (i) reflect a typical career profile including the normal pattern of education/training/employment
- (ii) reflect the differences between self-employed persons and employees as regards pension provisions and capital outlay.

Both these adjustments are necessary for the data for 1955/56 from the RCDDR surveys. They are therefore described in detail to illustrate the methodology. The raw age earnings profiles based on RCDDR data for Solicitors and Barristers in England and Wales are given in columns (1) and (4) of Table 6.8.

The first set of adjustments converts this to a more typical "career profile" (columns 2 and 5). In the case of legal professions the data presented in the RCDDR report is representative of all legal professions, the only adjustment to achieve a "career profile" therefore is to correct the earnings of those aged below 25 to reflect a typical education/training/employment profile. For solicitors in England and Wales a typical profile for someone qualified at 'A' level is a four year degree level course in law and a 2 year vocational course serving articles. We have assumed that for 4 years the individual receives a student maintenance grant together with vacation earnings and thereafter earnings at the appropriate rate for a salaried legal executive/solicitor in private practice. Since 1970, after completing the qualifying examinations the student is only allowed to set up in practice on his own account or in partnership after a further period of 3 years restricted practice. This adjustment reduces the average yearly income of a prospective solicitor from £400 to £323 per annum in 1955/56. The adjustments for Scotland are similar.

For Barristers the typical profile is somewhat different. A three year law degree is most common followed by a 1 year vocational course, leading to the Bar Final. After call to the Bar a barrister serves a year's pupillage and for the first six months of this is not permitted to accept work on his own account. Adjusting the earnings of prospective barristers results in a reduction from £350 to £226 per annum for those aged 20-25. The typical arrangements for advocates in Scotland are slightly different, here we follow Mulvey (1980b, Appendix 1).

The second set of adjustments reduces the gross age earnings profile by 14 per cent to make allowance for the provision of a pension and by around 10 per cent to account for the capital outlay typically incurred by a solicitor setting up in private practice. Both these adjustments are only assumed to apply to self-employed lawyers. No adjustments are required for lawyers employed in industry or in private practice. The overall adjustment is therefore scaled so as to apply to the proportion of self-employed only. If this proportion is S and the desired percentage deduction from gross income is D per cent, the overall adjustment factor applied to all solicitors is $(1 - \frac{D}{100} \times S)$. Since S varies across age groups, the adjustment factor is not the same for all ages.

For later years there is a separate age earnings data for principals in private practice and so their earnings can be adjusted directly. For barristers the profile is adjusted for pension provision only. The only significant capital outlay for most barristers is connected with the purchase of wig and gown and a "joining fee" at the start of their career and makes very little impact when spread over the complete age earnings profile.

Table 6.8 Adjustments to age-earnings profiles for lawyers 1955/56

Age	Solicitors			Barristers		
	Original Profile	Career Profile	Self Empl. Adjustments	Original Profile	Career Profile	Self Empl. Adjustments.
20-24	400	323	323	300	226	226
25-29	760	760	722	450	450	389
30-34	1120	1120	930	780	780	674
35-39	1393	1393	1143	1306	1306	1128
40-44	1978	1978	1602	2301	2301	1988
45-49	2180	2180	1744	2337	2337	2019
50-54	2400	2400	1926	2337	2337	2019
55-59	2774	2774	2164	2100	2100	1814
60-65	2774	2774	2191	1700	1700	1469
65+	2114	2114	1670	1090	1090	942

Sources: RCCDR (1960, p.282 and 284) and own estimates. See text for further details.

Results for Legal Professions 1955/56-1976/77

Using the RCDDR data without any adjustment we obtain estimates of rates of return for solicitors of 16.5 per cent and for barristers of just over 13.0 per cent. The lower figure for the latter confirms the differential noted by Mulvey for Scotland 1977/78. After adjustment to provide a more representative career profile the figures obtained in Table 6.9 are obtained. For both groups a small reduction of 0.5 - 1.0 percentage points results. For solicitors in England and Wales the expected average private rate of return is 16.0 per cent. In Scotland the figure is significantly lower at 12.0 per cent. For Barristers in England and Wales the expected return is 12.5 per cent. After adjustment for pensions and capital outlay for self-employed Solicitors the estimates are reduced to 14.0 for England and Wales and 10.5 per cent for Scotland. For barristers the adjustment for pension provision results in a fall to 10.5 per cent.

Also shown in Table 6.9 are corresponding estimates for 1976/77 (or 1977/78 in the case of Scotland). As far as it is possible to judge there are no major differences between the data sets on which the results for the two years are based. Both cover all lawyers, employed and self-employed, those in private practice and those employed in industry and commerce. Both sets of surveys covered a large proportion of the total population and had good response rates.

The results for the more recent period suggest a decline over the 20 year period, although nowhere near as large as that obtained for doctors. For all solicitors in England and Wales the estimate for 1976/77 is 13.0 per cent before further adjustment, a drop of 3 percentage points. For solicitors in Scotland and for barristers a smaller decline is evident.

After adjustment for pensions etc., the same conclusion applies. For all solicitors in England and Wales the adjusted return is 11.5 per cent. The corresponding figure for Scotland is 9.5 per cent. For barristers the estimate for England and Wales is 10.5 per cent after adjustment while for Scotland advocates command a return of 7.5 per cent.

Table 6.9 Rates of Return for Legal Professions

	per cent					
	1955/56		1976/77		1977/78	
	unadjusted	adjusted ^a	unadjusted	adjusted ^a	unadjusted	adjusted ^a
All Solicitors						
England & Wales	16.0	14.0	13.0	11.5	-	-
Scotland	12.5	10.5	-	-	11.5	9.5
All Barristers/Advocates						
England & Wales	12.0	10.5	11.5	10.5	-	-
Scotland	-	-	-	-	8.0	7.5

Sources : 1955/56 from RCDDR (1960) Appendix III.
1976/77 from RCLS (1979) Sections 16-20.
1977/78 from RCLS (Scotland) 1980, Appendices 7-12.

Notes : (a) Adjusted for pension provisions and capital outlay as discussed in the text.

It is possible to examine the situation in 1976/77 in somewhat greater detail since the RCLS surveys distinguish various groups of lawyers. In private practice, self-employed principals are distinguished as well as salaried employees. The unadjusted result for a person who becomes a partner or self-employed is 16.0 per cent. After deductions for capital outlay and pension provision this falls to 12.5 per cent. This, however, is still substantially above the 6.5 per cent figure expected by someone who remains an employee (Above the age of 35 less than 10 per cent of lawyers remain at this level according to surveys carried out by the RCLS).

For Barristers in private practice the return is significantly less than for solicitors. Mulvey explains a similar result for Scotland in terms of a significant negative compensating wage differential in favour of barristers and advocates. Their work it is argued involves a very high degree of "job satisfaction" and those who are successful in reaching the peak of their profession are the subject of great public admiration.

In Table 6.11 we present results for lawyers employed in industry and commerce. In addition to data from the RCLS surveys the NBPI and the Bar Association for Commerce Finance and Industry (BACFI) survey data are used to calculate additional estimates for 1966/67, 1970/71 and 1980/81. These results confirm the decline noted above. They suggest that it has probably flattened out during the late 1970s. Regrettably no comparable information is available from the RCDDR surveys from 1955/56 to assess whether there was any change up to the mid 1960s or whether the whole of the decline has occurred since then. Some information from the follow up to the census of 1966 may throw some light on this question. These results are discussed below.

For solicitors in industry and commerce the data from the NBPI (1968) report suggests an expected rate of return of about 17 per cent in 1966/67. By 1976/77 the RCLS survey data suggests a fall to 12.5 per cent (although

Table 6.10 Further results for lawyers in private practice in
England and Wales 1976/77.

		per cent
<hr/>		
Solicitors		
self employed	16.0	(12.5) ^a
principals or partners		
Salaried employee	6.5	n/a
Barristers		
in private practice	10.5	(9.0) ^b
<hr/>		

Notes (a) Adjusted for pension provision and capital outlay.

(b) Adjusted for pension provision.

Table 6.11 Further results for legal professions in industry and commerce

		per cent	
		Fringe benefits excluded	included
<u>Solicitors</u>			
In industry and commerce, England and Wales	1967/68 ^a	17.0	-
	1976/77 ^b	12.5	14.0
	1980/81 ^c	12.5	-
Scotland	1977/78 ^d	9.5	-
<u>Barristers</u>			
In industry and commerce England and Wales	1970/71 ^e	14.0	-
	1976/77 ^f	12.5	13.0

Data sources for age earnings profiles

- (a) NBPI (1968)
- (b) RCLS (1979)
- (c) BACFI (1981) (Solicitors and Barristers)
- (d) RCLS (Scotland) 1980)
- (e) RBDDR (1972)
- (f) RCLS (1979)

this is raised to 14.0 per cent if various fringe benefits are included. For barristers in industry and commerce a value of around 14.0 per cent is estimated for 1970/71. By 1976/77 this had fallen to 12.0 per cent. A survey for barristers and solicitors combined for 1980/81 by BACFI (1981) suggests little change in the late 1970s.

The results from the post censal survey of earnings in England and Wales for 1966/67 provides some further information on developments during the 1960s. However, this data covers all legal occupations including solicitors, barristers and judges and is not directly comparable to the results for 1955/56 or 1976/77. After making adjustment for capital provision and pensions assuming a similar proportion of self-employed to that in the other two years, the estimated rate of return was 17.0 per cent for 1966/67. Unfortunately the sample size for the post 1971 census data is too small to allow a corresponding calculation to be undertaken for 1971/72 as we have done for other professions.

The census based estimates appear high compared with the other results. The bulk of lawyers (over 82 per cent in England and Wales during 1976/77) were solicitors. We should therefore expect the figure for all lawyers to be closer to the earlier estimates for solicitors than to those for barristers. Furthermore the inclusion of judges, QCs etc., may raise the average earnings profile somewhat. The overall impression is that the rate of return to becoming a lawyer did not decline between 1955/56 and 1966/67 and probably increased. After the mid 1960s the results for lawyers employed in industry suggest a decline took place until the end of the 1970s when rates of return levelled out at about 12-13 per cent. For barristers the evidence for a decline is less clear cut. This may be related to the greater importance of non-wage compensating factors for those called to the bar as discussed below.

Comparison with Mulvey's results for Scotland

Mulvey's main results (Mulvey 1980b) are computed using as a comparison income profile the earnings of ^{an} unqualified legal assistant. This, he argues, is a better measure of the income foregone by someone not undergoing degree type training. Even this measure is, however, far from ideal as Mulvey admits. In addition to not possessing qualifications, such a group may well be different in many other respects from those undertaking degree level training. The main implication of using this profile is that, since it lies below that for all male workers, higher estimates of rates of return are obtained. However, Mulvey also presents results based on an all workers profile which enables a direct comparison of our results with his. Such a comparison is made in Table 6.12. Our basic result for Solicitors is 11.5 per cent compared with Mulvey's figure of 14.0 per cent. The bulk of this difference is explained by the fact that Mulvey adds 2 per cent to his estimates to reflect the secular growth of real incomes. Part of the difference also arises from the fact that we have adjusted our C_t profile for inflation between the tax year 1977/78 and April 1977. This "timing" adjustment increases the C_t profile reducing the rate of return by 0.5 per cent compared with Mulvey. A second contributory factor is that whereas Mulvey uses the C_t profile for 16-19 year olds as published in the NES the figure we have used is adjusted so as to be comparable with results pre ROSLA as discussed in Chapter 8. This adjustment makes a difference of 0.5-1.0 per cent. As shown in the table, together these points entirely explain the discrepancy. For advocates the sources of the differences are much the same.

Table 6.12 Comparison with estimates by Mulvey (Scotland)

	per cent	
	Solicitors	Advocates
Basic results ^a	11.5	8.0
After adjustment for capital outlay	10.5	8.0
After adjustment of C(I) profile for timing	11.0	9.0
After adjustment of C(I) profile for age of 16-19 year olds	12.0	9.5
After addition of 2% for secular growth in incomes	14.0	11.5
Mulvey's result ^b	14.0	11.5
Unexplained	-	-

Sources and Notes (a) Table 6.9 above.

(b) Mulvey (1980b,p.256). Includes adjustment for
capital outlay

(c) For details of adjustments see text.

Conclusions

Using information from various sources, we have been able to paint a fairly broad prush picture of the returns to entering the legal profession in Great Britain. It will perhaps come as a surprise to some people that the returns are not particularly high compared with groups such as scientists and engineers. The results would not support Siebert's assertion that there is 'strong evidence of the successful exertion of monopoly power' (Siebert, 1977, p.34). This point is re-inforced once adjustments for pension provision, capital outlay and so on are taken into account, factors which Siebert does not consider. In the case of solicitors for example, the basic rate of return for self-employed principals is estimated as 16.5 per cent in 1976/77. After adjustments this reduces to 12.5 per cent, the same as for solicitors employed in private industry and commerce. For barristers the adjusted return for private principals is significantly less than for those employed in industry.

Although the comparison of the changes in the estimates between 1955/56 and 1976/77 is probably less than perfect, the downward trend suggested is supported by information from the post censal survey and from surveys of lawyers working in industry. The precise timing of this decline is open to considerable doubt but the limited information available suggests that, as for many other professions, the main changes occurred during the late 1960s and early 1970s.

The various groups of lawyers distinguished have all experienced falling rates of return. There are, however, clear differences between certain groups. An important example of this is the difference in all the results between lawyers in Scotland and those in England and Wales. In part, this is a reflection of the importance of London as a business centre and the existance of London allowances, which raise the average income levels of those in England and Wales. Regrettably, there is insufficient information

to assess accurately the importance of this factor. The earnings and incomes of those working in London range from around 10 per cent higher for employed solicitors in commerce and industry to much larger differentials for London Chancery and specialist QCs compared with those on the circuit. The proportion of lawyers working in London is also not available from published statistics but, for principals in private practice, these accounted for 40 per cent of the total. Assuming lawyers in London earn on average 15 per cent more than those in the remainder of England and Wales and that they account for 40 per cent of the total number, then the "London factor" might explain about 1 percentage point of the Scotland-England and Wales differential in rates of return. In general, the differential is of the order of 2-3 percentage points so this is clearly only part of the explanation.

There is also a clear differential in rates of return between solicitors and barristers and advocates. Mulvey explains this in terms of a difference in entrepreneurial role (this being more important for solicitors) and a compensating negative wage differential for advocates. The entrepreneurial factor implies that some of the income differential favouring solicitors is a return to being a self-employed entrepreneur. We have adjusted the results for principals to reflect some of the costs of entering business. This adjustment is larger for solicitors than for barristers or advocates, narrowing the differential slightly. A considerable differential (2-2.5 percentage points) remains however. Much of this is probably attributable to the fact that the prestige and potentially very high incomes for the successful minority who undertake a career at the bar outweigh the disadvantages of a more costly and lengthier period of training. A further piece of indirect evidence supporting this view is that the rate of return estimates for solicitors and barristers employed in industry and commerce are virtually identical. The non-wage compensation factor would, of course, not be expected to apply in this case and this is what we observe. The fact that the earnings of those at the bar are largely determined by non-market considerations may also explain why practising barristers appear not to have suffered the fall in expected returns common to many other groups including solicitors and barristers in commerce and industry.

6.4 Business Professions

Amongst business professions we include such groups as accountants, actuaries, statisticians and economists. Information on the earnings of the first two of these groups is very limited. More regular surveys have been carried out concerning the last two categories.

The surveys carried out under the aegis of the RCDDR in 1955/6 covered both accountants and actuaries. That for accountants was a one in ten sample drawn from a list of corporate members of the Institute of Chartered Accountants in England and Wales, the Institute of Chartered Accountants of Scotland and the Society of Incorporated Accountants. The survey of actuaries covered about 75 per cent of the membership of the Institute of Actuaries and the Faculty of Actuaries. In 1968 the Institute and Faculty undertook a further survey on a corresponding basis. Regrettably the Accounting Institutions did not follow this example. However, the results from the follow up to the 1966 census does provide information on the earnings of qualified "accountants, professional company secretaries and registrars". More recently other surveys have been carried out by, for example, Accountancy Personnel but these have not covered earnings by age.

The earnings of business economists have been surveyed by the Society of Business Economists since 1964. The surveys conducted were of the membership of the society and are thus not necessarily representative of all economists. One possible source of bias common to some of the other professional groups we have considered is that this group is heavily concentrated in London. The profiles constructed from this data may therefore reflect London allowances. However, a comparison of relative earnings for this group between those in the GLC and the rest of the United Kingdom suggests that this bias is quite small. Therefore, no explicit adjustment was made to the age earnings profiles on this account.

Surveys were conducted for October 1964, 1968 and 1969 and for January 1973, 1975 and 1980. The data are based on a response rate of around 50 per cent of the total membership of the Society. The sample size is however small at about 300 on average and so the possibility of sampling error is quite large. Nevertheless the data does appear to produce a fairly "well behaved" age earnings profile at each point in time.

The Institute of Statisticians has carried out various surveys of its members earnings since 1967/68. We have been able to obtain data on age-earnings profiles from the surveys carried out in 1967/68, 1968/69, 1970/72 and 1977/78. The response rate to the questionnaire ranged from over 70 per cent in 1967/68 to just 47 per cent in 1970/71, this from a total membership of about 600-700. The problem of small sample size and possible bias therefore arises for this group also.

The Results

The average private return to becoming a business economist is summarised in Table 6.13. In contrast to the results for other groups these suggest a rise during the 1960s from 18.5 per cent in 1964/65 to 22.5 per cent by 1969/70. Then a decline occurred to about 16.5 per cent by the mid 1970s before a levelling off at around 16 per cent at the end of the decade. The overall values obtained for all years are well above average for salaried professions. (For a more detailed comparative analysis see Chapter 5). As noted above only a very minor part of this difference (well below half a percentage point) can be attributed to the inclusion of London weighting allowances for a large proportion of the sample. Given the absence of any obvious restrictions on entry to the profession and the lack of any means to directly govern the overall rate of remuneration these high rates of return would appear to be the result of market forces.

We have no clear idea of how representative our sample is of all econo-

Table 6.13 Rates of return for Economists and Statisticians

	per cent	
	Business Economists	Statisticians
1964/65	18.5	-
1967/68	-	21.0
1968/69	20,5	19,5
1969/70	22.5	-
1970/71	-	22,0
1972/73	19.0	-
1974/75	16.5	-
1977/78	-	12.0
1979/80	16.0	-

mists. Some evidence on this can be gleaned by comparing the data from our age earnings profiles with material collated by Booth and Coats (1978). In Table 6.14, the earnings of business economists aged 20-25 are compared with starting salaries for economists. This comparison is far from ideal for various reasons. The information on starting salaries presented by Booth and Coats is of movements in the minimum point on the scale for university staff and the minimum point on the Economic Assistant scale for government economists. Neither of these can be regarded as reliable indices of starting salaries since they may not reflect market conditions. There is considerable evidence that new appointees, often possessing above average qualifications are offered salaries over the minimum in periods of scarcity. A second problem is that the figure for business economists age 20-25 will include various incremental payments and will therefore be higher than a true starting salary figure. If we assume that business economists normally do not go in for post graduate training (this was true of 85 per cent of the sample for 1969), then the 20-25 year average income figure will typically apply to those on average aged about 23. Assuming a steady rate of incremental increase for individuals in their 20s the data suggests each increment is worth about 10 per cent of the 20-25 year old average income. For 1964 therefore, to arrive at a starting salary, $1-1\frac{1}{2}$ increments should be deducted from the figure of £1000 per annum shown in the table i.e. £100-150, giving a starting salary of £850-900. For 1975 the corresponding adjustment is from £3571 per annum to £3000-3200. Given these adjustments and subject to the problem of interpreting minimum points on salary scale as starting salaries, the comparisons suggest that the earnings of business economists were not exceptional, at least for 20-25 year olds. Some further evidence comes from the comparison of earnings of various social scientists reported by Westoby et al (1976 p.12). These suggest that, although the position of economics graduates had declined relative to other

Table 6.14 Starting Salaries of Business and other Economists

	Academic ^a	Government ^d	Business (1) ^e	Business (2) ^f	Business adjusted ^g
1964	1050	541	1245	1000	850-900
1968	1240 ^b	1051	-	1450	1225-1300
1969	1350	1145	1570 ^h	1800	1530-1620
1973	1929	1928	-	2500	2125-2250
1975	3174 ^c	2860	3200	3571	3000-3200

Sources and Notes: (a) Booth and Coats (1978) Table 6
 (b) 1967 value
 (c) Excluding threshold payments
 (d) Booth and Coats (1978) Table 6
 (e) Booth and Coats (1978) Table 6. Based on advertisements in the Economist.
 (f) Society of Business Economists. Earnings of those aged 20-25.
 (g) As(f) adjusted as described in text.
 (h) 1970 value.

groups compared with the 1950s and early 1960s, economists did unusually well even in the early 1970s, only more recent graduates in business studies receiving higher remuneration in 1972. Thus, on the basis of this rather limited evidence, the returns estimated for business economists may not be an unrealistic estimate of those to be expected by professional economists in general.

Turning to statisticians, we find that as for economists in the late 1960s and early 1970s expected rates of return were high relative to most other groups at about 20 per cent or more (see Table 6.13). The age earnings profiles for this group are much less well behaved than for any other and so it is difficult to know whether the fluctuation around the end of the 1960s decade has any meaning. By the end of the 1970s this picture altered sharply with a fall to 12 per cent, still favourable relative to most other professions but a much more rapid decline than that experienced by business economists.

The response to the 1977/78 survey was good (75 per cent of the institute's membership of about 800 replying to the questionnaire). One possible source of confusion however is that in the 1977/78 survey for the first time the question on income made an explicit attempt to distinguish between income from employment and self-employment. Previous surveys had been rather vague on this distinction. However, even if we assume a more comparable data set includes income from self-employment, then the rate of return estimate is only increased slightly from 12 to 12.5 per cent for 1977/78.

The results for the remaining groups amongst business professions are summarised in Table 6.15. For both accountants and actuaries the problem of income from self-employment arises. Approximately a quarter of accountants were self-employed principals. Adjusting the data on earnings by age to take into account the need for pension provision and capital outlay in the

same way as described for legal professions, reduces the estimated rate of return for accountants from 17 per cent in 1955/56 to 16.0 per cent. The adjustment for actuaries is less straightforward. No information is available on the proportion of the total sample who were self-employed. Furthermore the sample published in RCDDR (1960) explicitly excludes those in associate membership. This also biases the results upwards by an unknown amount. All one can safely conclude is that the estimate of 22 per cent in the table is probably a considerable overestimate for the typical entrant to this profession. Similar remarks apply to the estimate of 27.5 per cent for 1968/69. These two estimates are however comparable with each other so, although the return for actuaries relative to other groups is exaggerated, there is some indication that, contrary to the experience of almost every other professional group, expected rates of return rose between 1955/56 and 1968/69 and appear to offer prima facie evidence of restricted entry.

The results from the follow-up to the 1966 census suggest that for accountants there was very little change between 1955/56 and 1966/67. However, the inclusion of company secretaries and registrars may bias the results. If such persons have higher than average incomes than accountants in general, then this would tend to bias the results for 1966/67 upwards. The inclusion of these persons seems most likely to affect earnings of older age groups, however the impact on comparisons over time is probably not very significant. Again an adjustment for pension provision and capital outlay for self-employed principals is required. This reduces the basic estimates from 16.5 to 15.0 per cent. Estimates based on the follow-up to the 1971 census are on a corresponding basis to those for 1966/67. These suggest very little change over this five year period. This is broadly in line with the experience of economists over the period from the mid 1960s to the early 1970s. Compared with most other professions, accountants have apparently experienced very little erosion of differentials and expected returns were little different in the early 1970s to those in 1955/56.

Table 6J5 Rates of return for Accountants and Actuaries

	per cent		
	Accountants unadjusted	Accountants adjusted ^a	Actuaries
1955/56	17.0	16.0	22.0
1966/67	16.5 ^b	15.0 ^b	-
1968/69	-	-	27.5
1971/72	17.0 ^b	16.0 ^b	-

Notes: (a) Adjusted for capital outlay and pension provision
for self-employed accountants.

(b) Includes company secretaries and registrars.

Unfortunately, there is no comprehensive survey of earnings by age for accountants for years subsequent to 1971/72. A rough idea of developments since then can however be achieved using data collected by Accountancy Personnel (1982). This data does not give a complete age earnings profile and also does not give estimates for the country as a whole. Nevertheless, a crude age earnings profile for accounts in London can be constructed. This has been done for 1971 and 1981. Rates of return calculated on this data are 16.5 per cent for 1971 and 14 per cent for 1981 before any further adjustments. Although these estimates are based on much weaker data than those for earlier years, the comparison between the 1971/72 result for all accountants and that for 1971 for London based accountants suggests this data can be used as a rough guide to trends in the 1970s. This evidence suggests some decline in rates of return for accountants may have occurred between 1971 and 1981. The decline on this basis does not appear to be as rapid as for many other professions however and still leaves accountants with a relatively high expected reward to investment in their career. The average annual income for all ages in 1981 appears to be broadly comparable with a more comprehensive survey of all accountants reported in the Financial Times (Small and Stone, 1982), which reinforces the notion that these estimates provide a reasonable guide to recent trends.

6.5 Architects and Surveyors

Both architects and quantity surveyors were covered by the RCDDR surveys. For 1955/56 a one in five sample of the corporate members of the Royal Institute of British Architects (RIBA) was taken. This includes all classes of membership including associates and licenciates. The total sample size was 2980. For surveyors a one in three sample of the fellows and associates of the Royal Institution of Chartered Surveyors was taken. Response rates to both surveys were good and the results can be regarded as representative of these two professions.

RIBA has conducted further surveys of its members earnings for 1964, for 1970 and annually since 1973. These cover the whole of the United Kingdom whereas the RCDDR survey was for Great Britain only. A comparison made by the NBPI (Report no.71) indicates that there was no significant difference between the two. It has been possible to collect together age earnings profiles for the years since 1970 and these data provide the main basis for the results in this section. The surveys provide breakdowns between principals and salaried employees and for the latter distinguish the main area of employment. The NBPI carried out its own survey of architects' earnings in 1967/68 (NBPI, 1968a). A good response rate of over 85 per cent was achieved to its sample survey of over 4000 architects. This survey provides similar information to the RIBA surveys.

The Institute of Quantity Surveyors conducted a survey of its members in 1967/68. Regrettably the published information does not enable an age earnings profile to be constructed although a question on age was put. A further survey conducted in 1980 repairs this omission and enables a broad comparison to be made with architects. The sample size of around 3000 is again quite large and the results appear representative of the profession generally.

In addition to the surveys by the professional institutes, the follow up surveys to the 1966 and 1971 censuses provide further information for both those qualified in architecture and other vocational subjects and those in the occupational category "surveyors, architects".

Results for architects and surveyors

In Table 6.16 developments between 1955/56 and 1980/81 are summarised for both professions. A more detailed analysis for architects is given in Table 6.17. The estimates given in the first table are not adjusted for capital outlay and pension provisions for self-employed persons. The results for architects are presented for three different assumptions about course length. Probably the most common is a four year course and so the more detailed results for this group are all based on this assumption.

In 1955/56 the average private return to attaining professional status as an architect ranged from 12.5 to 16.5 per cent depending on the length of course assumed. In practice those undertaking longer courses may receive higher incomes so this range may exaggerate the difference. For quantity surveyors the expected return was very similar. Assuming a three year course, the return expected was 17.0 per cent.

By 1966/67 the rate of return for both occupational groups combined suggests a slight increase compared with 1955/56. For architects, assuming a 4 year course, from 14.5 to 16.5 per cent and for surveyors, assuming a three year course, from 17.0 to 18.5 per cent. The two data sets on which these comparisons are made may not be directly comparable. There is though, no obvious reason why the results from the census follow up should be biased upwards. The census data also enables a calculation of rates of return for those qualified in vocational subjects (the great majority of whom studied architecture). The estimates on this basis for architects are somewhat lower and in fact almost identical to those obtained for 1955/56. The possibility of an increase in rates of return for architects as a professional group is confirmed by information from the NBPI report for 1967/68. Assuming a four year course the estimated rate of return is 18.5 per cent for all architects. By the end of the decade however the results of the post censal survey for 1971/72 and the RIBA surveys suggest a significant decline. The results from the post-censal survey suggest a return of 13.5 per cent assuming a

four year course for the occupational group surveyors and architects, while the corresponding return for those studying vocational subjects fell to 10.5 per cent.

The RIBA survey of architects provides some indication of how things have developed during the 1970s. Estimates for all architects for 1973/74 confirm the results from the Census follow up. The estimate of rate of return using the RIBA survey and assuming a four year course, is about 12 per cent for all architects. The results for subsequent years suggest a downward trend through the decade and by 1980/81 the estimated rate of return is just 8 per cent for all architects.

For quantity surveyors we have much less information. The survey of the Institute of Quantity Surveyors for 1980/81 suggests a return of 6.5 per cent for salaried staff.⁸ Again it cannot be claimed that the results from this survey are directly comparable with that for 1955/56 or the Census follow-up surveys although there are no obvious sources of bias. Nevertheless, the fact that the return to this professions has generally been very close to that for architects and that the fall to around 8 per cent has also been observed for the latter, suggests that this result for quantity surveyors is probably broadly comparable with estimates for earlier years.

In Table 6.17 a more detailed analysis is presented of the results for architects. In this table separate estimates are calculated for principals, making adjustments for capital outlay and for pensions. Results for salaried architects are presented for those in private practice, local government, central government and other employment (education etc.).

(8) Including self employment income raises this estimate to 7 per cent.

The estimates for 1967/68 are based on the NBPI (1968a) report. Those for later years rely on data from RIBA surveys. Not surprisingly, the return for self-employed principals is greater than for all salaried staffs before allowance is made for the return to physical capital or the need to purchase an annuity to obtain pension provision equivalent to those available to employees. In 1973 the return for principals was 14.5 per cent compared with 11.5 per cent for all salaried architects and 11 per cent for salaried staff employed in private practice. By 1980 the corresponding figures were 9, 7.5 and 5.5 per cent respectively. This basic ranking is preserved throughout the decade.

Following the methodology adopted for legal and medical professions the income of principals is deflated by 7.5 per cent to allow for capital outlay and by 14 per cent to allow for pension provision in order to make the comparisons with salaried staff more meaningful.

These adjustments combined, result in estimates of the return to principals that for some years actually fall below those expected by salaried staff in private practice. This is before any account is taken of the entrepreneurial aspects of the principal's job. It suggests that for architects the adjustment made for capital outlay and pensions may be too large. Alternatively some of the non-pecuniary benefits of being self-employed may be sufficient to offset the risks and entrepreneurial burdens associated with this status. Certainly these results suggest that, if principals' incomes are accurately reported, they are not making excessive profits.

The returns for those employees in government and other employment are always higher than those in private practice by 1-2 per centage points.

Table 6.16 Rates of return for architects and surveyors

Assumed length of course (years)	Architects			per cent
	3	4	5	Quantity surveyors 3
1955/56 ^a	16.5	14.5	12.5	17.0
1966/67 occupation ^b subject ^c	18.5 16.5	16.5 14.0	14.5 12.5	18.5 ^f
1967/68 ^d	21.5	18.5	16.0	-
1971/72 occupation ^b subject ^c	16.0 12.5	13.5 10.5	12.0 9.0	16.0 ^f -
1980/81 ^e	8.5	8.0	7.5	5.5

Sources and Notes: (a) RCDDR (1960)

(b) Follow up to 1966 or 1971 census; occupational category "surveyors, architects".

(c) Follow up to 1966 or 1971 census; those with a first degree or equivalent qualification in "vocational subjects" (primarily architecture).

(d) NBPI (1968a); all architects.

(e) RIBA survey; all architects.

(f) Based on same profile as for architects.

(h) Excludes self employment incomes

Table 6.17

Detailed results for architects^a

	per cent							
	1967/68 ^b	1973/4	1975/6	1976/7	1977/8	1978/9	1979/80	1980/1
Principals	21.8	14.5	10.5	10.0	13.5	9.5	8.5	9.0
Adjusted for: capital outlay	20.5	12.5	9.5	9.0	12.0	8.0	7.5	8.0
capital outlay and pensions	18.5	11.0	7.5	7.0	9.5	6.0	5.0	5.5
All salaried	17.5	11.5	9.5	9.5	9.0	7.5	6.5	7.5
Private practice	16.5	11.0	8.0	8.0	7.5	6.5	6.0	5.5
Local Gov't)	18.0	12.0	9.5	10.0	9.5	7.5	6.5	8.0
Central Gov't)		12.0	11.0	11.0	9.5	8.5	7.0	9.5
Other	20.0	12.5	9.5	9.5	9.5	8.0	8.0	7.5

Sources: (a) Based on RIBA surveys, except where indicated.

(b) NBPI (1968a).

The precise ranking of these three categories varies. This variation is no doubt due, at least in part, to sampling errors and random noise in the data but also to differences in timing and size of major pay settlements in these sectors. The return for those in local government is usually lower than in the other two areas. In 1973 it was 12 per cent compared with 11 per cent in private practice and around 12.5 per cent in central government and other employment. By 1980 the return in local government had not fallen as rapidly as in private practice (to 8 and 5.5 per cent respectively). The return in central government had also held up at 9.5 per cent while that in other employment fell steadily after 1973 from 10.5 to 7.5 per cent.

The results presented in Table 6.16 covering the period 1955/56 to 1980/81 are not entirely consistent with those presented in Table 6.17 because the former make no adjustment for capital outlay or pensions for self-employed architects or surveyors. This is done in Table 6.18 where we present results on a consistent basis for 1955/56 to 1980/81. Deductions for pension provision and capital outlay for self-employed persons are made to the basic profiles as described above for principals. The proportion of self-employed persons was derived either from the basic earnings surveys (e.g. RCDDR 1960) or based upon data from the census of population. This summary table shows a clear pattern of rising rates of return up to the mid 1960s followed by a steady decline thereafter. This decline has been especially marked for surveyors.

Table 6.18 Rates of return for architects and surveyors
adjusted for self-employment incomes

	per cent	
	All architects ^{a,c}	Surveyors ^{b,c}
1955/56	13.5	16.0
1966/67	16.0	17.0
1967/68	17.5	-
1971/72	13.0	15.0
1973/74	11.5	-
1975/76	9.0	-
1977/78	9.0	-
1980/81	7.0	5.5

Notes: (a) Assuming a four year course.

(b) Assuming a three year course.

(c) Estimates adjusted for pension provision and capital outlay for self-employed persons.

6.6 Teachers

The study by Birch and Calvert on the return to teaching qualifications has already been referred to in Chapter 2. This paper (Birch and Calvert, 1973) presented estimates of the average private rate of return to various bundles of teaching qualifications for 1970. The methodology adopted was very similar to that used here. Birch and Calvert used information on earnings by age published by the DES to estimate the $B(I)$ profile and NES data for all workers to proxy the C_t profile. In this section we present further estimates of rates of return for teachers covering the period 1962-1979 on a broadly comparable basis. Most of these estimates are based upon the same DES data set but other information on earnings by age is also used to supplement this material. In addition rates of return are also calculated for those entering careers in further education and university lecturing. These are discussed in Section 6.7

The Return to Becoming a School Teacher

Following our standard methodology, estimates of average private rates of return to becoming a teacher have been computed. There are, of course, various different career paths any individual may follow in order to become a teacher. Currently the most common pattern is a four year course of study involving either a B.Ed. course or a first degree and Post-Graduate Certificate of Education (PGCE). In 1962 the 3 year certificate course was being introduced and many first degree graduates entered teaching without a PGCE. In the results presented we abstract from these changes in the pattern of initial training. Two basic assumptions are made. A graduate is assumed throughout to take a 3 year first degree course plus a PGCE, while a non-graduate is assumed to take a 3 year certificate course. This assumption facilitates comparisons over time, assuming that like is compared with like. The return actually achieved by graduates not taking a PGCE in the early years will, of course, be underestimated as will that for non-graduates undertaking courses of less than 3 years duration. Conversely, our estimates may over-estimate returns in recent years if the average size of the investment is greater than we have assumed. Since, however, the main feature of the results is the sharp decline in expected rates of return, allowing for such changes in training patterns would merely reinforce our conclusions.

The results are presented in Table 6.19. The information published by the DES (e.g. DES, 1980) distinguishes separate age earnings profiles for graduates and non-graduates, for teachers in primary and secondary schools and for males and females separately. We present estimates for each of these categories. This information has been published since 1961. These data are based on the Department's records of service and salaries of individual teachers. They cover all

Table 6.19 Average private rates of return for male teachers

		per cent ^c					
Year (March)		1962	1966	1970	1973	1976	1979
Primary	graduate ^a	8.5	7.0	5.5	2.0	4.0	1.0
	non-graduate ^b	6.0	4.5	4.0	0.5	4.0	1.0
Secondary	graduate ^a	10.5	9.5	8.0	4.5	6.0	3.0
	non-graduate ^b	6.0	5.0	4.0	0.0	3.5	0.5
Further	graduate ^a	15.0	13.0	11.0	6.0	8.0	5.5
Education	non-graduate ^b	10.0	9.5	8.0	3.5	6.0	3.5

Notes: (a) Assuming a four year course including post graduate year.

(b) Assuming a three year course.

(c) All estimates rounded to nearest 0.5 per cent.

maintained schools in England and Wales. A comparison of the results from this source with data from the follow-up to the 1966 census suggests that there are no significant differences, the two sources resulting in identical estimates of rates of return for all male teachers. The calculations have been confined to the following years, 1962, 1966, 1970, 1973, 1976 and 1979. From the results for these years it is possible to gain a clear impression of the underlying trends.

The outstanding feature of the results is the steady decline in expected rates of return over time. For a male graduate teacher in a secondary school the return to be expected from a career in teaching was 10.5 per cent in 1962. By 1973 this had fallen to about 4.5 per cent. To some extent the position was restored by the Houghton award in 1974 but already by 1976 the return had fallen to 6.0 per cent, and by 1979 the downward trend had continued. A graduate entering teaching in that year could anticipate a return of only 3 per cent on his investment in human capital. The position for non-graduate teachers and for teachers in general within the primary sector was even more gloomy. Even allowing for the shorter course of study, the expected return for a non-graduate was just 6 per cent in 1962. By 1973 it was insignificantly different from zero. After Houghton it increased to 4.0 per cent in 1976 but declined thereafter to less than 1 per cent by 1979. The absolute values of the estimated rates of return must be treated with a certain degree of circumspection. However, it seems clear from these results that in absolute terms, in terms of comparisons with recent historical experience, and relative to other groups, the rate of return to teaching for males was very low in 1973 and again at the end of the 1970s.

The detailed results for females are presented in Table 6.20. The basic features of the results are similar to males although, as is clear from Table 6.20, the absolute level is considerably higher. This result is common to most British studies that have calculated rates of return for females separately. It reflects, at least in part, the use of the all workers earnings profile as a measure of income foregone. This profile is much lower relative to graduate and professional groups for females than it is for males. In contrast, to males the earnings profiles for females are also adjusted for differences in activity rates between qualified and unqualified persons (see below for details). For graduates in secondary schools rates of return declined from 21.5 per cent in 1961/2 to 12.5 per cent by 1972/3. In contrast to males the impact of the Houghton award was much less dramatic and by 1975/6, rates of return were unchanged from the low of 1973. For females the beneficial effect of Houghton was probably offset by the impact of equal pay legislation on the earnings of women in general. Between 1970 and 1976 the earnings of manual females rose by 50 per cent more than those of manual men while for non-manual workers the gain was an extra 25 per cent. Equal pay was already the rule for teachers and so the effect of this change is to reduce the differential between B_t and C_t profiles. By 1979 the rate of return for female secondary school teachers was just 10.5 per cent, a fall of 11 percentage points since 1962. This compares with the male decline from 10.5 to 3.0 per cent.

The return to female graduates in primary school teaching is generally somewhat lower, and that to non-graduate teachers in both areas lower still. The latter results are based on the assumption of a 3 year course of study. The profile over time for each of these groups is very similar to that for graduate secondary school teachers.

Table 6.20 Average private rates of return for female teachers

		per cent ^c					
Year (March)		1962	1966	1970	1973	1976	1979
Primary graduate ^a		19.5	18.0	16.5	11.0	11.0	9.5
	non-graduate ^b	17.5	17.0	15.5	9.5	10.5	9.5
Secondary graduate ^a		21.5	20.5	18.0	12.5	12.5	10.5
	non-graduate ^b	18.5	18.0	16.5	10.5	11.0	10.0
Further Education graduate ^a		23.5	22.5	20.5	14.0	14.0	12.0
	non-graduate ^b	20.0	20.5	19.0	12.5	13.5	11.5

Notes: As for Table 6.19. All estimates in this table are also adjusted for participation. (See text for details).

It is interesting to compare our results with those obtained by Birch and Calvert. This comparison also serves to illustrate the sensitivity of the results to certain assumptions. The main differences are as follows:

- (i) Birch and Calvert use median earnings; we have used mean earnings to measure the age earnings profiles. Data on median earnings are not published by the DES. Birch and Calvert therefore calculated medians from the distribution presented in the DES volumes using graphical techniques.
- (ii) Birch and Calvert convert the earnings data as published from a 5 year grouped basis to an annual profile again using graphical techniques.
- (iii) Birch and Calvert adjust their profiles for survival, the probability of being unemployed and for economic activity. These adjustments are different for qualified and unqualified.
- (iv) They carry out their calculations using gross earnings without adjusting for taxation.
- (v) They make a slightly different assumption about the value of the student grant, using the nominal rather than actual value received.
- (vi) Finally, they adjust the comparison income profile to reflect the earnings of students so as to make the C_t profile representative of the whole population rather than those not undertaking investment in education.

For males the present result for graduate teachers in primary schools (5.6 per cent) is 3.1 per cent lower than obtained by Birch and Calvert (see Table 6.21). The sources of this difference can be analysed by altering the calculations step by step on to a more directly comparable basis to Birch and Calvert's results. Such an analysis is not definitive, however, since it is clear that the order in which the adjustments are made affects the size of the estimated effects. This is especially the case for females. For the latter there is also a powerful interactive effect especially between the tax and other adjustments. The other adjustments tend to move the C_t and B_t profile out of different tax brackets, making quite a large impact on the post-tax differential between B_t and C_t .

when some comparisons are made. For these reasons, too much should not be read into the precise values of the individual impact effects especially for females, for whom the overall impact of all of the effects is substantially greater than the sum of their individual parts. These caveats should be borne in mind throughout the following discussion.

From the table it is clear that for males the most significant differences arise from (i) and (vi). The first result arises from the fact that for teachers there appears to be very little difference in mean and median incomes. The earnings distribution does not appear to be skewed as is the case for the C_t profile. Consequently, estimated rates of return are significantly lower when mean profiles are used since the B_t profile is virtually unchanged but the C_t profile is some 2½-5 per cent higher. It might be argued that the individual is more interested in median earnings. This is because, due to the skewed nature of most income distributions, in general more people will attain this level of earnings than will achieve the average level. In fact, a measure such as the mode might be even more appropriate. From the social viewpoint, however, the mean or average value seems more useful as a measure of the overall returns to be expected averaged over all individuals. Often, because of data limitations, we have no choice. Since the DES publishes information on mean rather than median earnings we chose to use this measure. It also facilitates comparisons of social returns in Chapter 6.

The other main difference concerns the adjustment of the C_t profile to reflect students' incomes. While appropriate in Birch and Calvert's context, given their explicit statement that they are attempting to equate lifetime benefits for teachers with those for the whole population, this adjustment seems inappropriate if one is

Table 6.21 Comparison with results obtained by Birch and Calvert for 1970

	per cent	
	Male, graduate primary school	Female, graduate secondary school
Present result	5.6	15.7
Differences ^b due to:		
(i) median	+1.8	1.5
(ii) annualisation	-1.3	-2.0
(iii) participation ^a	-	1.5
(iv) tax	+0.3	2.5
(v) grant	+0.7	2.0
(vi) student income	+1.3	4.9
Interactive effect	-	4.0
Unexplained factors	0.3	-2.0
Birch and Calvert	8.7	28.1

Source: Own estimates; Birch and Calvert(1973 Table 1).

Notes: (a) Not significant for males.

(b) For definition of terms see text. Both absolute and relative size of these estimates are subject to quite large margins of error; see text for details.

attempting to proxy the income foregone by an individual planning to become a teacher. Of course, such an individual may choose an alternative career profile that does or does not involve investment in education and Birch and Calvert's "total population" measure of C_t would reflect this average position accurately. It will not represent an accurate picture of the income foregone by anyone who actually stays on at school intending to go on into further or higher education. For this reason we prefer our somewhat higher estimates of income foregone during education and training to that assumed by Birch and Calvert.

Together, the use of median as opposed to mean earnings and the adjustment for student incomes entirely accounts for the 3.0 per cent difference. There are however various offsetting factors that are also important. The use of grouped data by age explains -1.3 per cent of the remaining difference. This is offset by the fact that we have used the average rather than nominal value of the student maintenance grant; by our use of net as opposed to gross income profiles; and, by other unexplained factors. These three categories account for 0.3, 0.7 and 0.3 percentage points respectively of the difference between the current estimates and those of Birch and Calvert. These estimates are dependent upon the order in which the various adjustments are made. We would therefore not place too much stress on their relative magnitude. Together, however, these various adjustments account almost exactly for the difference for males between the current estimates and those presented by Birch and Calvert.

For females the gap is much wider. For graduate secondary school teachers, for example, it amounts to 12.4 percentage points. This large difference is attributed in part, as for males, to the use of median incomes (1.5 per cent). One of the most important effects however is the interactive effect of all the various individual

effects. This accounts for almost a quarter of the difference and cannot be allocated unequivocally to any individual cause. Again, as for males, the relative magnitude of the different effects is dependent on the order in which the adjustments are made. Overall, however, the various adjustments independently and in conjunction more than account for the 12.4 per cent difference.

For females the effect of the adjustment for participation is much larger than for males. Although this adjustment reduces expected incomes for both qualified and unqualified, the much higher activity rate for females who are qualified has a substantial impact on the estimates. Alone this explains 1.5 per cent of the total difference.

In contrast to the results for males it is clear that the adjustment for participation is quite an important one. In the detailed results for females presented in Table 2 we have therefore chosen to adjust both the B_t and C_t profiles for participation using information from the 1966 and 1971 Census of Population. The use of gross incomes by Birch and Calvert explains a further 2 percentage points. The latter is much more important than for males because of the fact that the average tax rate for qualified females is significantly higher than for unqualified females due to the larger differential than exists for men and the fact that the tax system is progressive. Birch and Calvert's use of the nominal grant adds 2.0 per cent, while their use of annual age groups subtracts the same amount. Finally, their adjustment of the C_t profile for student incomes accounts for 4.9 percentage points.

On balance we prefer the present measures as giving a more accurate picture of the rate of return to be expected by an individual making a career choice. Net income is the more relevant variable and the appropriate estimate of income foregone is the average income of

those not undertaking the investment. Mean income is preferred to median for the same reason as given for males.

Birch and Calvert (1973) also present a set of results adjusted for the average holidays enjoyed by teachers. Others have also pointed to the low hours of work implied by the timetabled working week for teachers. The Clegg Commission (Clegg 1980) cites some evidence from a National Foundation for Educational Research survey. This indicates that on average primary teachers work about the average working week for non-manual employees and secondary teachers somewhat longer than average, once the additional preparation time is included with timetabled hours. These figures are based on a 46 week year and assume the work is spread over some holiday periods. Although the comparisons are crude, Clegg concludes that no adjustment is warranted to salaries on account of differences in hours of work or holidays. We therefore do not make any additional adjustments to our rate of return calculations.

Data is not yet available for years since 1979. However, some idea of trends since then can be gauged from the impact of the award by the Clegg Commission (Clegg 1980). This award raised teachers' salaries on average by between 17 and 25 per cent between the 31st March 1979 and 31st March 1981. This was in addition to 9 per cent already agreed to apply to the scales in force at the earlier date. By applying such percentage increases to the 1979 profile, we can obtain a rough idea of the rate of return for 1981. For male secondary school graduate teachers, even with the Clegg award, the estimated rate of return falls from 3 per cent in 1979 to 1.5 per cent in 1981. Over this period the earnings of males as a whole increased by almost 40 per cent. This compares with the Clegg

award (including the initial 9 per cent increase) of 26-34 per cent. For primary teachers the rate of return turns negative even with the Clegg increase. Clearly, therefore, although many commentators regarded the Commission's award as generous (especially in the light of the now celebrated error), it failed to halt the downward trend in expected rates of return to entering the teaching profession.

6.7 Teachers in Further and Higher Education

Teachers in grant aided further education establishments

Teachers in grant aided further education establishments are also covered by the DES statistics on earnings published in Statistics of Education. Estimates of rates of return for those following such careers are also given in Tables 6.19 and 6.20. It is immediately apparent that such teachers can expect a considerably higher return than those in primary or secondary schools. This applies equally to graduates and non-graduates. In 1962 the return for male graduates was 4.5 per cent higher than for secondary schools with a corresponding 4 per cent margin for non-graduates.

Over time the rate of return has fallen as for school teachers reaching a low in 1973 of 6.5 per cent for graduates and 3.5 per cent for non-graduates. Again things improved during the mid-1970s but by 1979 rates of return had again reached the low values observed in the early 1970s. Given the close links between the various parts of the education system and between the various pay scales, the similarities in the profiles over time for different groups is hardly surprising. What does stand out however is the marked reduction that has occurred in less than 20 years and the low absolute levels to which the expected returns have fallen for this part of the teaching profession. This may be some cause for concern to policy makers anxious to maintain the quality of entrants to the profession. We return to these general issues below.

As for school teachers, the returns for females are high relative to males. This is undoubtedly a reflection of the low average earnings for females as a whole. Most of the comments made with regard to the profile over time for female secondary and primary teachers also applies to those in further education. For female

graduates the 23.5 per cent expected return in 1962 falls to 14 per cent by 1973 holding this value in the mid-1970s as the Houghton award temporarily offset the effect of the rapidly rising C_t profile. At the end of the 1970s, as relative pay in teaching continued to fall, the rate of return declined to just 12 per cent. The pattern for non-graduates was similar.

The differential between teachers in further education and those in schools, and also that between primary and secondary school teachers deserves some comment. In the discussion above of hours worked, we noted that secondary school teachers work longer hours on average than primary school teachers. The estimates presented in the Clegg Commission report suggest primary school teachers averaged 38 hours per week over a 46 week year compared with 41 hours for secondary teachers. Taking the results for male graduates in 1966, 1-1.5 per cent of the differential in rates of return of 2.5 per cent is explicable in terms of this factor. Teachers in further education probably do not work any longer than secondary school teachers. They must however be prepared to do up to 6 hours evening teaching per week.

The other important factor that might explain these differentials is one of quality. Generally speaking, secondary teachers are better qualified than those in primary education and lecturers in further education are better qualified still.⁹ Clegg concludes that the differential in salary between further education and school teachers is probably justified on these grounds (Clegg, 1980, para 76).

(9) In the sense of having more and better academic qualifications.

University lecturers

For University lecturers the DES has published UGG information on earnings by age since 1972/73 (e.g. DES 1980a). This data is very similar to that described above for other teachers. In addition there have over the years been a number of surveys covering this group from which it is possible to gain a fair idea of both trends over time and make comparisons with other professions.

The earliest survey was carried out under the auspices of the RCDDR for 1955/56. This covered all the teaching staffs of universities and medical schools in Great Britain. The sample of 3320 names was carefully chosen to be representative by university and by faculty. From those eventually contacted, a response rate of 80 per cent was achieved and a usable sample of 2332 returns. (For further details see RCDDR, 1960 Appendix III).

As for the other surveys the published information does not allow a breakdown by sex of the age earnings profiles. In order to avoid problems of the impact of changes in the proportion of females on the C(I) profile over time the average earnings of all males is used throughout this section rather than a weighted average for males and females. This also makes comparisons with other professional groups more straightforward. Assuming females are not discriminated against in university employment, this will tend to bias the rate of return estimates down as measures for both sexes combined. However, some "natural" discrimination undoubtedly occurs as the result of the common pattern of disruption of career profiles of women due to family responsibilities (for further discussion of this point see Williams et.al 1974 p.375-402). The overall impact this has on rates of return is therefore difficult to judge. The estimates obtained are likely to be reasonably close to the expected return for males.

In 1961/62 the AUT carried out a survey of its membership (AUT 1962). The published report included detailed information on earnings by age. The main survey excluded Oxbridge. Information from a parallel survey and other sources suggests this will tend to result in a lower level of average income. This point is discussed further below. A large sample of 21,502 was approached and a response rate of 69 per cent obtained. This survey was repeated in 1964/65 and again in 1967/68 and 1970/71. Apart from the inclusion of the Colleges of Advanced Technology in the last two surveys, the basic sampling frame remained unaltered. Separate information on the CATs suggests that their inclusion will not bias any comparison over time to any significant extent.

Further information on the age earnings profile for university lecturers was published by the NBPI for 1966/67 (NBPI, 1968b). This profile was based on UGC data and, like the AUT surveys, excluded Oxbridge. A profile for 1967/68 was published in the second report - NBPI (1970). Unlike that for 1966/67 the latter published the actual estimates rather than merely presenting graphical information. For 1966/67, of course, we also have the follow up to the 1966 Census. In 1968/69 a further survey was carried out by the Higher Education Research Unit on behalf of the NBPI (NBPI, 1970). This survey was based on a stratified sample of 10-20 per cent of the total population and achieved a response rate of 63 per cent. According to the RBDDR they represented at that time the only information on a comparable basis to that used by the Royal Commission for 1955/56 (RBDDR, 1972, Appendix II, Annex A para 25). This however seems to exaggerate the case, given the availability of the other sources we have mentioned some of which (e.g. the AUT surveys) appear to be at least as well based statistically as the HERU survey, although as noted above they do exclude Oxbridge. Furthermore they do not include supplementary income.

The HERU data set was used by Williams et al (1974) to compute present values of lifetime incomes. It was also the basis of work by Metcalf on rates of return to a PhD (Metcalf (1973)). The survey covered both 1968/69 and 1969/70.

For the 1970s the follow up to the 1971 census is inadequate in terms of sample size to provide information on university teachers. However, as noted above, from 1972 onwards the DES has published information, comparable to that for other teachers, on earnings by age for university staff in Great Britain. Again this is based on individual source and salary records. It provides details of the salaries of all full-time teaching and research staff on non-clinical rates of pay, paid wholly from university funds. It does not include supplementary income.

Finally in 1977/78 the RCLS (Scotland) published some information on the earnings of university lecturers in Scotland as part of their analysis of the earnings of the legal procession (RCLS (Scotland), 1980, Appendix B.7). Although not directly comparable with the earlier surveys this information provides some additional information as to how things have changed during the 1970s.

Results for University Lecturers

Estimates of rates of return to becoming a university lecturer based upon these various surveys are presented in Table 6.22. Three alternative estimates are provided making different assumptions about the length of the course of study necessary to attain a lecturing post. These may be interpreted as equivalent to first degree only, first degree plus a masters degree and first degree and PhD respectively, although in practice it is clear that persons with higher qualifications will earn more. The differences between these three assumptions therefore will tend to exaggerate the differences between different qualificational routes to attaining a university post. The rate of return for the "PhD route" is probably underestimated and conversely that for a first degree only is probably an overestimate. Without data on earnings by age, which also distinguishes qualifications held, it is not possible to be more precise.

In 1955/56 the estimated rates of return range from 23 per cent to 15.5 per cent depending upon this key assumption. By 1978/79 in Scotland the corresponding range is much lower (9.0 to 7.5 per cent). In the 1950s a PhD was probably a "luxury". The majority of university lecturers (56 per cent) in 1961/62 did not have a PhD (Williams et al 1974, Table 5.1). During the 1960s with the rapid expansion of the higher educational system there is evidence that the quality of entrants to university posts fell somewhat (NBPI, 1968b, para 30). Williams et al 1974 argues that this apparent decline was probably due to changes in definition, the expansion of research activities and the reclassification of Colleges of Advanced Technology. By the end of the 1960s and in the 1970s a PhD was becoming a necessity in many faculties and 51 per cent of all staff held such qualifications in 1969/70. All subsequent results assume either a 4 or 6 year course of study is required.

Table 6.22 Rates of return estimates for University Lecturers

	per cent		
	Length of course assumed		
	3 years	4 years	6 years
1955/56 ^a	23.0	20.5	15.5
1966/67 ^b	18.0	17.0	14.0
1968/69 ^c	16.0	14.5	12.0
1977/78 ^d	10.0	9.5	9.0

Sources and Notes: (a) RCDDR (1960).
 (b) Follow up survey to 1966 Census.
 (c) NBPI (1970), HERU survey.
 (d) RCLS (Scotland)(1980). Data refer to Scotland.

In comparing the results for 1955/56 with later years 3 further considerations must be borne in mind. First, the 1955/56 survey included Oxbridge. The results of the HERU survey suggest that on average lecturers at Oxbridge earn 33 per cent more than those in other universities.¹⁰ Second, this 1955/56 survey includes medical faculties. The earnings of these lecturers are negotiated separately from other faculties. The HERU survey and also the AUT survey suggests that medical faculty earn on average 15 per cent more than those in other faculties.¹¹ Finally, the 1955/56 survey includes all earned income. Various surveys have been conducted to establish the size of supplementary income of university lecturers. The NBPI (1968b) report suggested that this might amount to 7.5 per cent of gross income. The HERU survey indicated a somewhat larger figure (12 per cent). This survey also suggested that the level of supplementary income varied positively with age, differed across faculties and was higher in London and Oxbridge. The results in Table 6.22 are those based on surveys of all earned income. All apart from the 1977/78 result, which is for Scotland only, cover all universities.

Between 1955/56 and the mid 1960s there was apparently only a slight decline in expected rates of return (from 15.5 to 14.0 per cent for someone following a six year course of study). This is consistent with the idea of very rapid expansion in the demand for faculty at least keeping pace with supply. By the 1970s, however, with the cessation of expansion of the higher education system, the decline in expected rates of return noted for most other professions became apparent for this group. Even by 1968/69 a decline for a PhD/6 year course was down to 12 per cent. Between 1968/69 and by 1977/78 the expected return to someone taking a 6 year course fell even further, to 9 per cent. (If we can take the result for Scotland as being representative.)

(10) This varies significantly by age however. It is also related to the supplementary incomes received at Oxbridge.

(11) Again this varies significantly by age.

Table 6.23 Rates of Return based on basic salary for
University lecturers

	per cent	
	Length of course 4 years	6 years
1961/62 ^a	13.0	11.0
1964/65 ^a	16.0	13.5
1967/68 ^a	13.0	11.5
1969/70 ^b	12.0	10.5
1970/71 ^a	11.5	10.0
1972/73 ^c	10.5	9.0
1975/76 ^c	9.5	8.0
1978/79 ^c	9.0	7.5

Sources and Notes : (a) AUT Surveys, excluding Oxbridge and medical faculties.

(b) NBPI (1970), HERU data, excluding medical faculties.

(c) DES (1980a), excluding clinical medicine.

Compared with teachers in further education (for example comparing a university lecturer with a PhD and a male graduate teacher in further education in possession of a masters degree), university lecturers have just about maintained the slight advantage observed in the mid 1960s (14.0 per cent compared with 11.0 per cent) through to the mid to late 1970s (9 per cent compared with 5.5 per cent). This differential can be interpreted again as reflecting differences in quality between teachers in further education and lecturers in universities. For both groups however the trend has been strongly downward. As for school teachers and teachers in further education, this again poses the problem of whether, if such trends continue, sufficient young people of the appropriate quality will be persuaded to undergo the length investment required to become a teacher in further or higher education.

In Table 6.23 we report estimates of rates of return based on the other surveys. These exclude supplementary income. Furthermore, the estimates based on the AUT surveys exclude Oxbridge. A fairly clear pattern emerges of a rise during the 1960s from a low of 11.0 per cent in 1961/62 for the 6 year course assumption to around 14 per cent in the mid 1960s. Thereafter a slow but steady decline is apparent to 7.5 per cent by 1978/79.

In Table 6.25 we present the results of adjusting the estimated rates of return given in Table 6.23 on to a comparable basis to those in Table 6.22. These estimates which include an allowance for supplementary income and the inclusion of Oxbridge and all medical faculties are the appropriate ones for comparison with other professions.

In order to allow for supplementary income the age earnings profiles have been adjusted upwards. The adjustment is based on the information from HERU and NBPI surveys referred to above. In Table 6.24

the size of the adjustments necessary to allow for supplementary income by age are indicated. This supplementary income includes various allowances; London allowance, Oxbridge allowances, family allowances, as well as outside earnings. In the table we also show how the differentials between Oxbridge and all other universities (excluding London) and between medical faculties and other faculties vary by age. The analysis of the HERU survey in the NBPI report shows that a major part of the differential between Oxbridge and other universities is in fact the result of higher supplementary earnings both inside and outside the university (NBPI 1968b, para 63). In fact, basic salary, when standardised for age, was found to be very similar. It is important therefore to avoid double counting when making adjustments for supplementary income and the inclusion of Oxbridge. The information on supplementary income covers all universities, therefore no further adjustment was made for the inclusion of Oxbridge.

Another problem is that there is a marked difference between the mean and median values of supplementary income. The average value of supplementary income as a proportion of total income was 11.7 per cent; the median proportion was just 4.6 per cent. Twenty-one per cent of staff received no supplement to the basic salary at all and 47 per cent received less than £100 per annum in 1968/69 according to the HERU survey.

In order to make the results shown in Table 6.23 consistent with those in Table 6.22 the B_t profiles were therefore scaled by two adjustment factors. The first to allow for the addition of supplementary income (and implicitly therefore the inclusion of Oxbridge), and the second to allow for the inclusion of medical faculties. In order to allow for the difference between median and mean supplementary income, two alternative assumptions were adopted. The first increased gross income by an average 12 per cent, the second by 5 per cent. A range of estimated rates of return was therefore computed. The adjustment factors were allowed to vary by age as indicated in Table 6.24. The estimates in Table 6.25 represent the central points of

Table 6.24 Supplementary income for university lecturers

Age	Supplementary income as a percentage of gross income ^a	Total income in Oxbridge as a proportion of that in other universities ^b	Total income in medical faculties as a proportion of that in other faculties ^c
20-24	6.0	1.014	1.021
25-29	7.3	1.063	1.036
30-34	8.5	1.496	1.110
35-39	9.9	1.342	1.055
40-44	8.7	1.327	1.121
45-49	8.7	1.150	1.108
50-55	8.3	1.220	1.197
55+	11.1	1.182	1.210
All	8.9	1.335	1.171

Source: NBPI (1968b, Appendix C) and AUT (1965).

Notes: (a) Excluding London and Oxbridge; mean income.

(b) Excluding London; mean income.

(c) Mean income; AUT survey, Table 9.

Table 6.25 Rates of Return based on total income for
University lecturers

Selected years	per cent	
	4 years	6 years
1955/56 ^a	20.5	15.5
1961/62 ^b	15.0	12.5
1964/65 ^b	17.5	15.0
1966/67 ^c	17.0	14.0
1967/68 ^b	14.5	12.5
1968/69 ^d	14.5	12.0
1970/71 ^b	13.0	11.5
1972/73 ^e	13.0	10.0
1975/76 ^e	11.0	9.0
1978/79 ^e	10.5	8.5

Sources and Notes: (a) RCDDR (1960).

(b) AUT surveys.

(c) Follow up survey to 1966 census.

(d) NBPI (1970), HERU data.

(e) DES (1980a) and earlier volumes.

Despite the uncertainty attached to some of the estimates, the overall pattern is very clear. Rates of return for all university lecturers (including supplementary income) declined quite sharply between 1955/56 and 1961/62. In the early 1960s this decline was not only halted but reversed during this period of very rapid expansion of the education system. However, after the mid 1960s, the previous downward trend was resumed. By 1978/79 expected rates of return were barely half those facing prospective lecturers in 1955/56, a decline, assuming a 6 year course, from 15.5 per cent in 1955/56 to about 8.5 per cent in 1978/79.

Compared with teachers in further education assuming a 4 year course, university lecturers have more than maintained the advantage observed in the mid-1960s (17-18 per cent compared with 13.0 per cent). This differential can be interpreted again as reflecting differences in quality between teachers in further education and lecturers in universities. If, however, supplementary income is excluded then rates of return were higher for teachers in further education at the start of the 1960s. For both groups, however, the trend has been strongly downward. As for school teachers and teachers in further education, this poses the problem of whether, if such trends continue, sufficient young people of the appropriate quality will be persuaded to undergo the lengthy investment required to become a teacher in further or higher education. This is discussed in more detail in Chapter 5.

7. Social Rates of Return for Other Professions

In Chapter 3, estimates of the average social rate of return to becoming a professional scientist or engineer were calculated. We now turn our attention to the various other professional groups considered earlier. As with private rates of return, the extension of the analysis to other groups raises various theoretical and practical difficulties. In fact these are probably even more serious in the case of social rates of return. These problems are discussed in Section 7.1 as are the details of the methodology and the particular assumptions adopted for the different professional groups. Section 7.2 presents estimates for each of our main professional groups of the average social rate of return over the period 1955/56-1980/81. These results are compared with those for scientists and engineers and the causes and implications of the pattern of results obtained are discussed.

7.1 Theoretical and Practical Problems in Estimating Social Rates of Return for Other Professions

All the difficulties in making comparable estimates of private rates of return to attaining professional status in different professions outlined in Chapter 5 apply with equal force in the case of estimating social rates of return. It would be unnecessarily repetitive to discuss these again here. (See pages 5.1-5.19 for details). It is sufficient to say, that as for the private rates of return discussed earlier, the estimates presented here are adjusted in an analogous manner to reflect necessary deductions from self-employment incomes, the addition of supplementary incomes, allowance for differences in hours worked and allowance for differences in the length of the period of education and training typically required.

In the case of social rates of return however, another crucial issue arises. Computation of private rates of return based on age earnings profiles will, given the assumption that cross-section profiles provide a reasonable proxy for the lifetime income profiles, give a measure of the return to be expected by an individual from investment in education or training. From the individual's point of view, it is not particularly relevant whether the higher income he expects to receive arises because his investment raises his productivity or is due to some other cause.

In the case of the social calculation, however, it is crucial that an individual's earnings reflect his marginal contribution to output if the rate of return estimates are to provide a useful guide to whether such investment is an attractive proposition from a social viewpoint. In a perfectly competitive world with complete information, this would be the case. In an imperfect world where individuals have incomplete information about the opportunities available to them and employers are uncertain about the productivity of potential employees, such calculations are called into question.

The two main areas of doubt are therefore; first, whether the measured age earnings profiles reflect social marginal products; and, second, the related but different question of whether the education and training process increases the individual's productivity or whether it merely acts as some sort of screening device to sort out individuals of higher ability (and hence of higher productivity).

Dealing with the screening hypothesis first. As discussed by authors such as Arrow (1973) Wiles (1974) and Layard and Psacharopoulos (1974) this suggests that formal education may, in whole or in part, merely be acting as a screening device which labels individuals as of different abilities. Firms can then use these

labels to easily identify those individuals with particular levels of ability that they wish to employ. If subsequent incomes reflect the marginal product of the individual concerned then the main difficulty that his possibility raises is that there may be cheaper and more efficient means of sorting individuals than processing them through many years of formal education or training. Thus far there have been no generally agreed estimates of the importance of this phenomenon. Psacharopoulos (1981) notes that, if one makes the distinction between initial and persistent screening, while there is much evidence for the former there is very little corroborating the latter. Once employers recruit an individual there is little evidence that firms continue to pay wages in excess of the workers' productivity (see also Psacharopoulos (1979)).

A related issue is what Psacharopoulos (1981) has termed 'bumping'. This is the notion that workers compete for jobs rather than wages and that those with higher qualifications bump out of the job queue those less well qualified. We thus observe the effects of what Berg (1970) has termed the 'great training robbery' in which there is a progressive tendency for jobs, that were previously done by non-graduates, to now require a degree holder. Psacharopoulos (1981) argues that unless it is demonstrated that the job being done is identical this does not imply that such bumping is socially inefficient. Indeed, he argues that there is considerable micro evidence on earnings that suggests that the more qualified are more productive than the less qualified even after standardising for occupation.

Social rate of return calculations founder whenever earnings cannot be taken as reflecting an individual's contribution to the gross national product. Earnings may differ from marginal social

product for two other reasons. The first is that labour markets may not operate as assumed in the perfectly competitive neo-classical model. Either or both of the supply or demand side of the market may possess some power to explicitly influence the determination of earnings. Undoubtedly there are numerous imperfections of this nature in British labour markets. Three of the most obvious cases have already been discussed in Chapter 5 where the possibility of monopoly power of the legal and medical professions was raised as well as the monopsonistic position occupied by the government as employer of groups such as school teachers.

The evidence discussed in Chapter 5 was far from conclusive in establishing the existence of such market imperfections. On balance there appears to be some support for the idea that some medical professions, especially dental practitioners, have benefitted from restricting the inflow of entrants and so maintained their incomes at relatively high levels. The case against legal professions is much weaker. Evidence on the earnings of those lawyers employed by private employers tends to suggest that the incomes of these groups broadly reflect market pressures. In the case of school teachers there appears to be some evidence to support the idea that the Department of Education and Science has been able to exploit a monopsonistic position and allow the relative earnings of this group to fall to very low levels.

On this basis the social rates of return estimated for medical profession may exaggerate the true position while those for school teachers may underestimate their true value to society. There is no clear guide from the evidence we have collected together on the size of such biases however. For other groups we take the view that earnings and incomes broadly reflect the operation of competitive market forces.

Even in the absence of monopoly or monopsony power, earnings may fail to reflect marginal social product due to the presence of externalities. For example, the existence of a population well versed in science and technology may have all sorts of beneficial effects in terms of attitudes to technical progress, acceptance of new ideas and so on. Those benefits may not be reflected directly in higher individual incomes but in terms of benefits for others either at the same point in time or at some future date. Such external effects by their very nature are notoriously difficult to quantify in general terms. We find it impossible to attempt to quantify differential effects between different professions. Given that in general such external effects seem likely to be beneficial, we would simply note that all the estimated social rates of return presented here are probably underestimates (*ceteris paribus*).

Methodology and assumptions

The basic methodology is as described in Chapter 3 above. The main differences compared with the results for scientists and engineers are concerned with the assumptions regarding the length and costs of the periods of education and training associated with each of the various professions. The estimates of direct costs of a first degree that were used distinguish between 6 different subject groupings, medicine, engineering and technology, science (including mathematics), social sciences, vocational subjects (primarily architecture) and all subjects. These reflect the average length of courses followed. To these basic estimates are added the costs of doing a 2 year 'A' level course. The basic data on which they are based comes from unpublished DES material and is described in more detail in Chapter 3 and Appendix A3. The detailed cost estimates used are also presented in that appendix.

7.2 Social Rates of Return : Results for Other Professions

The estimated social rates of return for various professional groups including scientists and engineers are summarised in Table 7.1. The results for graduates as a whole are discussed first, before considering each of the main professional groups in turn.

As for the private rate of return estimates reported in Chapters 5 and 6, the social calculations are based on three main data sources. These are the RCDDR survey for 1955/56, the follow-up surveys to the 1966 and 1971 Censuses of Population and, for recent years, the GHS. In 1955/56, using data on the earnings of all graduates employed in industry and commerce an average return (to 'A' level plus three year first degree course) of 10½ per cent was estimated. By 1966/67 the return to all graduates had fallen to about 8½ per cent. A sharp fall from about 8 to 4½ per cent occurred between 1970/71 and 1977/78 before a slight recovery towards the end of the decade. As already noted for scientists and engineers in Chapter 3 the estimates of social returns are significantly lower than the private ones. This reflects the large direct costs of education which are borne by the state rather than the individual and also the fact that the individual receives a subsidy (a transfer payment which is not included in the social calculation). Given this difference the pattern of returns over time is very much a reflection of the private results. These results provide a useful yardstick with which to compare those for the other professions to which we now turn. Only a limited number of fairly general estimates are produced for each group. These are sufficient to make clear the main differences from the more detailed estimates of private returns discussed in Chapters 5 and 6.

Table 7.1 Average Social Rates of Return : Different Professions Compared

	Chemists	Physicists	Engineers	Architects ^c	GPs ^b	Consultants ^b	Hospital Doctors ^b 'High fliers' 'Low fliers'	GPs ^b
1955/56	9.5	-	6.5	6.5	10.5	12.0	11.0	6.5
1956/57	-	10.5	-	-	-	-	-	16.0
1957/58	-	-	-	-	-	-	-	-
1958/59	10.0	-	-	-	-	-	-	-
1959/60	-	-	8.0	-	-	-	-	-
1960/61	-	11.0	-	-	-	-	-	-
1961/62	9.5	-	8.0	-	-	-	-	-
1962/63	-	-	-	-	-	-	-	-
1963/64	-	-	-	-	-	-	-	-
1964/65	9.0	11.0	-	-	-	-	-	-
1965/66	-	-	7.0	-	-	-	-	-
1966/67	-	-	-	-	-	-	-	-
1967/68	8.5	9.0	7.5	9.0	-	-	-	-
1968/69	-	-	-	-	-	-	-	-
1969/70	-	-	-	-	8.0	9.0	9.0	5.0
1970/71	8.0	8.5	7.0	-	-	-	-	12.0
1971/72	-	-	-	-	-	-	-	-
1972/73	-	-	6.0	-	-	-	-	-
1973/74	6.0	6.5	-	7.0	-	-	-	-
1974/75	-	-	6.0	-	-	-	-	-
1975/76	-	-	-	-	-	-	-	-
1976/77	6.0	6.5	5.5	-	-	-	-	-
1977/78	-	-	-	5.5	-	-	-	-
1978/79	-	-	5.5	-	-	-	-	-
1979/80	6.0	6.5	-	-	-	-	-	-
1980/81	-	-	-	4.5	7.5	8.0	8.5	4.0
								9.0

- Notes: (a) Three year course unless elsewhere specified.
 (b) Five year course; adjusted for hours as appropriate.
 (c) Four year course.
 (d) Based on data for 1981/82.

(continued)

Table 7.1 Average Social Rates of Return (continued)

	Solicitors	Barristers	Primary Teachers	Secondary Teachers	F. Ed. Teachers	University Lecturers	Economists	Statisticians	Accountants	All Graduates
1955/56	9.5	8.0	-	-	-	10.0	-	-	9.5	10.5
1956/57	-	-	-	-	-	-	-	-	-	-
1957/58	-	-	-	-	-	-	-	-	-	-
1958/59	-	-	-	-	-	-	-	-	-	-
1959/60	-	-	-	-	-	-	-	-	-	-
1960/61	-	-	-	-	-	-	-	-	-	-
1961/62	-	-	4.0	6.0	8.0	8.5	-	-	-	-
1962/63	-	-	-	-	-	-	-	-	-	-
1963/64	-	-	-	-	-	-	-	-	-	-
1964/65	-	-	-	-	-	10.0	11.5	-	-	-
1965/66	-	-	2.5	5.0	6.5	-	-	-	-	-
1966/67	-	-	-	-	-	-	-	12.0	9.5	8.5
1967/68	-	-	-	-	-	9.0	-	-	-	-
1968/69	-	-	-	-	-	-	13.5	12.0	-	-
1969/70	-	-	2.0	4.5	6.0	-	14.5	-	-	-
1970/71	-	-	-	-	-	8.0	-	13.5	-	7.5
1971/72	-	-	-	-	-	-	-	-	10.5	6.5
1972/73	-	-	(-ve)	2.0	3.5	7.5	13.0	-	-	6.5
1973/74	-	-	-	-	-	-	-	-	-	6.5
1974/75	-	-	-	-	-	-	11.5	-	-	6.5
1975/76	-	-	2.0	3.0	4.5	7.0	-	-	-	5.5
1976/77	9.5	8.5	-	-	-	-	-	-	-	5.5
1977/78	-	-	-	-	-	-	-	8.5	-	4.5
1978/79	-	-	(-ve)	1.0	3.0	6.5	-	-	-	6.0
1979/80	-	-	-	-	-	-	11.5	-	-	6.0
1980/81	-	-	(-ve)	(-ve)	(2.0)	-	-	-	9.0 ^d	-

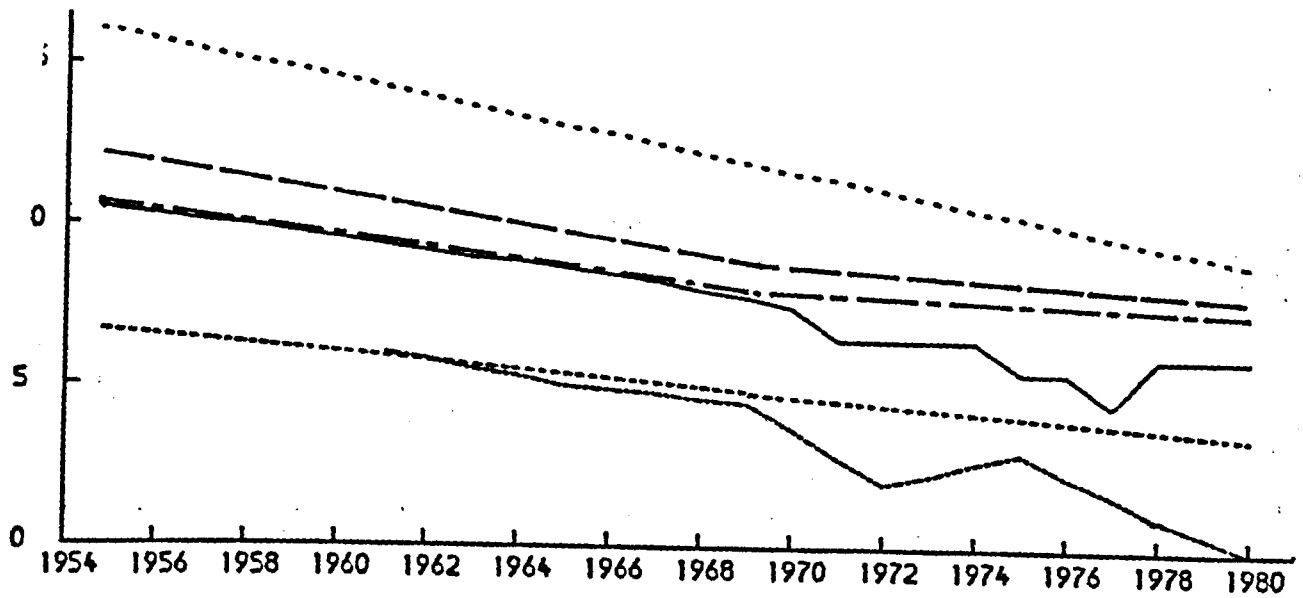
Medical professions

The results for medical professions are, in most respects, very much in line with the private rate of return estimates reported in Chapter 6. However, due to the large direct costs of education and training the differential in their favour compared with graduates in general is much less than for the private returns. Indeed, for GMPs in 1955/56 it completely disappears (see Figure 7.1). GDPs maintain a large (albeit reduced) margin with a social return some $5\frac{1}{2}$ percentage points above the estimate of 10.5 per cent obtained for all graduates.

The results for all medical professions show a significant decline over the period 1955/56 to 1980/81. For dentists the return falls from 16 per cent to 9 per cent; for doctors, other than 'low fliers', from around 11 to around 8 per cent, while for the less successful doctor the decline is from $6\frac{1}{2}$ to 4 per cent. The estimates for all except the latter are well above those for all graduates for whom a social return of about 6 per cent was obtained for 1979/80.

In Chapters 5 and 6 the case for believing that earnings in medical professions may reflect monopolistic restrictions on entry was discussed. Our conclusions there were that it is very difficult to clearly demonstrate the existence of such impediments to the free workings of the labour market from the rate of return estimates obtained. However, there was some indication of 'excessively' high returns especially for dentists. It should be made clear that the existence of monopoly incomes does not necessarily imply a discrepancy between the social marginal product of medical professions and their wage. What is implied is that the restricted level of labour input raises the value of the marginal product of the last doctor employed (Bowen, 1963).

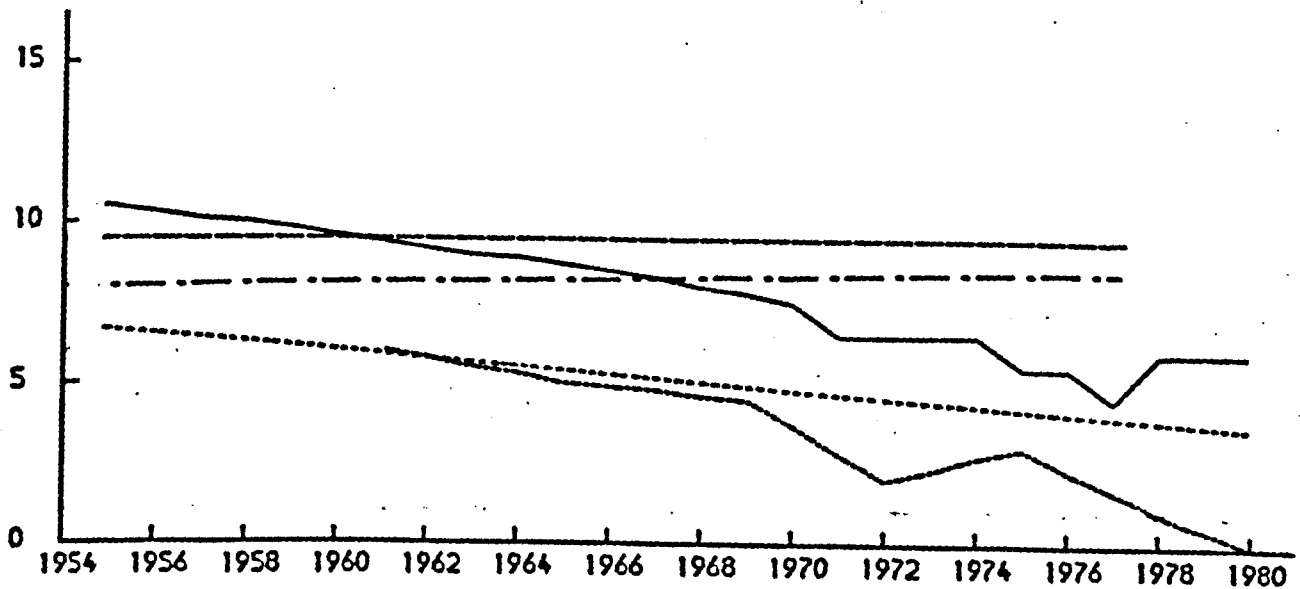
Figure 7.1 Social Rates of Return for Medical Professions, 1955-1980



Key:

General medical practitioners
Hospital doctors (low fliers)
Consultants
General dental practitioners
All graduates

Figure 7.2 Social Rates of Return for Legal Professions, 1955-1980



Key:

All solicitors
All barristers
All graduates
Secondary teachers (1961-1980 only)
Hospital doctors (low fliers)

Note: For details of estimates see notes to Table 7.1

Compared with most other groups the results obtained suggest that there may be a case for expanding the supply of medical students in order to reap the relatively high social returns suggested. This point of view is reinforced by the fact that these results include adjustments for hours worked which bring them down by perhaps 1 percentage point in 1980/81. It has already been noted in Chapters 5 and 6 that junior doctors in particular work extremely long hours and are under very severe pressure from heavy workloads. There would seem to be a strong case for expanding supply to reduce this pressure on young doctors to more reasonable levels. Such a policy would also have important cost implications for the NHS, however, which are not considered here.

Although the social returns for medical profession are relatively high there are other groups such as lawyers and business professions where returns are equally good. In contrast with the private rate of return estimates, however, the relatively large direct costs of producing doctors and dentists reduces the advantage in favour of medical professions from a social viewpoint.

Legal professions

Social returns for legal professions are represented in Table 7.1 by estimates for all solicitors and all barristers in England and Wales. Only two data points are available and these suggest little or no change between 1955/56 and 1976/77, (as noted for private returns in Chapter 5, however, there is some evidence that returns may have risen in the 1960s before falling again). For solicitors the average social return is about 9½ per cent while for barristers it is about 1½ percentage points lower.

Compared with graduates as a whole these figures were somewhat below average in 1955/56 but well above by 1976/77. As shown

in Figure 7.2 the social return for both barristers and solicitors has remained high relative to secondary school teachers and hospital doctors ("low fliers"). They remain low compared with other members of the medical profession and some business professions however. Generally speaking, however, the results suggest a relatively high social return for legal professions.

As for medical professions the question of the extent to which these relatively high figures might reflect barriers to entry was discussed in Chapters 5 and 6. There we concluded that there was no real evidence from the rates of returns calculated to support the idea of the existence of significant monopoly rents. The results for the social calculation, however, suggest some scope for further expansion of the supply of entrants to legal professions. However, given the uncertainties attached to the estimates, the safest conclusion to draw would be that there is no evidence of any significant underprovision of places for legal students. However, when compared with returns for scientists and engineers the results for this group, and for other social scientists discussed below, suggest that if anything the emphasis should be changed from producing more scientists and engineers, as advocated by, for example, Finniston (1980), to producing more social scientists.

Business professions

Figure 7.3 shows that (at least for the period covered by the available data) social returns for business professions were well above average. In part this results from the assumption of a relatively short three year course and the relatively lower average costs of doing a first degree in the social sciences. However, it also reflects the ranking of the private returns estimated in Chapter 4.

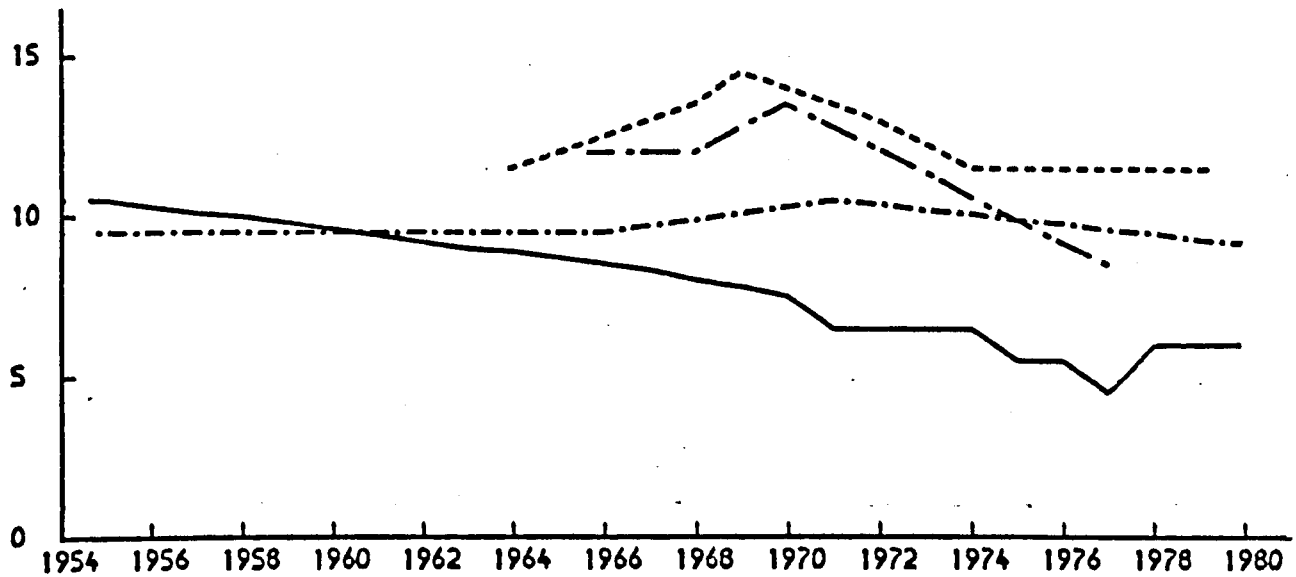
The social return for accountants was, at about 9½ per cent, roughly in line with the average for all graduates in 1955/56. By 1966/67 it remained unchanged while that for graduates as a whole had fallen by 2 percentage points. The results for all the business professions covered showed signs of increasing in the mid to late 1960s reaching a peak for economists of 14 per cent in 1969/70 and of 13 per cent for statisticians in 1970/71. For statisticians the data suggest a quite sharp fall to 1977/78, reflecting the private measures. However, as noted in Chapter 6 the earnings profiles for this group were rather erratic, in sharp contrast to those for other professions. The return for economists settled down at around 11 per cent in the middle to late 1970s while that for accountants was about 9 per cent. Accountants are another profession where some commentators have suggested there may be barriers to entry and that consequently wage levels are held up above market clearing levels. The higher returns obtained for business economists, a career for which the basic entry requirement is the possession of a first degree, seems to belie such a possibility. The results do, however, suggest that as for legal professions the market could probably absorb more social scientists and that this would be more socially productive than increasing the numbers of pure scientists or engineers.

Scientists, Engineers etc.

The estimates of the social return to becoming a professional engineer or scientist have already been discussed in detail in Chapter 3. The calculations are extended here back to 1955/56. In addition, we also consider the returns for architects and compare all these groups with graduates in general. The results are summarised in Figure 7.4. It is clear that in 1955/56 the return for both physicists and chemists was roughly on a par with the value of 10.5 per cent obtained for all graduates. The return for physicists rose slightly up to 1964/65 before falling fairly steadily to around 6.5 per cent by 1973/74, levelling out thereafter. For chemists the decline started earlier in 1958/59 but otherwise the pattern is similar with the social returns levelling out at about 6 per cent after 1973/74. In fact this is quite similar to the pattern for graduates as a whole.

For engineers there was a rise in the 1950s but from a much lower starting point of around 6½ per cent. Returns rose up to the end of the 1950s then levelled out at around 7-8 per cent until 1970/71. After this, social rates of return fell bit by bit to a level of 5½ per cent by the end of the decade. Architects also saw a rise, in fact a more sustained one than engineers. Between 1955/56 and 1966/67 the social rate of return rose from 6.5 to 9 per cent. Thereafter there has been a steady decline to values of just 4½ per cent by 1980/81. The results for engineers are based on the assumption of a three year course of study. Adopting the assumption of a four year course would reduce the estimated returns from around 6 per cent in 1978/79 to about 5½ per cent. Such a change would not significantly alter the profile over time. (for further discussion of sensitivity to this assumption see Chapter 8).

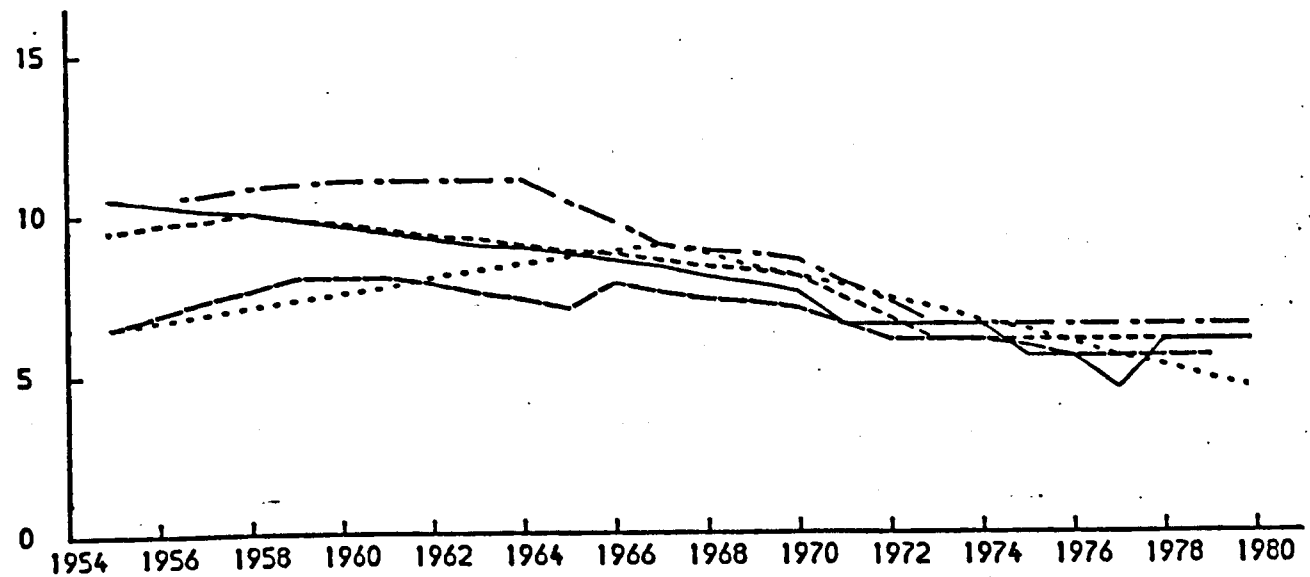
Figure 7.3 Social Rates of Return for Business Professions , 1955-1980



Key:

- Accountants
- Economists (1964-1979 only)
- Statisticians (1966-1977 only)
- All graduates

Figure 7.4 Social Rates of Return for Scientists, Engineers, etc., 1955-1980



Key:

- Chemists
- Physicists
- Engineers
- Architects
- All graduates

Note: For details of estimates see notes to Table 7.1.

Overall the profiles of social rates of return over time for scientists, engineers etc. closely reflect the private estimates (compare Figures 7.4 with 5.6), the former being a "scaled-down" version of the latter). Broadly speaking, the direct costs of education have kept pace with average earnings (see Chapter 4) so that the pattern of social returns has been influenced by the same factors as the private returns. In the case of scientists and engineers the most important factors appear to have been general movements in the balance of supply and demand for the various disciplines. These issues are discussed in detail in Chapter 5 and so will not be repeated here. However, from the analysis in that chapter and from the results presented earlier in this chapter, it is far from clear that there is a case for producing scientists and engineers at a more rapid rate than the educational system is doing at present. Indeed if anything the results suggest the emphasis should be switched to other disciplines such as the law, business studies and economics.

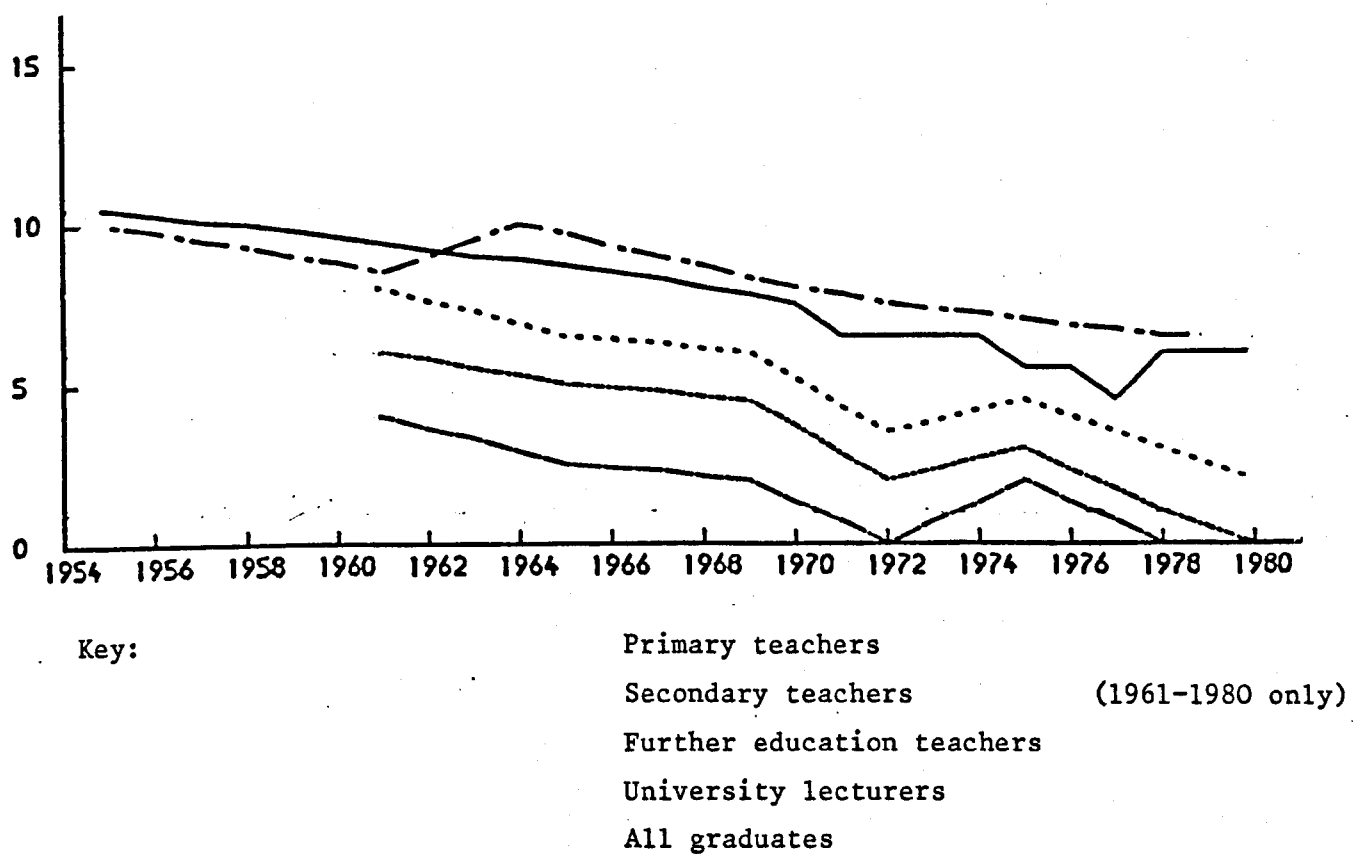
Teaching Professions

The results for the final group, teaching professions, are summarised in Figure 7.5. It is immediately clear from this figure that apart from university lecturers the social returns to teaching professions are well below the average for all graduates, especially for primary and secondary school teachers. Like the analagous results for private returns (Figure 5.7) there were sharp falls between 1969/70 and 1972/73 and again between 1975/76 and 1978/79. Indeed for primary school teachers, social returns were negative in 1972/73 and 1978/79. For University lecturers (here assuming a 4 year course of education and training)

the social return was somewhat below average during the late 1950s, rose sharply in the early 1960s and has been somewhat higher than the average for all graduates since then. It has however followed the downward trend observed for all categories, falling from 10 per cent in 1965/66 to 6½ per cent by 1978/79. For other teachers the picture has been one of almost un-interrupted decline in rates of return. Apart from a temporary hiccup resulting from the Houghton award, returns have fallen steadily from 1961/62 to 1980/81. For primary and secondary teachers the estimated social returns are negative for 1980/81 and for those in further education just 2 per cent.

As noted in Chapter 5, the main explanation for these movements over time can again probably be found in broad movements in the balance of supply and demand. There is however some evidence to support the notion that the DES has in recent years acted as a monopsonist and forced real earnings down below long-run equilibrium levels. Certainly the very low social returns in 1972/73 and again in 1978/79 suggest that either there is a very significant surplus of teachers or that they are not being paid in line with their social marginal product. The truth of the matter obviously lies somewhere between these two extremes. With changes in the age structure of the population the demand for teachers may be expected to have fallen sharply in recent years in line with falling school rolls. However, the demand for teachers is to a significant degree decided on political rather than economic grounds. There is, for example, no reason in principle why falling rolls could not have been used as an opportunity to improve staff-pupil ratios and generally improve the quality of educational provision. Instead, the government has appeared to use the growing surplus of teachers as a means

Figure 7.5 Social Rates of Return for Teaching Professions, 1955-1980



Note: For details of estimates see notes to Table 7.1.

of forcing down the relative wages of the teaching profession. While this policy may have some short-term benefits in terms of restricting the growth in government expenditure, it may cause many problems if it is pursued for long. The prospective returns for new entrants are already very low while those already in the teaching profession may be encouraged to seek opportunities in other directions. This, of course, is the appropriate market response to a surplus. The market for teachers is (in common with other professions) different in many respects from the market for, say, corn. In particular, the production of new teachers takes many years (especially teachers in further and higher education). There is thus the danger of exacerbating the natural cobweb pattern of dynamic adjustment common to most professional labour markets (for a description of such markets see Freeman, 1971). Very low returns will undoubtedly seriously discourage many potential entrants from following a career in teaching which can result in future shortages. Perhaps more important, however, is the effect on quality. First degree graduates are especially likely to be dissuaded from following a teaching career. Within the profession those most likely to leave will be the more dynamic who have talents that can be used in other walks of life. The very real danger is therefore that a policy of restricting the relative earnings of teachers and thus depressing rates of return to low or indeed negative levels will result in very serious recruitment and other manpower problems particularly in respect of better qualified staff.

8. Sensitivity Analysis

The sensitivity of the rate of return estimates to variations in certain key assumptions has been discussed at various points above. The purpose of the present chapter is to draw this analysis together in one place and to also consider some further variations which have not been considered thus far. In the previous chapter we have discussed the sensitivity of the results to the size of the student grant, assumptions about the growth of starting salaries and tax rates and allowances. These are not covered in this chapter.

The chapter begins by discussing the issue of hours and holidays. The discussion then turns to the question of unemployment and the related issue of risk and uncertainty. This is followed by an examination of the importance of assumptions relating to the length of course. Supplementary income and fringe benefits are then discussed before turning to the question of ability. Alternative assumptions regarding the C_t profile are then considered. Finally in the light of all these results, as well as those from the previous chapters, a 'ready reckoner' is developed which enables the reader to assess the implications for rates of return of any different assumptions, given their general implications for C_t or B_t profiles.

Hours and Holidays

The question of hours has already been raised in the analysis of medical professions and teaching professions. In the case of the latter the related issue of holidays has also been mentioned. In preparing the results in Chapter 6 we have taken the position that in the case of medical professions one of the reasons for high incomes is the long average working week worked by many doctors. Adjustments to the profiles to reflect this were demonstrated to lead to a significant reduction in the estimated rates of return. In the case of teachers the commonly held

view is that longer than average holidays and shorter contracted hours are characteristic for this group. However, evidence on preparation time and time spent on extra-curricular activities quoted in Chapter 6 suggested that no further adjustment was necessary to the basic rate of return calculation.

The theoretical argument for making adjustments to the basic profiles to reflect differences in hours worked is now well established. Ekhaus (1973a and 1973b) argues that in contrast to physical capital the use of human capital to earn income entails some disutility to the individual in the sacrifice of leisure. Returns to education should therefore take into account the effects of decisions as to its utilization. Ekhaus argues that strictly speaking one should base such calculations on "maximum income" defined as the maximum income that could be earned at the maximum hours that can be worked (allowing for some unavoidable "down time" to maintain the human capital in order). In practice the difficulties in finding a representative maximum ^{number of} hours make this ideal difficult to achieve. As a second best solution Ekhaus therefore advocated adjustment of all incomes on to a standard 40 hour week, 50 week year basis. This, he demonstrates, results in a substantial reduction in many rates of return estimates for different levels of education and in particular for professions such as doctors in the United States. Lindsay (1973 and 1976) presents results to confirm this view although his results have been disputed by Sloan (1976) who argues that Lindsay assumed too high a level of hours worked for medical professions.

The main problem, as in many of the questions discussed in this chapter, lies in the question of measurement. There are very real problems in obtaining comparable measures of hours worked in different professions and occupations. Various ad hoc surveys have been carried out from time to time such as that referred to by the Clegg Commission

dealing with teachers and the evidence referred to by the RBDDR for doctors. The professional institutes, such as the CEI have also introduced questions relating to hours from time to time. In addition there is evidence from more general surveys such as the Census of population and the New Earning Survey which have also asked questions relating to hours worked. Even when data is available for different professions from the same survey significant doubts regarding comparability may still arise. For example Table 8.1 presents some data from the 1971 Census of population.

This table shows the percentage of different groups of workers who worked certain ranges of hours during the week of the 1971 census. Taking all male workers first, the most common length of the working week was between 36 and 40 hours. However, some 28 per cent worked longer than 40 hours. Engineers and scientists hours were bunched more closely into the 36-40 range although a significant proportion of civil engineers in particular worked more than 40 hours. Architects showed a similar pattern. On average the length of the working week for all these occupations was below the average for all workers according to this data.

Legal professions and University lecturers, perhaps surprisingly to some, reported longer than average hours in many cases although for both groups a significant proportion worked between 21 and 36 hours (over 25 per cent in the case of legal professions). In contrast to University teachers, other teachers generally reported much shorter hours, 70 per cent falling into the 21-36 hour category.

The apparently very low hours usually worked by teachers demonstrates some of the pitfalls in comparisons of this kind. This low figure is primarily a reflection of the number of contracted hours that a typical teacher is expected to be in attendance at school (it also reflects the relatively large number of part-time workers). Hours worked after school hours, organising out of school activities, meeting with

parents, preparation time and marking and reports are not included. More detailed analysis taking these factors into account suggests that teachers generally work considerably longer hours than the data in this table suggests (see Clegg, 1980 p.30). This is still the case when holidays are also taken into account.

Returning to the data in the table, dental practitioners and accountants appear to fall somewhere between other teachers and legal professions, with a wide variation in patterns of hours worked. Finally, medical practitioners, on this measure at least, stand out quite clearly as the group with the longest average hours, with over 80 per cent working in excess of 40 hours. However, this again raises the question of how comparable the data are for the different professions. Doctors by necessity tend to spend most of their working hours either at their place of work (e.g. a hospital) or actively ^{ing} carry/out their profession (e.g. making visits to patients). This contrasts with teachers who may work a considerable proportion of their hours outside the school classroom. Similar remarks may apply to various other professions who 'bring work home'. Considerable caution is therefore necessary before using the data in Table 8.1 as a guide to the number of hours of effort put in by various groups to achieve their professional incomes.

In the case of hospital doctors there does seem to be considerable evidence that hours worked are considerably in excess of the norm especially for junior doctors in hospitals. It has been demonstrated in Chapter 6 that the addition of class A/B supplements to basic salaries can increase the rate of return for certain doctors by around 4 per cent on a basic figure of 8 per cent. Given that these supplements can account for over a third of income for junior doctors the size of this effect is not surprising. It does however indicate the potential importance of the whole question of hours worked.

Table 8.1 Hours usually worked by professional workers, 1971^a

	per cent ^b			
	Less than 21	21-36	36-40	More than 40
All males	2.3	7.6	62.2	28.0
Medical practitioners	3.0	5.0	11.0	81.0
Dental practitioners	3.1	24.2	38.3	34.4
University teachers	2.6	13.6	28.4	55.4
Other teachers	2.9	70.3	12.1	14.7
Civil engineers	0.8	7.7	70.1	21.4
Mechanical engineers	0.7	9.7	79.5	10.1
Electrical engineers	0.4	9.3	77.2	13.0
Chemists	0.3	17.4	72.9	9.4
Accountants	2.1	34.6	50.7	12.6
Architects	1.1	20.3	67.2	11.4
Legal professions	2.4	26.6	38.5	32.4

Source: OPCS Census of Population 1971 Economic Activity Part IV Table 24.

Notes: (a) Excluding overtime and meal breaks but including part-time workers.

(b) Percentages working certain hours per week.

The regular survey of professional engineers provides data on hours worked by this group which can be compared with other groups. In 1976/77 for example professional engineers worked just over 38 hours per week on average, compared with over 39 hours per week for male non-manual workers and about 41 hours for all male workers. In addition, they received between 31 and 32 days annual leave compared with an average figure of just under 27 days. In total it appears that the professional engineer had to work roughly 5 per cent fewer hours per year than an average person in order to obtain his income. We can adjust the age earnings profile to take this into account very crudely (if we assume that leisure is valued equally with income at the margin) by scaling the income of qualified engineers up by 5 per cent. This results in an increase in the estimated private rate of return of approximately 1 percentage point.

A corresponding upward adjustment could be made for the various other professional groups that have been considered such as scientists and architects. Conversely the data in Table 8.1 suggests that for some groups such as University lecturers hours worked are well above average; a downward adjustment to rates of return might be deemed appropriate here. However, this group provides an excellent illustration of a situation where for many individuals work ceases to be a burden or purely a means of earning a living but becomes an end in itself. For this reason we have not chosen to make such an adjustment to the rate of return estimates presented in Chapter 6.

Another important aspect of the question of hours worked is the fact that for the economy in general there has been a significant secular decline in the length of the working year. Average hours have fallen from around 47 per week for all full-time men in 1955 to around 42 hours by 1980. At the same time the average holiday entitlement has risen

from a norm of around two to three weeks per year in 1955 to almost 6 weeks by 1980 (Bosworth and Wilson, 1980, Table 4.1). In contrast, the average hours for many professional workers such as doctors and teachers appear to have changed very little. Information on other professional groups is hard to come by but again the impression seems to be that professional hours are both less clearly defined than those for say manual workers and have shown less tendency to change over time.

By not making any explicit adjustment for differences in hours worked we have implicitly assumed that professionals have shared in the general reduction in hours worked. In practice, this does not appear to be the case. For some groups such as teachers the situation is probably more accurately characterised as other workers' hours being gradually reduced towards the average worked by teachers (including preparation time etc.). The implication is that rates of return for earlier years for such professions will be underestimates, since to achieve the income foregone would require working longer hours than worked by teachers. In contrast, for doctors the position is more one of other workers achieving significant reductions in hours while doctors have stood still. This would tend to bias the results for more recent years upwards but the adjustments made in Chapter 6 should compensate for this. In general, the effect of changes in hours would, if we could accurately take them into account, re-inforce the observed secular decline in rates of return for most groups.

Risk and uncertainty

A glance at the statistics on unemployment rates by occupation is sufficient to show that professionally qualified persons have a much lower probability of being unemployed. Weighting the B_t and C_t profiles by the probability of being in employment is therefore likely to raise the

estimated rate of return to attaining professional status. Statistics on unemployment given in Table 8.2 show that between the mid 1960s and mid 1970s the probability of obtaining a job had declined for all workers. The pertinent question here is whether this has affected the qualified significantly differently from the unqualified and whether this might reverse or reinforce the decline in rates of return observed over this period. There are various reasons for expecting the probability of obtaining a job to be higher for the qualified person. In practice, we do not possess the detailed age-unemployment profiles by qualification needed to test this hypothesis. Nevertheless, taking professional scientists and engineers as an example, it is possible to make fairly rough and ready estimates, from which we can obtain some notion of what these profiles might look like. The first row of Table 8.2 gives the average percentage rate of unemployment for qualified scientists and engineers (U_Q) taken from DI (1977). The second row gives the percentage of newly qualified graduates who are still searching for work in the December after graduation (U_{NQ}). These are taken from the UGC publication, First Destination of University Graduates. The third row gives the average rate of unemployment for all males in Great Britain while the fourth and last row is the percentage of young males (<19 years of age) unemployed. In the absence of full age unemployment profiles, these estimates are used to adjust our age earning profiles for the probability of being able to obtain a job (i.e. weighting by one minus the appropriate unemployment rate). For the unqualified profile the estimates for young persons (U_{YP}) were used to adjust the earnings of those less than 20 years of age while all the remaining age groups were adjusted by the whole economy rate (U). The qualified earnings profile was adjusted for those aged less than 23 by U_{NQ} and for all ages above 23 by U_Q . Although this adjustment is necessarily crude, we have estimated distinct employment probabilities

Table 8.2

Unemployment Rates for Qualified Scientists and Engineers Compared with all Workers

						per cent
Unemployment rates						
	1960/61	1962/63	1967/68	1970/71	1973/74	1976/77
Qualified scientists and engineers (a)	0.7	-	1.2	1.9	1.5	3.1
Scientists (a)	0.8	-	1.3	2.1	1.7	3.7
Engineers (a)	0.6	-	1.1	1.7	1.3	2.2
Newly qualified graduates						
All subjects (b)	-	2.9	3.9	8.2	6.6	9.7
Science (c)	1.7	2.8	3.5	7.5	6.2	10.3
Engineering (c)	0.8	1.6	1.7	6.8	3.3	4.8
All males (d)	1.8	1.6	1.7	6.8	3.3	4.8
All males under 20 years of age (e)	1.7	2.2	3.1	6.7	8.1	14.9

Sources and Notes: (a) 1960/61-1970/71 based on Census of Population estimates.

(b) 1973/74-1976/77 own estimates based on occupational data and Department of Industry estimates of total numbers in employment.

(c) Those still seeking work in the December of the second year; First destination of University graduates. 1973/74 and 1976/77 include those in temporary home employment.

(d) Estimates based on data in DI(1977). Results for recent years use unpublished material supplied by the Department of Employment.

(e) Wholly unemployed males in Great Britain in December of the second year based on data published in DE Gazettes.

(f) Based on data in Wells (1983) which were for mid-year. Averages were calculated from data for the second and the following year to give the best correspondence to the December observations used for the other series.

Table 8.3 Rates of Return for Scientists and Engineers Adjusted for Unemployment¹

	1967/68	1970/71	1973/74	1976/77
per cent				
Scientists				
Private rates of return				
Standard result	14.5	12.5	9.5	9.5
Adjusted (for probability of finding a job)	15.0	13.5	10.0	10.5
Social rates of return				
Standard	8.5	8.0	6.0	6.0
Adjusted	9.0	8.0	6.5	6.5
Engineers				
Private rates of return				
Standard result	14.5	13.0	10.5	9.5
Adjusted (for probability of finding a job)	15.0	14.0	11.5	10.0
Social rates of return				
Standard	7.5	7.0	6.0	5.5
Adjusted	7.5	7.5	6.5	6.0

Note: (1) The results in this table differ in various minor respects from those reported in Wilson (1983) Table 3.

for the first 10 years which are by far the most important in our rate of return calculation, given the high rate at which later years are discounted.⁽¹⁾ Table 8.3 compares our adjusted rate of return estimates with the original estimates for all scientists and engineers. As expected, the employment probability adjustment improves the rate of return reflecting the lower probability of unemployment in professional occupations. More surprising perhaps is that this advantage does not reverse the decline in the rate of return as the economy moved into recession in the 1970s.

For scientists this adjustment serves simply to increase the private rate of return at each point in time by about half a percentage point, reflecting the higher probability of qualified persons finding employment. For engineers the impact of the adjustment increases over time reflecting the falling relative unemployment rate for engineers over this period. Nevertheless the effect is still quite small and only slightly offsets the overall decline we have observed. The method of adjustment used will also tend to exaggerate the impact of short-term fluctuations in relative unemployment rates on the expected probabilities of obtaining employment in different careers. Our adjustments assume that individuals take current rates of unemployment as representing probable future unemployment probabilities. If, as seems more likely, people take a rather longer-term view, the effect on the profile of the estimated rates of return over time of adjusting for the probability of finding employment will be even smaller.

The reasons for this seem clear on referring back to Table 8.2. Unemployment has risen rapidly for all workers, especially young people, which ceteris paribus would reduce the expected earnings foregone while

(1) The estimates of rates of return obtained were not very sensitive to the precise nature of the adjustment.

undertaking the course of study and increase the differential obtained upon qualifying. However, all else has not been equal and the rate of unemployment of scientists and engineers has also increased especially for the newly qualified. This has therefore offset the worsening employment prospects of the unqualified. This adjustment does not therefore lead us to change our conclusion that there has been a substantial decline in the prospective return to obtaining professional qualifications at degree level over this period.

Of course, risk of unemployment is only one aspect of the risks and uncertainties connected with investment in human capital. In Chapter 4 the issue of the risks associated with self employment was raised. There we argued that substantial adjustments to the incomes of self-employed were justified on account of necessary capital outlays and expenses on pension provisions. Even when these adjustments are made there are still various other risks associated with self employment which are not associated with status as an employee. Doctors and lawyers for example may be sued if they make a professional misjudgement. Even if they are insured against such an eventuality, reputations are more easily lost than gained. Some differential in incomes to reflect such risk is therefore to be expected.

Apart from unemployment there are other risks and uncertainties associated with both employee and self-employment status. It is a well established fact that there is enormous variation in individual incomes even when one has standardised for important factors such as age, education and qualifications.⁽²⁾ Thus, even if an individual decides to follow a certain career path which involves a substantial investment in human capital, there is in principal a substantial range around the average income for a typical qualified person within which his income may

(2) See for example the discussion in Routh (1980 p.212).

actually fall. Evidence collected by the RCLS for this country confirms the results of studies for the US such as that by Friedman and Kuznets (1954) that variation in income is even more marked for self-employed professions such as doctors and lawyers.

In the discussion of results for teachers the choice of whether it is best to use median or mean income profiles in calculating rates of return was raised. From a social viewpoint it is clearly the mean income profiles that are relevant. From an individual viewpoint however an individual may be more interested in the income he is most likely to receive rather than the average income to be expected for all individuals undertaking a particular investment. For a risk averse individual the median or indeed modal income profile may be the more relevant. The variations of income profiles around the mean or median value is therefore of considerable interest. Ceteris paribus more risk averse individuals may prefer careers in which there is less variation in incomes while the more adventurous type may prefer the reverse. Some careers such as teaching seem likely to appeal more to the former category while a career as an entertainer may appeal more to someone in the latter group. Such considerations may be one reason for variations in rates of return estimated for different professions (see for example the discussion concerning solicitors and advocates in Chapter 6 page 6.40, above). This question is also related to the length of course as noted in Chapter 6. Persons undertaking a larger (longer) investment such as that associated with a medical career may receive a higher return to reflect the additional risks associated with such a career plan compared with a shorter investment involving for example just a first degree with more immediate returns. We return to the issue of sensitivity of the results to the assumption of course length below.

Regrettably there is insufficient data to make meaningful comparisons of the degree of risk associated with the range of possible earnings in different professional careers. However, the professional engineering institutions have collected and published information on the spread of earnings including age earnings profiles for highest and lowest deciles etc. The estimates of rates of return presented so far have been based upon the assumption that individuals expect to attain the median earnings levels achieved by their contemporaries as revealed by cross-sectional age-earnings profiles. It is apparent from the data published by the CEI for engineers that there is an enormous variation in the earnings of individuals within the same occupational category even if they are of similar age and hold similar qualifications.

Some insight into the possible range within which rates of return might fall ex post can therefore be obtained by reworking the calculations using instead of the median earnings the earnings achieved by for example the highest and lowest decile. The results of such an exercise are presented in Table 8.4 using as an example the data for professional engineers. Taking the results for 1965/66 the rate of return, assuming an individual obtains the median level of earnings, is 14.5 per cent. If the individual is exceptionally gifted or perhaps just lucky enough to achieve a profile equivalent to that obtained by the highest decile, his expected rate of return jumps to 21.8 per cent. Conversely someone unfortunate enough to only achieve the lowest decile earnings would get a return of 8.2 per cent. Nevertheless the latter still compares favourably with alternative investments. This statement cannot be made with confidence when the results for more recent years are considered however. By the end of the 1970s the rate of return based on the lowest decile has fallen to just over 3 per cent.

Rates of return based on the lowest and highest deciles and quartiles tend to follow the path of those based on the median earnings quite closely, falling up to 1976/77 with some recovery in the last year or two. The range of possible rates of return has also fallen but only slightly from a 13.5 per cent difference between highest and lowest decile in the mid 1960s to 11.5 per cent in 1976/77. This fall is less than half the fall in the median based rate of return however and by 1978/9 the range was back up to 13.0 per cent.

In absolute terms the prospective "high fliers" appear to have suffered most, expected rates of return falling by almost 7 percentage points between 1965/66 and 1976/77 compared with 5 per cent for the median and for the lowest decile. On the other hand the high fliers appear to have benefitted most from the slight recovery in 1978/79. Compared with 1965/66 the drop is now 5 percentage points, only $\frac{1}{2}$ per cent more than for the lowest decile. The growth in relative earnings of the highest decile in the last few years is consistent with the view that employers may have been using the earnings to attract the top fliers even if they have not been willing to increase the relative wage of engineers as a whole in order to choke off the so-called shortage.

Very similar remarks apply in the case of social rates of return as the results in Table 8.4 clearly show. Given the lower absolute levels, it is not surprising that the range of values around the median based estimate is much smaller (+ 4 percentage points in 1965/66 between median and lower and upper deciles). One interesting aspect of the social results however is that the returns to high fliers above the highest decile have not fallen in line with those for the median. This is in contrast to private returns and reflects the fact that only at very high income levels are the large direct costs of education offset in recent years.

Table 8.4 Rates of Return for High and Lower Fliers :
Engineers 1965 - 1978

	per cent				
	Lowest decile	Lowest quartile	Median	Highest quartile	Highest decile
Private returns					
1965/66	8.2	11.2	14.5	18.2	21.8
1967/68	8.3	11.4	14.6	18.2	22.0
1970/71	7.0	9.6	13.0	16.0	19.5
1972/73	4.4	7.7	10.5	13.9	17.6
1974/75	4.1	7.3	10.5	13.8	17.1
1976/77	3.4	6.7	9.3	12.3	15.3
1979/80	3.3	6.5	9.4	12.3	16.2
Social returns					
1965/66	3.6	5.5	7.4	9.5	11.5
1967/68	3.9	5.7	7.6	9.6	11.6
1970/71	3.4	5.1	7.0	8.9	10.9
1972/73	1.8	4.1	5.9	8.1	10.3
1974/75	1.6	3.9	6.0	8.1	10.2
1976/77	1.1	3.5	5.4	7.4	9.3
1979/80	1.2	3.4	5.4	7.5	11.6

Course Length

It has already been demonstrated for groups such as architects and university lecturers that alternative assumptions regarding the length of course can make quite a significant difference to the overall rate of return. While this does not usually have much impact on the profile of rates of return over time it can be of great importance when making comparisons between different professional/occupational groups.

The results presented for engineers in Chapter 3 were based on an assumption of a three year degree course. It is useful to assess the sensitivity of these results to this assumption both as a general guide and also to provide a more complete picture for engineers. From the evidence presented in Chapter 5 it is apparent that although most engineers still followed a 3 year degree course in 1972 a very significant proportion (42 per cent) follow a 4 year course, and 2 per cent a course of 5 years or more.

The results in Table 8.5 demonstrate the impact of assuming longer course lengths on the basic calculation. In the case of private rates of return each additional year of course assumed reduces the result by around 1 percentage point, the impact being larger the larger is the basic estimate (i.e. in 1967/68 each additional year subtracts about 1.2-1.3 percentage points, in 1976/77 the impact is 0.6-0.7 percentage points). This almost certainly exaggerates the true difference since in carrying out these calculations we assume the same B_t profile in each case whereas in practice those undertaking a longer investment might expect to achieve higher incomes if firms value the additional education and training this represents. These results are basically in line with those presented in Chapter 6 for architects and for university lecturers.

Table 8.5 Rates of Return for Engineers : Alternative
Assumptions about Course Lengths and Comparison Incomes

	per cent					
	Private Returns Course length:			Social Returns		
	3 years	4 years	5 years	3 years	4 years	5 years
1967/68						
All workers C _t profile	14.6	13.3	12.2	7.6	7.3	6.9
Non-manual workers C _t profile	13.7	12.3	11.1	6.7	6.4	6.0
1976/77						
All workers C _t profile	9.5	8.8	8.2	5.5	5.2	4.9
Non-manual workers C _t profile	8.8	8.0	7.3	4.7	4.4	4.1

Alternative Comparison Incomes

The results in Table 8.5 also show the sensitivity of the estimates to alternative assumptions regarding the comparison income profile. For all the results presented so far we have assumed that the C_t profile is best represented by the age earnings profile for all (generally male) workers. This can be justified on pragmatic grounds in the absence of data on the age earnings profile of potential professional/graduate personnel who do not make that investment in human capital. It also seems to be an appropriate yardstick against which to set the fortunes of any particular profession or occupational group. One possible alternative profile would be that for all non-manual workers. It could be argued that this might be more representative of the potential population from which the graduate or professional person might be drawn. It was not used as the basic C_t profile in the present analysis for two reasons. First, there is not a general index of the earnings of non-manual workers comparable to the index of average earnings for all workers. The latter has been used extensively for 'timing' adjustments to the C_t profile as described in earlier chapters. Second, the use of the all workers profile suffers from the disadvantage that this profile includes the earnings of the relatively small proportion of professional persons with degrees or equivalent qualification. For non-manual workers this problem is roughly twice as severe since non-manual workers represent around 50 per cent of the employed labour force.

In any event it is clear from the results presented in Table 8.5 that, apart from a scalar difference of around one percentage point, the use of the non-manual earnings profile in place of the all workers one has very little impact. Comparisons over time are basically unchanged (a reduction of 5.1 per cent for engineers using the all workers profile between 1967/68 and 1976/77 is reduced to 4.9 per cent when the non-manual profile is used. Comparisons between professions are also not affected.

The use of the non-manual profile in place of the all workers profile does not however imply a scalar adjustment to the C_t profile. In fact, in the initial part of the age-earnings profile, earnings of non-manual workers are below average and it is only after the age of around 25-30 that non-manual groups open up a significant differential over manual workers. The effect of a scalar adjustment to the $C(I)$ profile is discussed in the section on "ready reckoners" below.

Supplementary Income and Fringe Benefits

For a number of professions fringe benefits or supplementary income may make a significant contribution to the overall remuneration package. It is therefore important to take such benefits into account both to improve the estimates of the absolute values of rates of return and also to ensure comparability between different professions. It is usually the case that the importance of fringe benefits, which include such factors as employer financed pension schemes and the use of a company car, is rather difficult to assess. According to the survey of professional engineers in 1972/73 only half the respondents admitted being in receipt of fringe benefits and the latter amounted to about 20 per cent of their original income. In the 1974/75 survey, while the proportion of receipt of such benefits remained the same, the value of the benefits as a proportion of basic income was only 11 per cent. Regrettably comparable information has not been collected in subsequent surveys so it is difficult to assess whether the prevalent view that fringe benefits have increased as a proportion of income is in fact the case.⁽³⁾ On average a figure of some 5-10 per cent of income seems to be a rough estimate of the value of such benefits for engineers. Of

(3) Results from the 1976/7 and 1978/9 surveys do however suggest a rise in the proportion of people in receipt of benefits such as index linked pension schemes.

course unqualified people may also have their real incomes supplemented in a similar manner. It would therefore be unrealistic to regard all of this 5-10 per cent as a net gain to obtaining a relevant qualification. At most perhaps 5 per cent might be attributable to attaining professional status. Making suitable adjustments to the age earnings profiles, this again translates into an increase in the private rate of return of roughly 1 percentage point.

The Royal Commission on Legal Services (1979, para 20.72) in attempting to assess the value of fringe benefits, noted the difficulty in quantifying such diverse things as free insurance, company car and subsidised lunches. The value to an employee may vary from zero to the increase in gross salary necessary to enable the individual to supply it for himself. Furthermore there are enormous disparities in the degree of provision of different benefits. For these reasons estimates of the average value of such benefits must be hedged with caveats. The RCLS estimated that for barristers and solicitors employed in industry a 10 per cent addition to gross salaries was appropriate. Reference to Chapter 6 above will show that the inclusion of such benefits raises the estimated rate of return by about 1 percentage point. As for engineers however, this probably over-estimates the true effect since some fringe benefits will also be available to unqualified persons.

Similar remarks apply to university lecturers. There is considerable evidence that large numbers of people in this profession supplement their income by taking on additional work outside their normal teaching responsibilities. In Chapter 6 we estimated that such income might amount to an addition of 5-12 per cent to gross salaries. Translating this into terms of rates of return, the inclusion of supplementary income would raise a typical estimate of 10 per cent to 11 per cent.

Ability

Next we turn to the question of how much of the observed differential in earnings is the result of differences in ability. Psacharopoulos (1975) after an exhaustive survey, concludes that previous studies which have attributed as much as a third of earnings differentials to ability have exaggerated its importance as an independent factor. He argues that a more realistic estimate lies between 10 and 20 per cent. This estimate does not allow for the fact that the contribution of education may be in part solely due to ability if the education system functions as a screening device for "labelling" potential recruits. However Psacharopoulos has argued that the screening argument has been overstated. It is crucial to distinguish between initial (or 'weak') screening and persistent (or 'strong') screening (Psacharopoulos 1981). The former refers to a situation where employers use qualifications as a guide to inherent ability just at the initial hiring point, the latter to a situation in which employers continue to pay higher wages solely on the basis of qualifications held and regardless of individual productivity. Once this distinction is made it is apparent that initial screening is both very common and also has a social informational value. On the other hand there is so far very little evidence to support the notion of persistent screening (Psacharopoulos, 1979). The overall conclusion must be that previous adjustments to the differential between the B_t and C_t profiles by the " α factor" (as for example advocated in Blaug (1965)) have tended to overestimate the effect of ability and underestimate the contribution of education and training.

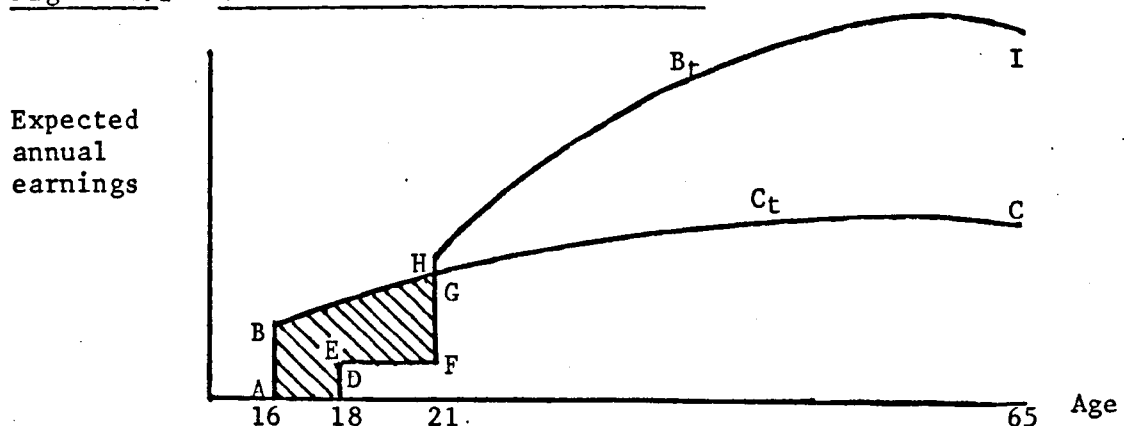
In the results presented so far no adjustment has been made for ability. All the estimates can be regarded as biased upwards for this reason.⁽⁴⁾ The extent of the bias can be gauged by reworking the

(4) However there are other biases as noted below and these tend to be off-setting.

estimates after adjusting the differential between B_t and C_t profiles. A moment's reflection however will be sufficient to recognise that a straightforward application of the α factor to the difference between B_t and C_t is not appropriate. Consider Figure 2.1 reproduced here as Figure 8.1. To the right of the line HGF the net benefits from the investment in education and training represented by the area CGHI can be obtained by subtracting C_t from B_t and summing over all t . However, if an individual is brighter than average, then C_t will underestimate his earnings without education and training. Suppose the proportion of the earnings differential due to education and training is α , then, pre-multiplying both B_t and C_t by this proportion will provide the appropriate adjustment for the rate of return calculation. However, to adjust the B_t and C_t profiles to the left of HGF in a similar fashion would not be appropriate.

The basic difficulty is that almost by definition the B_t and C_t profiles relate to groups of different average abilities. In practice we do not observe a notional C_t profile which would be achieved by people of the same average ability as those who actually achieve the B_t age-earnings profile. This notional C_t profile (say C_t^*) would presumably lie above C_t for all ages.

Figure 8.1 The Rate of Return Calculation



The brighter than average individual will presumably therefore forgo a larger amount of income than indicated by the C_t profile. In order to take this into account it is necessary to adjust the differential between B_t and C_t to the left of HGF (e.g. the shaded area) upwards. Surprisingly, this is not an issue that has been explicitly discussed in the literature yet it is clearly important. We have chosen to increase the differential represented by the shaded area upwards by a factor of $\frac{1}{\alpha}$ to reflect this additional cost.

In order to demonstrate the sensitivity of our results to the assumptions about ability we take engineers and scientists as an example. Adjusting the age earnings profiles to remove the proportion $(1-\alpha)$ due to ability by premultiplying through by α , or $\frac{1}{\alpha}$ to the left of GHF, reduces both private and social rates of return for both groups by roughly the same proportion. Thus in 1976/77 for engineers the standard result of a private rate of return of 9.5 per cent is reduced to 6.0, 7.5 and 8.5 per cent respectively if α is assumed to take the value $\frac{2}{3}$, $\frac{3}{4}$ or $\frac{9}{10}$. This adjustment has no real impact on the profile of rates of return over time. For social rates of return a basic estimate of 5.5 per cent is reduced to 3.5, 4.0 and 5.0 respectively. Similar conclusions apply with respect to the impact of the alternative assumptions on the estimates for scientists and for other professional groups. Taking a value for α of 0.9, then the adjustment for ability and that for unemployment discussed above are roughly offsetting. For example, taking both these factors into account social rates of return for engineers in 1976/77 is 5.5 per cent, the same as the original estimate presented in Chapter 3.

Two further questions relating to ability should be raised here. The first is the question of differences in ability between different professions; should these differences affect the comparison of rates of

return? The second is the question of change over time: is the educational system scraping the bottom of the ability barrel?

It might be argued that, in making comparisons between scientists, engineers and other professions, different assumptions should be made with regard to the ability adjustment. Finniston (1980 p.78) has expressed doubts about the quality of entrants into the engineering profession. If one accepts 'A' level scores as a quantitative measure of the ability of those entering university, applicants for engineering and technological subjects are of consistently lower quality than the average for those applying to other disciplines. This however also applies to most science courses other than medical degrees for which entrants are generally much better qualified. The differences are however not large. In 1978 the average value of 'A' level scores for engineering and technology, science and all subjects were 9.06, 9.25 and 9.45 respectively (Department of Employment, 1980 p.271). 'A' level scores are of course only one possible measure of quality or ability. (For further discussion on this issue see Lumsden et al (1980)).

It is not possible to convert such scores into a cardinal measure of ability; however it does seem clear that in general engineers and technologists are drawn from a somewhat less able pool of individuals. The implication is that, in order to compare like with like, a somewhat larger adjustment factor should be used in the case of engineers, thus tending to increase the estimates of rate of return for this group relative to scientists. However on the basis of 'A' level scores, the difference appears to be very small and insufficient to seriously overturn the results presented here and in earlier chapters. Conversely a smaller adjustment factor may be justified in the case of medical professions reducing rates of return compared with other groups and reflecting the higher average level of ability of this group. However, given the present state of our knowledge, it is very difficult to

estimate what proportion of the differential in favour of medical professions is in fact attributable to pure ability.

Probably even less is known about secular changes in the average level of ability. Many fears have been expressed from time to time about falling educational standards and the limited pool of able people. Nevertheless, despite a substantial expansion of the educational system in the post-war period, it is not clear that these fears have been justified. Certainly there is not enough hard information on the ability levels of typical professionals in 1955/56 and 1980/81 to enable us to make any serious estimate of whether declining ability could explain the observed decline in rates of return. However, given the much larger proportions of individuals who are regarded as worthy of degree level training in many other countries and given the evidence from 'A' level results etc., of the maintenance of academic standards in this country, it seems unlikely that the growth in professional numbers has had a significant effect on average ability levels. Consequently, this cannot have played a significant role in declining returns to professional status.

Ready Reckoner

From the analysis discussed above, it will be clear that most of the questions regarding the sensitivity of the rate of return estimates to different assumptions can be resolved by making appropriate adjustments to the C_t and/or B_t profiles in whole or in part. In order to enable the reader to take this further, we provide in this section a set of "ready reckoners" from which it is possible to gain a rough idea of the impact of a change in any given assumption once this is translated into the form of a change in the C_t or B_t profile.

Since the sensitivity of the results depends in part on the absolute level of the original rate of return estimate and also on the size of the adjustment factor applied to the age-earnings profiles, the best way of presenting this information is in the form of a series of figures. These illustrate the effect of changes in the basic assumptions relating to the main elements of B_t and C_t profiles on the estimated rates of return for three professions, economists, chemists and architects. The impact also varies depending upon whether one is dealing with social or private rates of return.

Figures 8.2 and 8.3 show the effect of applying different adjustment factors to the C_t profile. Figures 8.4 and 8.5 show the effect of just altering that part of the C_t profile corresponding to the earnings of young people below the age of 20. The next figure demonstrates the effect of adjustments to the assumptions about the size of the maintenance grant and vacation earnings. This is shown for private returns only since the maintenance grant does not figure in the social rate of return calculation. Figure 8.7 on the other hand refers only to social returns and shows the effects of alternative assumptions about the direct costs of education and training. The following 6 figures show how the results are affected by adjustment factors applied to various portions of the B_t profile. In conjunction the information in these figures enables the reader to assess the result of changes in any of the basic assumptions on any particular rate of return estimate. The figures give just three basic results but it is clear that, although the responses to adjustment factors are not linear, they show very similar patterns for the three groups covered. The impact on other groups can therefore be assessed by interpolating between the functional relationships shown (which incidentally are based on results for economists, physicists and architects for 1979/80).

Adjustment of the C_t profile for those aged 15-19 in an upward direction naturally reduces the estimated rates of return (see Figure 8.2). However, even if the value of C_{15-19} is doubled, the impact on rates of return is not too dramatic. The basic results (when the adjustment factor is unity) are 6, 10 and 16 per cent for the bottom, middle and top lines in each figure. Doubling C_{15-19} reduces these to about 4, 8 and 12 per cent respectively. On the other hand, a reduction in C_{15-19} by a factor of 50 per cent increases the returns to 9, 13 and 23 per cent respectively. This non-linearity is common to many of the figures. In the case of social returns (Figure 8.3), the effects are similar but here the non-linearities are not so pronounced.

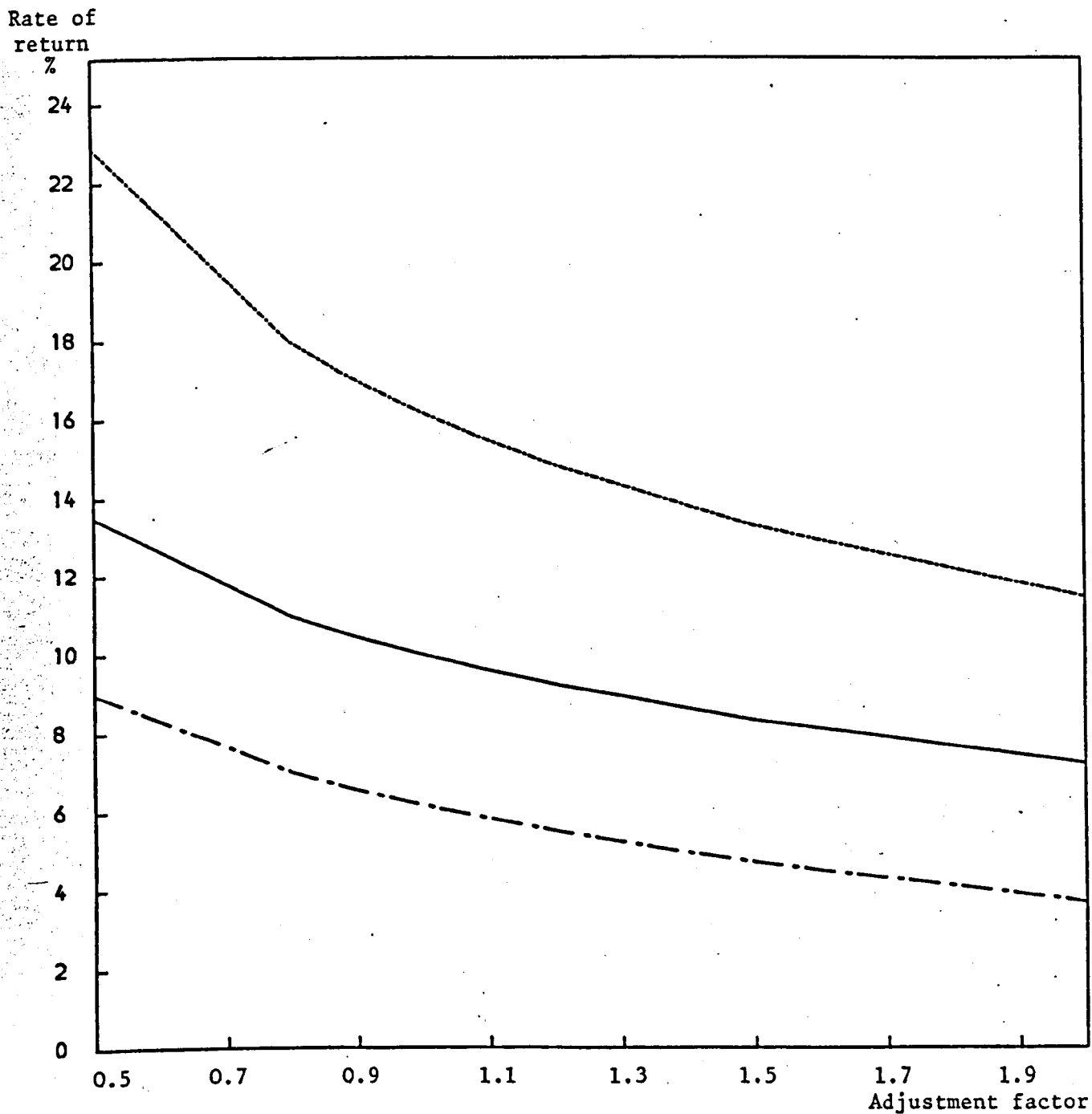
When the whole of the C_t profile is adjusted as in Figures 8.4 and 8.5, the impact on estimated rates of return is naturally much greater. Doubling C_{15+} reduces returns for the two lower lines below zero for both the private and social case. Halving the C_{15+} profile increases the returns for all three examples significantly to around 25 per cent for the two lower lines and for the upper line to almost 35 per cent. Obviously these are extreme values. However, it is clear from the figures that although non-linear, there is a clear monotonic relationship between the rates of return estimated and the size of the adjustment factors applied.

The effects of variations on the basic values assumed for the size of the student grants and for the cost of doing a first degree plus 'A' levels are shown in the next two figures. Clearly these are almost linear. Using these two figures the approximate impact of any proportionate adjustment to these key assumptions can be gauged. For example, consider the effect on the private return for physicists in 1970/71 (of 13.5 per cent) of a 25 per cent increase in the student grant. From the top line in the figure such an increase would raise the estimated rate of return by about $\frac{1}{3}$ of one per cent;

from the central line the effect is nearer $\frac{1}{2}$ of one per cent. Interpolating between these values gives an estimated effect of about $\frac{5}{8}$ of one per cent.

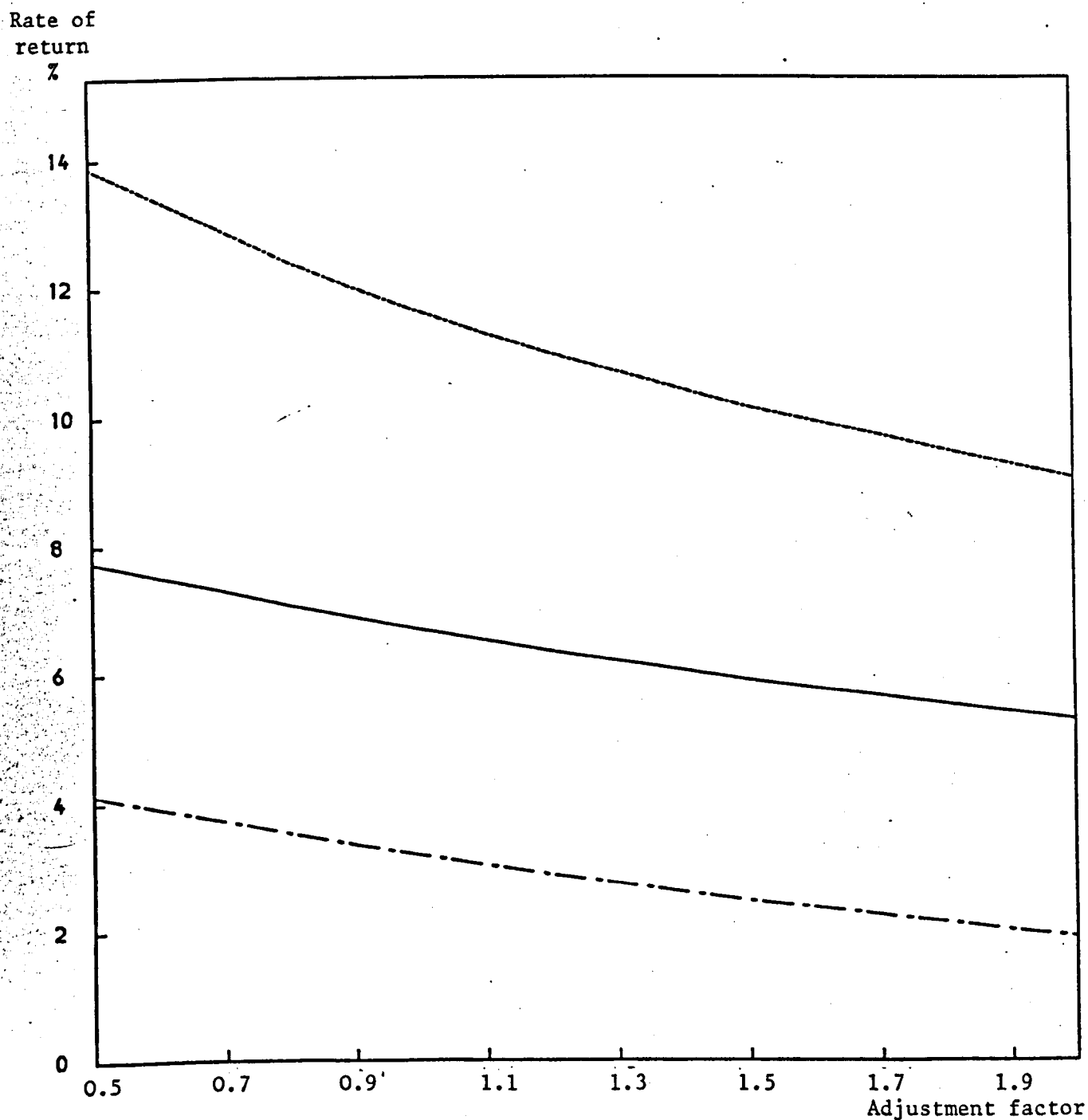
Figures 8.8 to 8.13 show that adjusting various parts of the B_t profile also has a non-linear impact on rates of return. An interesting feature here, however, is that, while the effect of increasing B_{20-24} has a more than proportionate effect on estimated rates of return, the effect of increasing B_{25+} becomes proportionately less as the adjustment factor is increased. In combination, however, the effect of increasing B_{20+} ($B_{20-24} + B_{25+}$) is dominated by the latter.

Figure 8.2 Impact on Private Rates of Return of Applying
Different Adjustment Factors to C_{15-19}



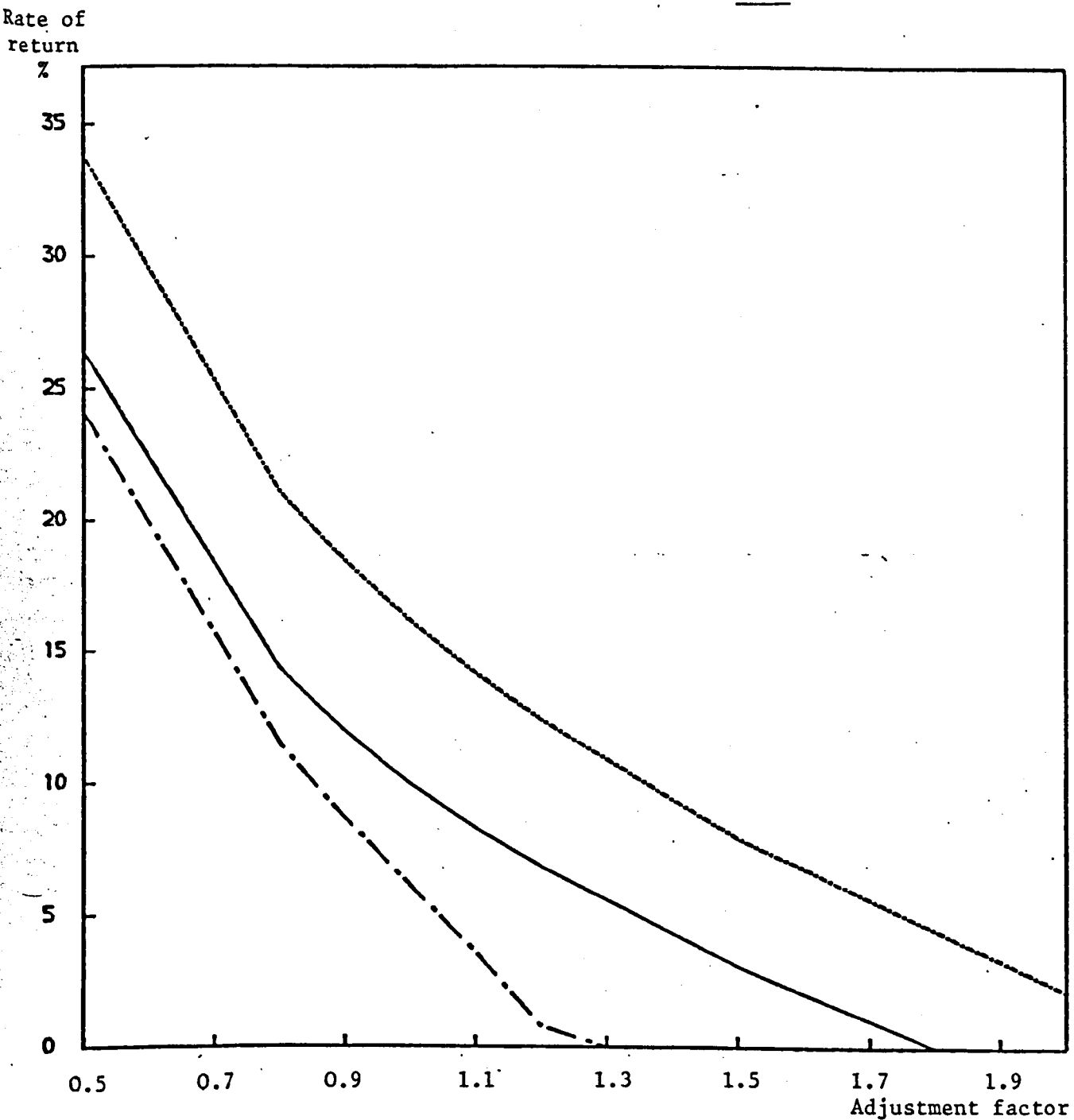
Notes: The figure shows for 3 cases the effect of adjusting the value of C_{15-19} , (i.e. that part of the C_t profile concerning those aged 15-19) by different adjustment factors.

Figure 8.3 Impact on Social Rates of Return of Applying
Different Adjustment Factors to C_{15-19}



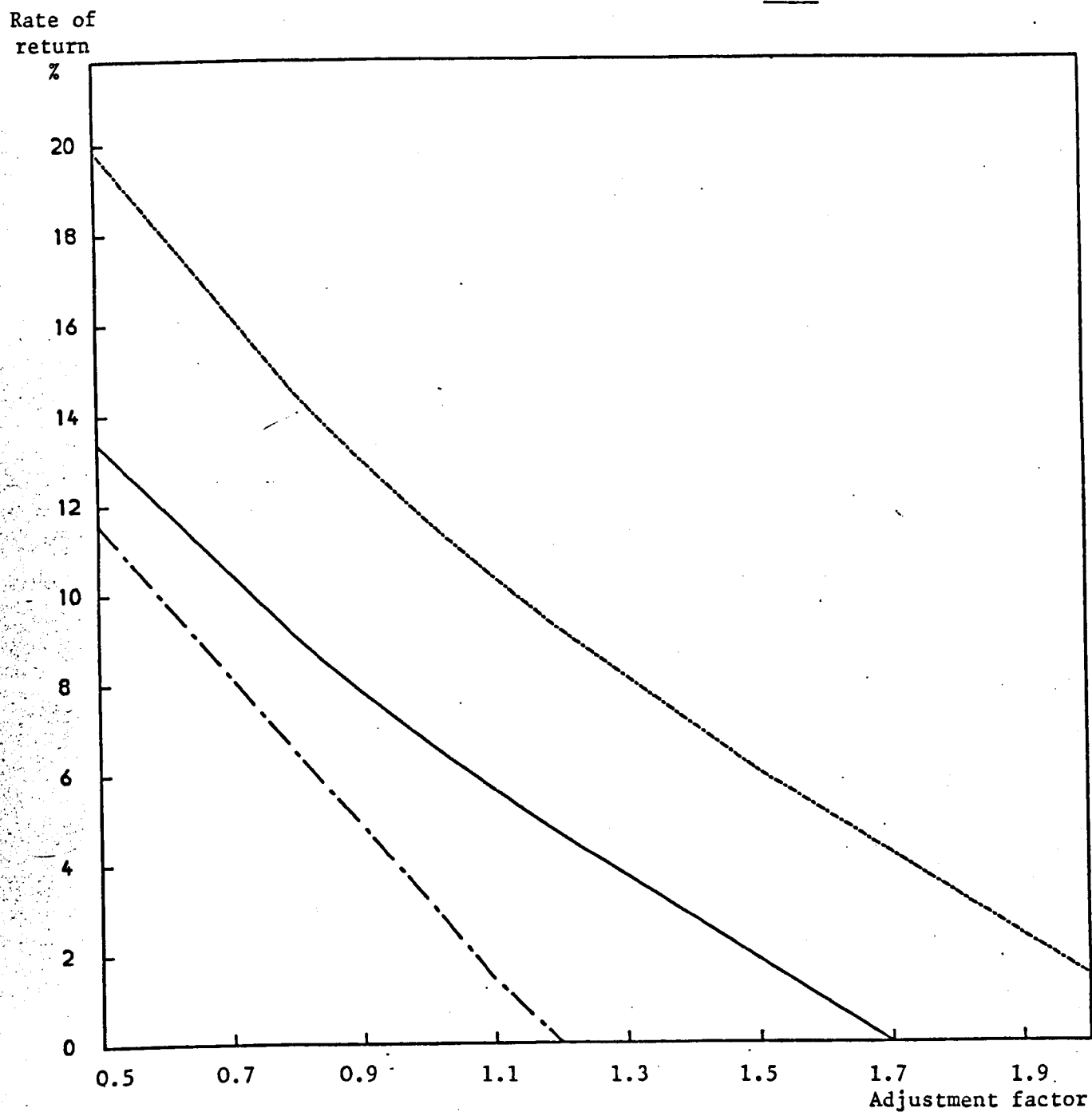
Notes: The figure shows for 3 cases the effect of adjusting the value of C_{15-19} , (i.e. that part of the C_t profile concerning those aged 15-19) by different adjustment factors.

Figure 8.4 Impact on Private Rates of Return of Applying
Different Adjustments Factors to C_{15+}



Notes: The figure shows for 3 cases the effect of adjusting the value of C_{15+} , (i.e. the whole of the C_t profile) by different adjustment factors.

Figure 8.5 Impact on Social Rates of Return of Applying
Different Adjustment Factors to C_{15+}

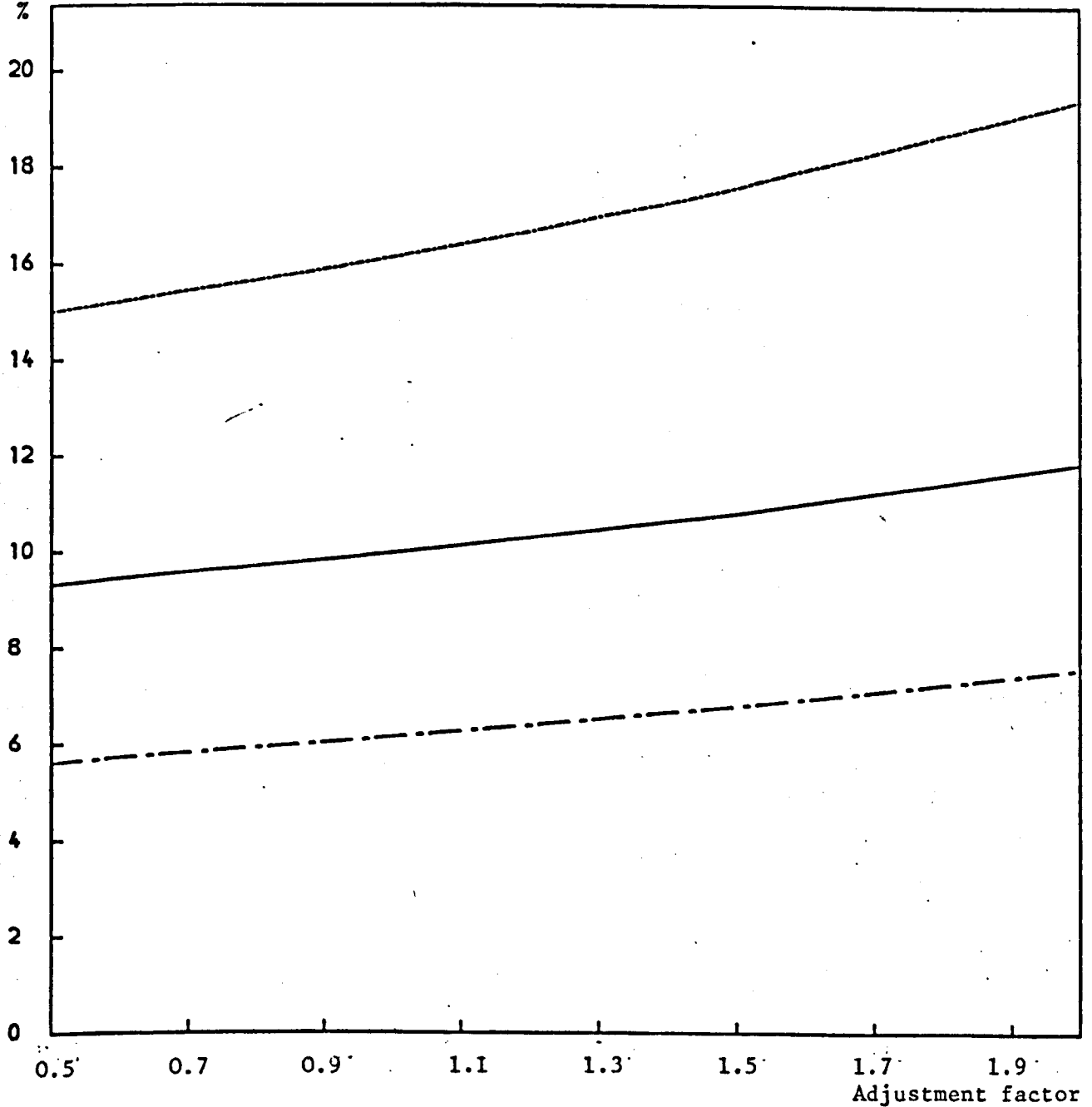


Notes: The figure shows for 3 cases the effect of adjusting the value of C_{15+} , (i.e. the whole of the C_t profile) by different adjustment factors.

Figure 8.6

Impact on Private Rates of Return of Applying
Different Adjustment Factors to the Student Grant

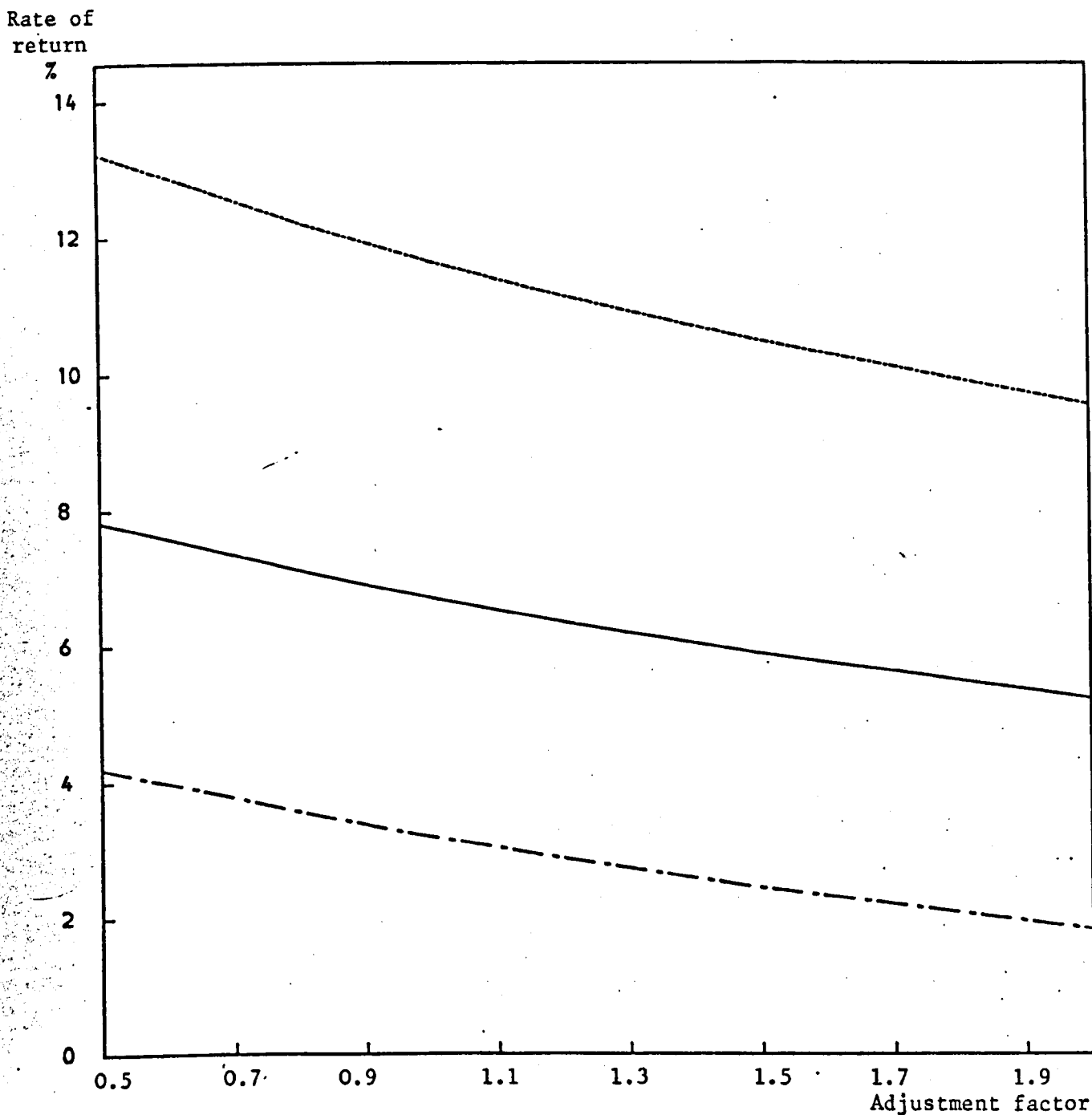
Rate of
return
%



Notes: The figure shows for 3 cases the effect of adjusting the value of the student grant by different adjustment factors.

Figure 8.7

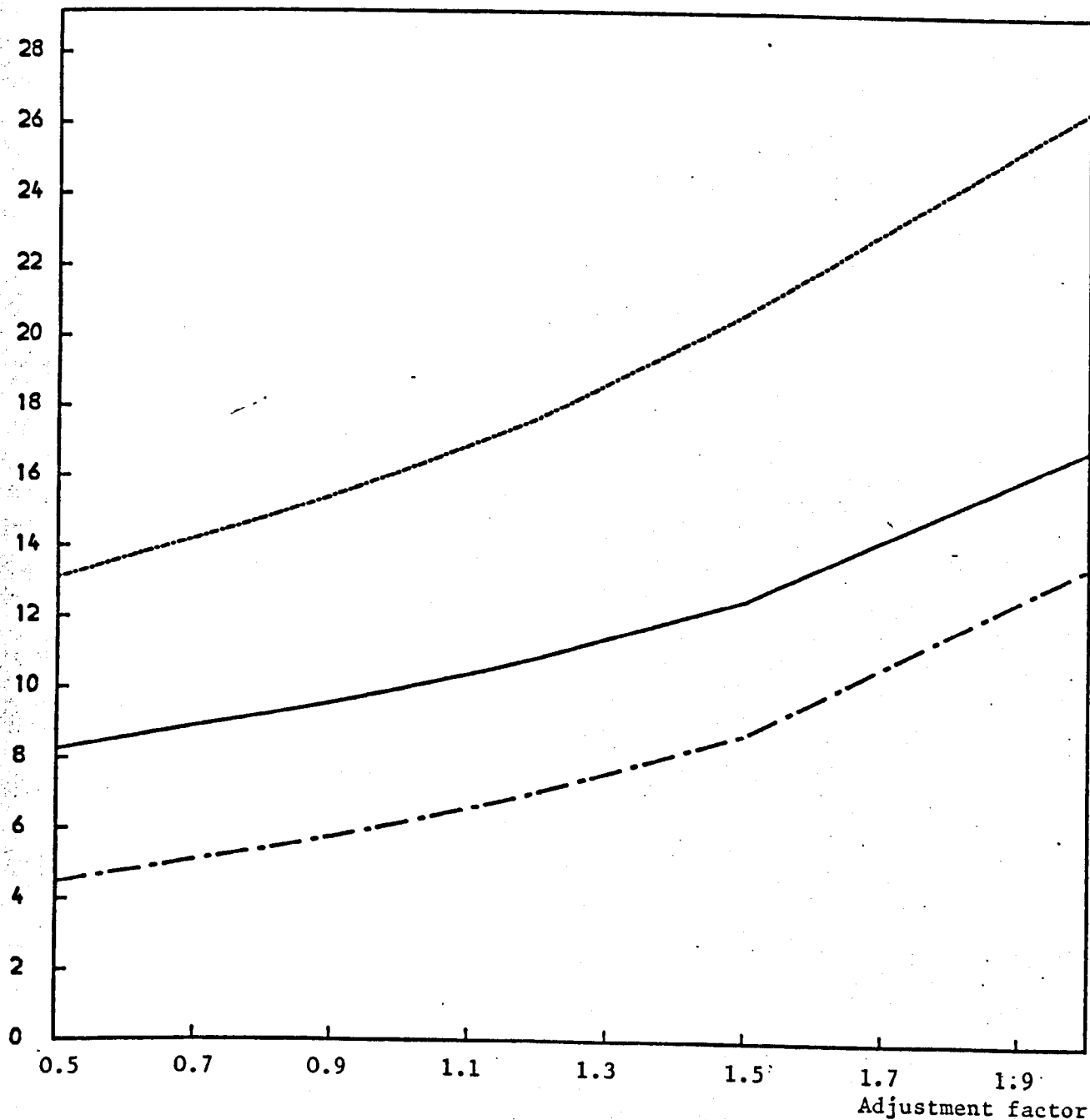
Impact on Social Rates of Return of Applying
Different Adjustment Factors to the Cost of
a First Degree Plus 'A' Level



Notes: The figure shows, for 3 cases, the effect of adjusting the value of a first degree plus 'A' level by different adjustment factors.

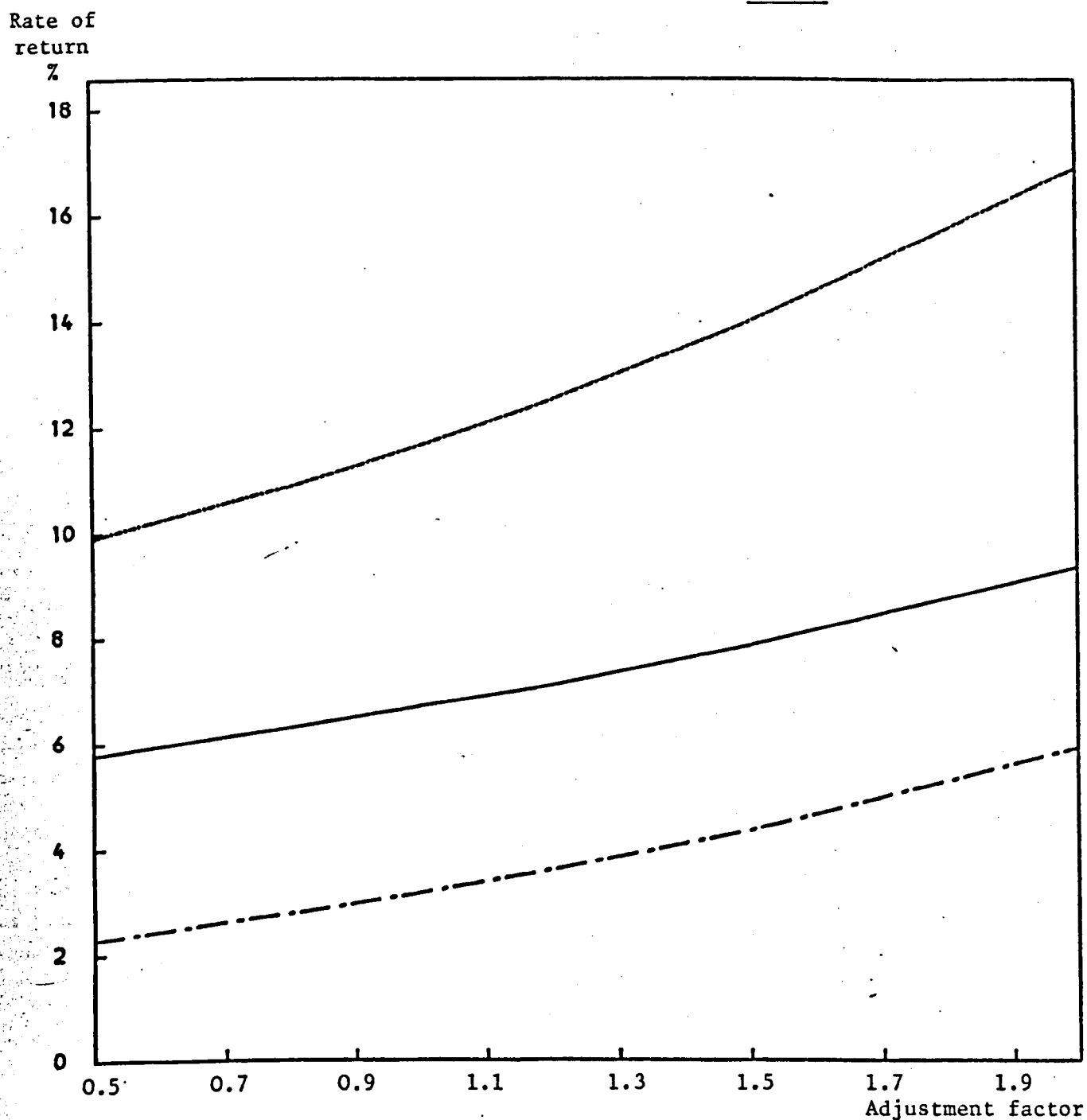
Figure 8.8 Impact on Private Rates of Return of Applying
Different Adjustment Factors to B_{20-24}

Rate of
return
%



Notes: The figure shows, for 3 cases, the effect of adjusting the value of B_{20-24} , (i.e. that part of the B_t profile concerning those aged 20-24) by different adjustment factors.

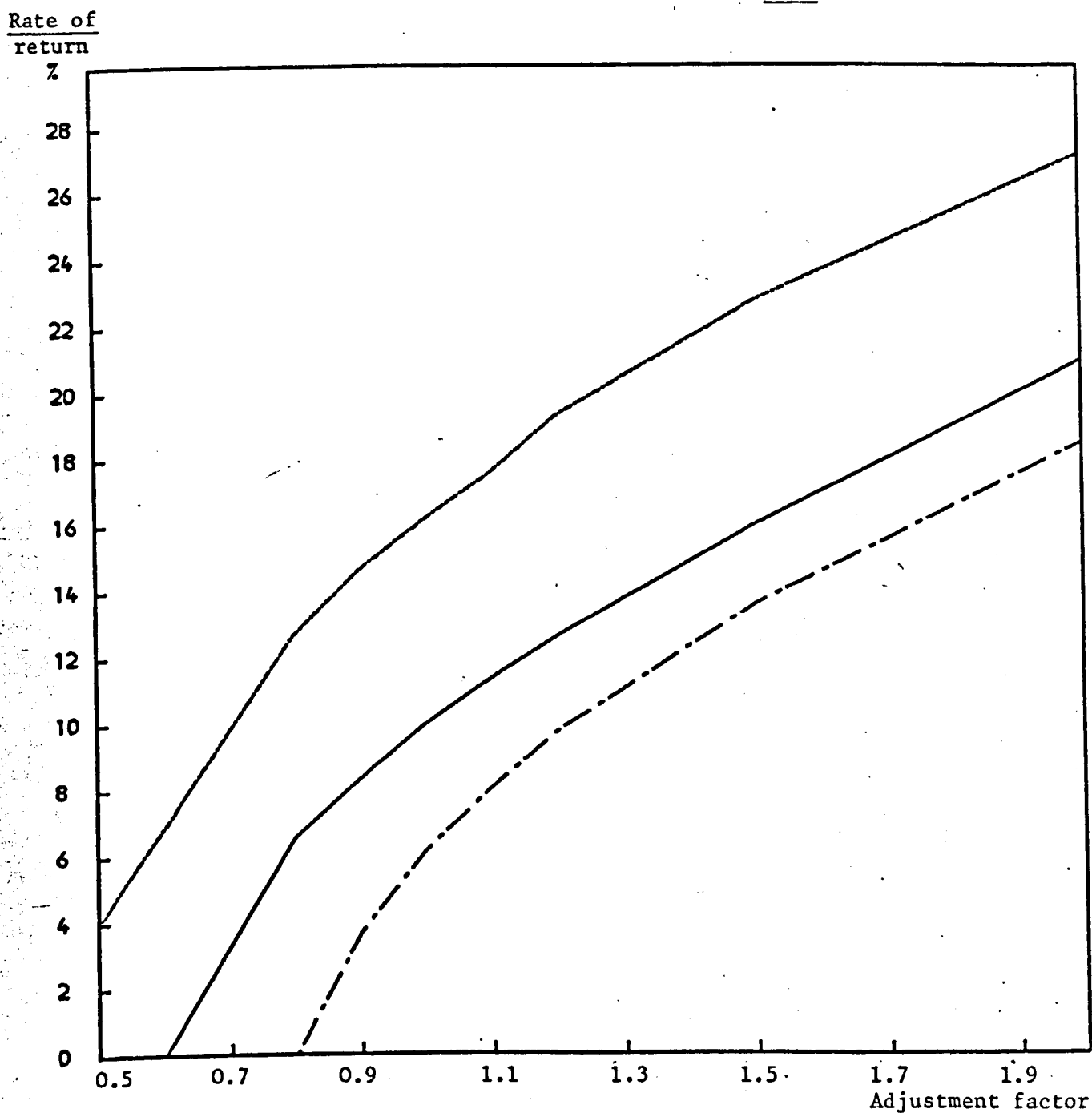
Figure 8.9 Impact on Social Rates of Return of Applying
Different Adjustment Factors to B_{20-24}



Notes: The figure shows, for 3 cases, the effect of adjusting the value of B_{20-24} , (i.e. that part of the B_t profile concerning those aged 20-24), by different adjustment factors.

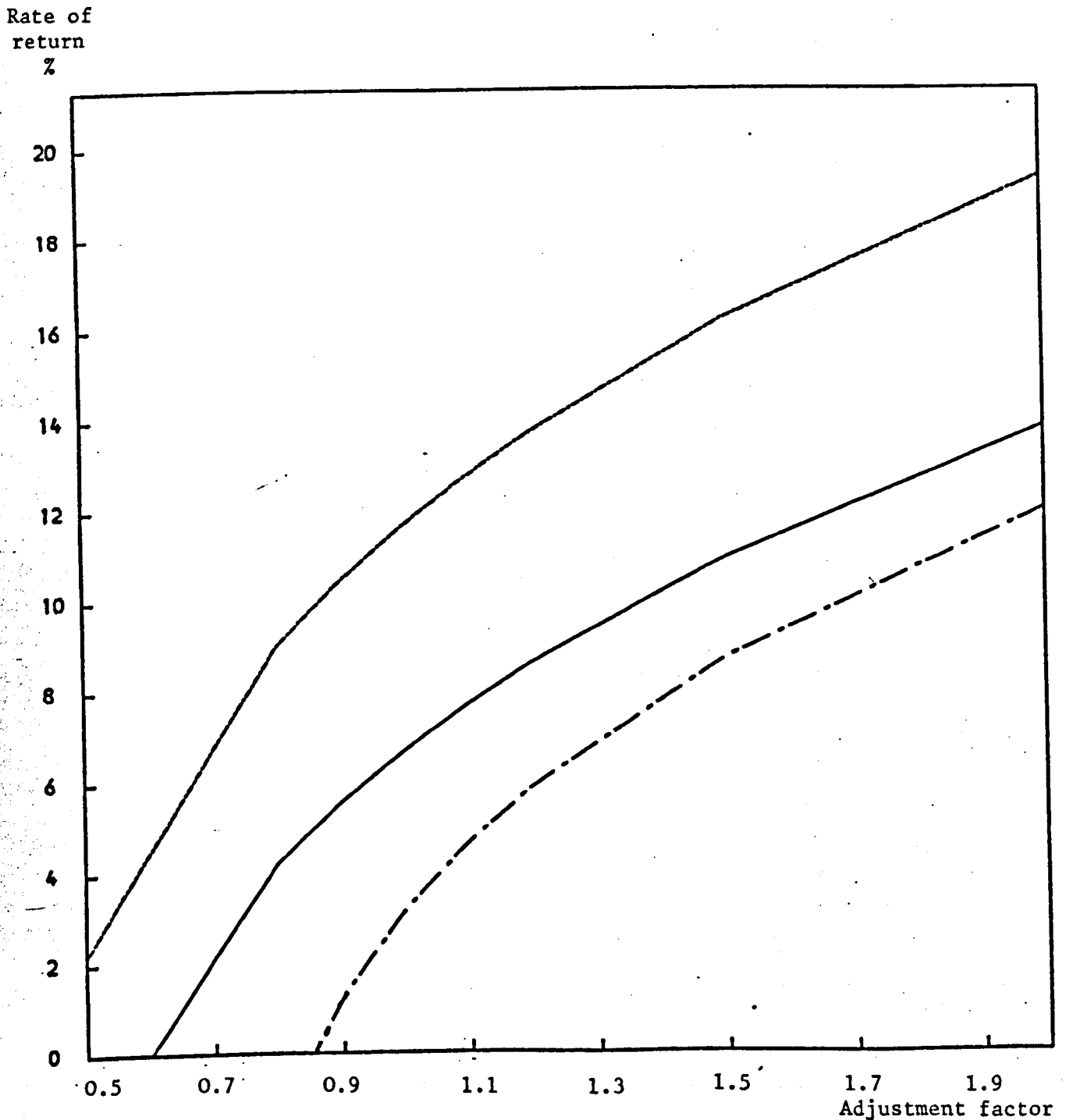
Figure 8.10

Impact on Private Rates of Return of Applying
Different Adjustment Factors to B_{25+}



Notes: The figure shows, for 3 cases, the effect of adjusting the value of B_{25+} , (i.e. that part of the B_t profile concerning those aged 25+) by different adjustment factors.

Figure 8.11 Impact on Social Rates of Return of Applying
Different Adjustment Factors to B_{25+}

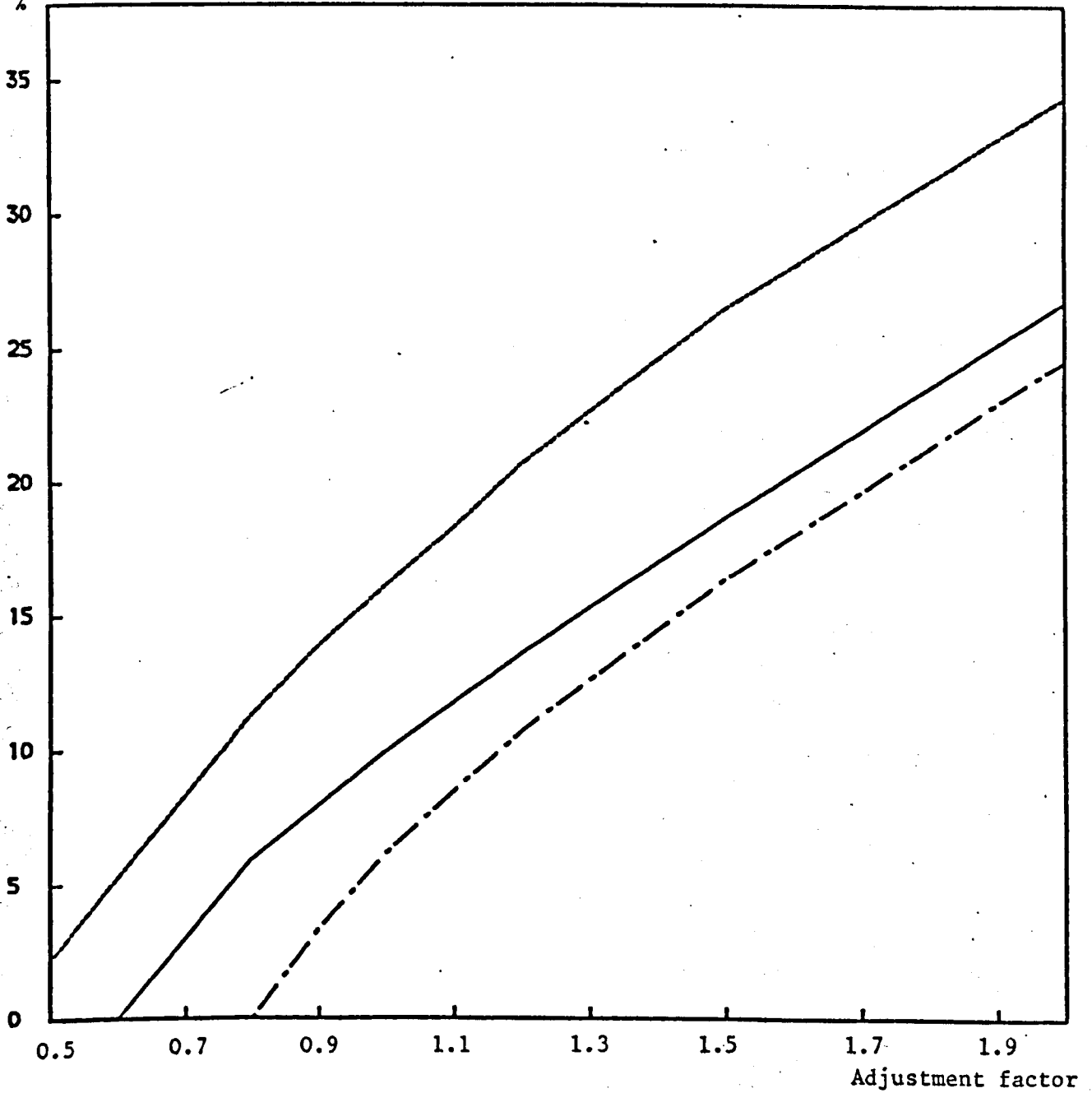


Notes: The figure shows, for 3 cases, the effect of adjusting the value of B_{25+} , (i.e. that part of the B_t profile concerning those aged 25+), by different adjustment factors.

Figure 8.12

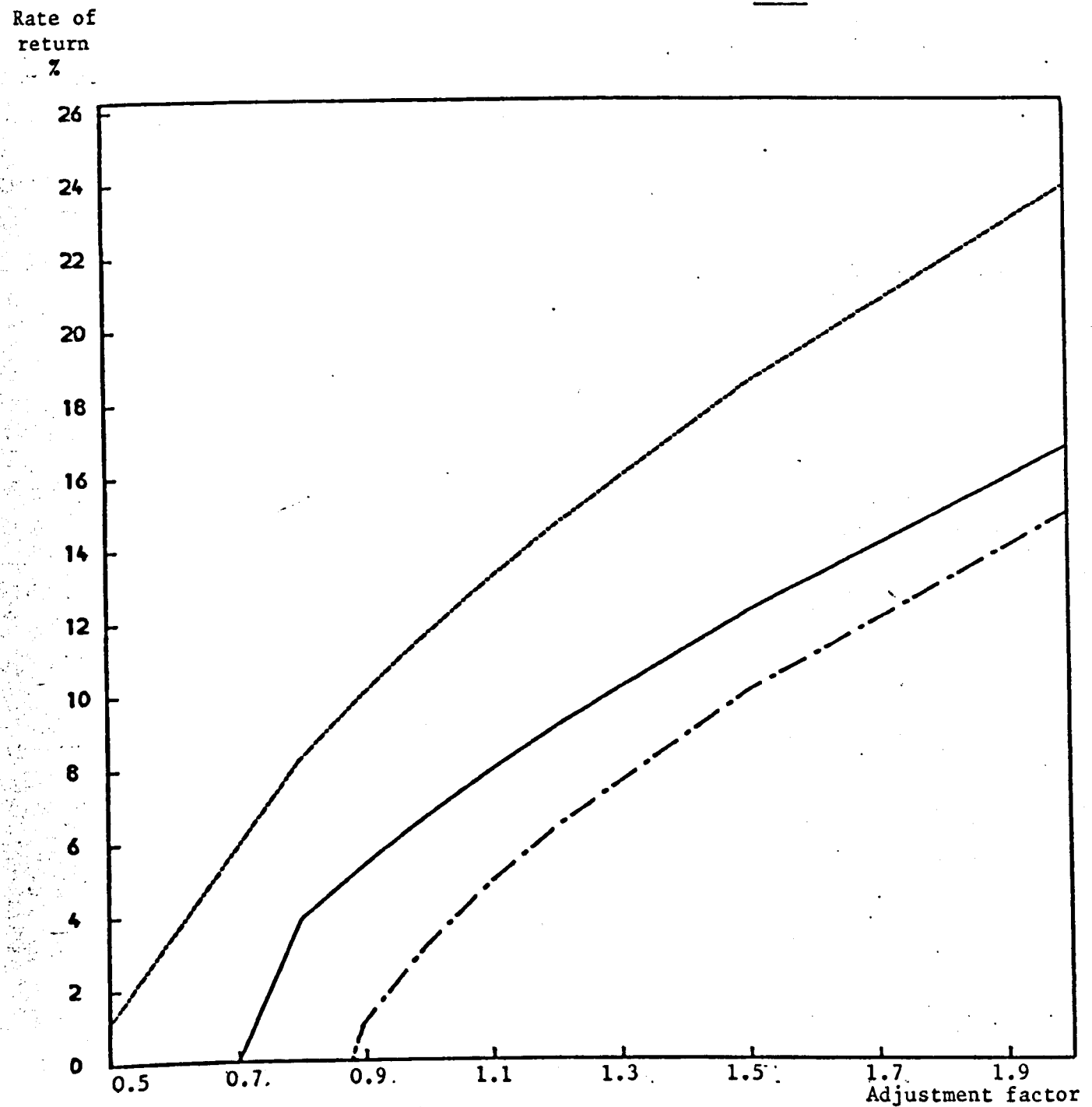
Impact on Private Rates of Return of Applying
Different Adjustment Factors to B_{20+}

Rate of
return
%



Notes: The figure shows, for 3 cases, the effect of adjusting the value of B_{20+} , (i.e. that part of the B_t profile concerning those aged 20+), by different adjustment factors.

Figure 8.13 Impact on Social Rates of Return of Applying
Different Adjustment Factors to B_{20+}



Notes: The figure shows, for 3 cases, the effect of adjusting the value of B_{20+} , (i.e. that part of the B_t profile concerning those those aged 20+), by different adjustment factors.

Appendix A.1

Rates of return and expected growth in real incomes

It might be thought that since earnings may be expected to grow in real terms for both qualified and unqualified that this will not affect the rate of return calculation. However, each cohort will experience a rise in real income year by year which will not be offset by rising foregone income. The expected rate of return will therefore be higher.

Suppose earnings are expected to grow in real terms such that the differential between qualified and unqualified grows at the exponential rate x per cent per annum. The present value of this differential ($B_t - C_t$) will therefore be:

$$PV = \sum_{t=16}^{70} \frac{D_t (1+x)^{t-15}}{(1+r)^{t-15}} \quad A.2$$

rather than the expression given as equation 1 in the chapter.

But, if x and r are small this can be rewritten as:

$$PV = \sum_{t=16}^{70} \frac{D_t}{(1+r-x)^t} \quad A.2$$

The true rate of return is therefore the value of r that results in PV equalling zero in equation A2 given x . If we make no adjustment for secular income growth the estimated rate of return will be $\hat{r} = (r-x)$, the value that sets PV equal to zero. The true rate of return is therefore given as $\hat{r} + x$. In other words, we can adjust for the expected secular growth in real incomes by adding x percentage points to the unadjusted result. This is legitimate if

- (i) r and x are small
- (ii) the expected growth in real income is such as to result in a constant growth rate of x per cent per annum in the differential.

Rates of return and inflation

The age earnings profiles are assumed to represent expected real incomes by age. If the expected increase in earnings W_e equals the expected increase in prices P_e (i.e. real incomes are not expected to grow) then no further adjustment is necessary as long as P_e is assumed to be the same for both profiles. In this case both C_t and B_t profiles will be increased as will the difference. However, in contrast to the case described above, the rise in the differential will be in money terms only. The increase is exactly offset by P_e .

Therefore in comparing expected rates of return at different points in time no adjustment for differences in the expected rate of inflation is required. The calculated rates of return are therefore expected real returns and should be compared with returns on other assets adjusted for expected inflation.

Appendix A.2 Sources and methods for rate of return calculations

(1) OPCS data. Profiles for 1966/67 were taken from Department of Education and Science (1971). Data for 1971/72 was unpublished information from the Department of Education and Science. Comparison income profiles were taken from Morris and Ziderman (1971). The comparison profile for males is based on a $\frac{1}{2}$ per cent sample of all holders of national insurance cards carried out by DHSS. The female profile was estimated by Morris and Ziderman from results of the Department of Employment's New Earnings Survey, 1968.

(2) Professional Institutes data. Data was obtained from surveys carried out by the following institutes:

The Institute of Biology

The Royal Institute of Chemistry

The Institute of Mathematics and its Applications

The Institution of Metallurgists

The Institute of Physics and the Physical Society

The Council of Engineering Institutions

(3) Comparison income profiles. These were obtained using information from the New Earnings Survey, 1968-1981, for years when data was published on earnings by age. The raw data was adjusted to take account of inflation between the dates of the surveys carried out by the professional institutes and the dates of the new earnings surveys and also to provide comparison profiles on an annual income basis where appropriate.

(4) Tax adjustments. All calculations were carried out using the following assumptions with respect to taxation:

Family status assumed for tax purposes

Age	Males
15-22	Single
23-24	Married, no children
25-29	Married, one child < 1 years old
30-34	Married, two children < 11 years old
35-44	Married, one child < 11, one child < 16 years old
45-49	Married, two children > 16 years old
50-69	Married, no children

Females are assumed to receive the standard personal allowance throughout.

(5) Maintenance grant and vacation earnings. The following estimates were made. Nominal rates of grant are given for comparison.

f/annum	Nominal grant	Average grant	Vacation earnings*
1966/67	340	250.6	80
1967/68	340	254.5	80
1970/71	380	270.4	100
1972/73	445	298.1	120
1973/74	485	316.8	130
1974/75	605	411.8	140
1976/77	875	595.0	200
1978/79	1100	749.0	257
1979/80	1245	847.5	287

Average grant actually paid by local authorities including those on the minimum grant but excluding fees.

* Based on various ad hoc surveys and adjusted according to increments in the index of average earnings.

Source: Statistics of Education, volume 5.

Appendix A.3. Costs of Education Excluding Research

Qualification costs. These represent the average cost per student including both recurrent and capital costs but excluding research activities. They also include allowances for wastage, repeat and examination failure rates and course length. They are based on very detailed unpublished estimates provided by the Department of Education and Science for 1971/72 extended to other years using an index of costs. This procedure therefore assumes that factors such as wastage rates have remained fairly stable over the period in question. (The DES provided some evidence to corroborate this assumption.) A large number of alternative routes are available to individuals aiming at a first degree or equivalent qualification especially for those following science subjects. The costs of these various courses differ according to whether students study full time or part time as well as the type of qualifications undertaken. Since there are severe difficulties in comparing estimates of costs across different routes we have taken the figures relating to students doing 'A' levels at school and continuing with a first degree at university as typical. Again, discussion with the DES suggests that qualification costs in the public and university sectors are not very different and have moved in similar fashion over time. The costs estimates used were as follows:

Average Costs of Education (excluding Research)

	First degree level course in:							'A' level Course	
	Medicine etc	Engineering & Technology	Science (incl. Maths)	Social Sciences	Vocational	Language & Literature	Arts	Other arts	All Subjects
1955/56	2525	1722	1281	798	1531	804	808	811	1256
1956/57	2698	6840	1369	852	1636	859	863	866	1342
1957/58	2878	1963	1460	909	1746	917	921	924	1432
1958/59	2983	2035	1513	943	1810	950	954	958	1484
1959/60	3141	2142	1593	992	1905	1000	1005	1009	1562
1960/61	3292	2245	1670	1040	1996	1048	1053	1057	1637
1961/62	3502	2388	1776	1106	2124	1115	1120	1124	1742
1962/63	3637	2481	1845	1149	2206	1158	1164	1168	1809
1963/64	4141	2824	2100	1308	2511	1319	1325	1330	2060
1964/65	4735	3229	2402	1496	2872	1508	1515	1520	2355
1965/66	4975	3393	2524	1572	3017	1584	1591	1597	2475
1966/67	5178	3531	2626	1636	3140	1649	1656	1663	2575
1967/68	5433	3705	2756	1716	3295	1730	1738	1745	2703
1968/69	5456	3721	2768	1724	3309	1737	1745	1752	2714
1969/70	5944	4054	3015	1878	3605	1893	1902	1909	2957
1970/71	6711	4577	3404	2120	4070	2137	2147	2155	3338
1971/72	7515	5125	3812	2374	4558	2393	2404	2413	3738
1972/73	8815	6012	4471	2785	5347	2807	2820	2830	4385
1973/74	9867	6729	5005	3117	5985	3142	3156	3168	4908
1974/75	11,340	7734	5752	3582	6878	3611	3628	3641	5641
1975/76	13,858	9451	7029	4378	8405	4413	4433	4450	6893
1976/77	15,346	10,465	7784	4848	9307	4887	4909	4927	7633
1977/78	16,097	10,978	8165	5085	9763	5126	5149	5169	8007
1978/79	16,924	11,542	8585	5346	10,265	5389	5414	5434	8418
1979/80	19,524	13,315	9904	6168	11,842	6217	6246	6269	9711
1980/81	23,372	15,939	11,855	7383	14,175	7442	7476	7504	11,625

Source: Own estimates based upon unpublished information obtained from DES.

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