

Education, earnings and productivity: recent UK evidence

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Key points

- The relationship between educational levels and wage rates in the Labour Force Survey (LFS) suggests that there is a high financial return to education.
- However, the LFS also reveals that this varies considerably across individuals, and that the degree subject plays an important role, with Arts degrees having little effect on average wages, while studying Economics, Management and Law have large effects.
- There is no evidence that the recent expansion in higher education has resulted in the financial returns falling – implying that the expansion in supply is just keeping up with growing demand.
- There is no evidence that raising the minimum school leaving age made people who had not intended to leave at the minimum age raise their educational standard. This is consistent with the view that education raises productivity and not with the view that productive people get more education.

The relationship between education and earnings is strong. Using recent Labour Force Survey datasets, the theory that education also raises productivity is tested.

Introduction

PARTICIPATION IN post-compulsory education has grown dramatically in the UK in recent times. Participation in higher education doubled in just a few years from the mid 1960s with the post-Robbins creation of polytechnics and expansion in traditional universities. Participation doubled again in the 1980s following the removal of quotas on student numbers and the creation of many ‘new’ universities from the ‘old’ polytechnics. The proportion of young people going to university to study full time has increased from 13 per cent in 1980 to 33 per cent in 2000. At present, 41.5 per cent of those aged 18-30 enter higher education and the Government target is to increase this proportion to 50 per cent by 2010.

It is sensible to ask whether this massive investment in higher education is economically justifiable. This article tries to do exactly this by taking a narrow view of the returns to education – if the investment is justifiable on this narrow view then it will be even more justifiable if there are arguments for including wider benefits.¹ This narrow view is based just on the earnings associated with increased education. It will be demonstrated, mainly using the Labour Force Survey (LFS), that there is a large earnings premium associated with more education – perhaps as much as 10 per cent per additional year of education. The analysis concentrates on the effect on wages because, in reasonably competitive labour markets,

wage differences across individuals would be expected to reflect productivity differences.

The rate of return

The earnings premium associated with additional education can be thought of as a 'rate of return' on that educational investment. Indeed, if the costs of education to the individual are small (and, even for higher education, it is approximately the case that the main private costs of education are the earnings that you forgo when you continue your education rather than leave and join the workforce) and the working life is long (and since most education occurs early in life this is also approximately true) then the earnings premium is approximately a financial rate of return.² Thus, an earnings premium of 10 per cent per additional year of education corresponds to a (real) rate of return on that investment of 10 per cent.

Since education is an asset (but one with some distinctive characteristics – for example, it is embedded in people) it could be expected that the return to owning this asset would be broadly comparable with the return on other assets – if that were not true then it would be sensible for individuals to switch resources away from assets with low returns into assets with high returns. So if individuals invested in the 'right' amount of education the return to education would be expected to be comparable to what might be earned on other (say, financial) long-term investments of similar riskiness. If a higher return is observed then this may suggest that individuals are investing too little in education (for example, leaving too early) – that is, individuals should stay longer in education, up to the point where the rate of return on the last pound invested in education equals the return that that pound could have earned if it were invested elsewhere.

Later in this article wage differentials associated with different levels of education are estimated. The first concern is whether the return on education is high relative to other investments. There have been several worries expressed about the expansion in post-compulsory education – and further

expansion – that amount to wondering whether the education that individuals are getting is worthwhile. That is, has the expansion in post-compulsory education so flooded the labour market with highly educated individuals that the return to additional education has been significantly reduced?

Productivity

A further concern is that the expansion in post-compulsory education and, in particular, higher education has resulted in institutions digging deeper into the ability barrel – that we are admitting weaker and weaker students into higher education and that the resulting 'output' is not as productive as was the case for previous cohorts of graduates.

A related question mark hangs over whether education actually directly affects people's productivities in the workplace. For example, many students take subjects which have little direct vocational content, and many university graduates record that they are in jobs that do not directly use the skills from their university courses. It is seldom clear what this means but if there is some mismatch between demand and supply of graduates of particular types this might be expected to be reflected in the premium attached to graduates from different subjects.

Further on in the article the problem is also addressed that while education may well be strongly correlated with the wages that are paid to individuals in the labour market it may not be because education raises productivity but for other reasons. In particular, it has been recognised for nearly 30 years that education may act merely as a 'signal' of productivity. Employers, believing that education is correlated with productivity, will screen their employees and pay higher wages to more educated workers. The employers' beliefs will be confirmed by their experience if it is the case that high productivity individuals signal their productivity by choosing high levels of education. It will be rational for individuals to behave in this way if (as seems reasonable) the cost of acquiring education is less for high productivity individuals than it is for low productivity individuals. Thus, under reasonable

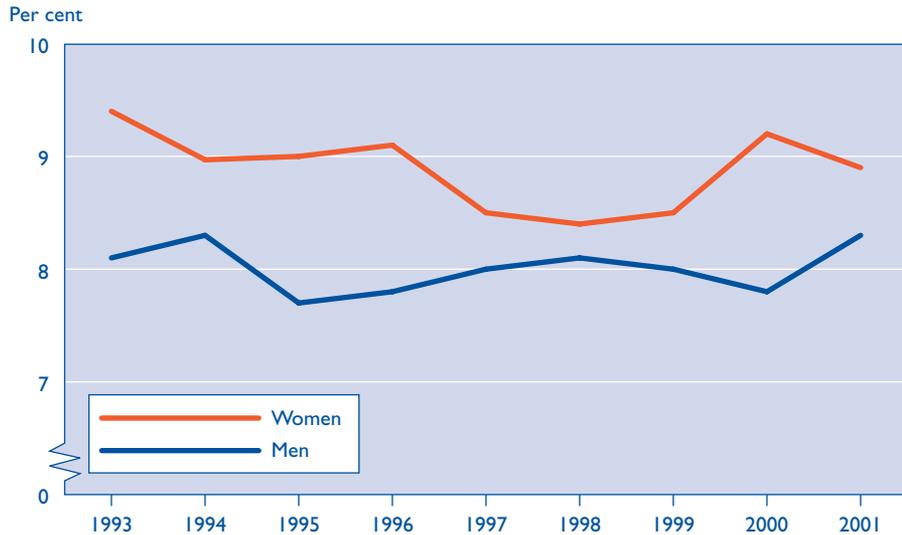
conditions, the labour market will feature high productivity individuals choosing high levels of education and earning high wages. This signalling theory is largely due to Spence (1973). In contrast, the 'human capital' explanation, espoused earlier and due to Becker (1962), suggests that the correlation between education and wages is due to education enhancing productivity.

The fundamental difficulty in unravelling the extent to which education is a signal of existing productivity as opposed to enhancing productivity is that both human capital and signalling theories imply that there is a positive correlation between earnings and education. Indeed, Lazear (1977) in an early review stated that this "...makes it virtually impossible to come up with a valid test of the screening hypothesis...". However, the essence of the signalling theory is that wages depend on relative educational levels, while the human capital theory says that wages depend on absolute levels of education. So, signalling theory says that if one group of individuals are forced or encouraged to acquire more education, then other individuals will need to acquire more education also so as to continue to signal that they are different. In contrast, the human capital theory says that a rise in the educational levels of one set of individuals does not affect the decisions that other individuals should make. Thus, the article concludes by looking at how the whole distribution of educational levels has changed in response to a change in the minimum school leaving age as a way of distinguishing between the two theories.

Evidence on the relationship between wages and education

The UK Dearing Report (1997) made much of the correlation between wages and education and was careful to distinguish between this correlation and the causal effect that education has on productivity and hence wages. The difference between the two is essentially due to the signalling, and hence non-productive, component of

Figure 1 Proportional effect of additional year of education on wages by sex; England and Wales; 1993 to 2001



Source: Labour Force Survey

the correlation. The report termed the difference between the two: α . In the absence of information about the size of α , the report included calculations for several values – with 20 per cent and 40 per cent being typically used. In fact, there is very little evidence in the UK to show how well correlated education and wages are, or that pertains to α . In this article some new estimates are given that contribute to the debate about the returns to education. These estimates have been based on several datasets.

Average rates of return

First, conventional estimates of wage differentials associated with different educational levels are given. These are based on LFS data pooled from 1993 to 2001 and exclude: those living in Scotland (which has quite a different education system from England and Wales); those with zero or missing hours of work or earnings; immigrants (who will mostly have been educated outside the UK); and those aged below 25 and above 59. The analysis is based on the employed – the self-employed have been excluded, and no account has been taken of the correlation between education and employment (which might be construed as an additional component of the return to education). An hourly wage rate has been computed from the ratio of usual earnings to usual

hours (in the main job). The methodology estimates the wage premia associated with different levels of education, but factors out the variance in wages that arises from differences in age, region of residence, year, decade of birth, having a work-limiting health problem, being non-White, being a union member and marital status.⁴ Separate analyses have been conducted for women and men. The samples are large (averaging more than 10,000 men, and close to the same number of women, each year) so estimates of the effects of education are statistically very precise. *Figure 1* shows the resulting effect of education⁵ on wages, in each year of the data, for a very simple (although commonly used) specification that assumes that the effect of each additional year of education is the same for all individuals. The effect of education on wages is large. Rates of return average around 8 per cent for men and 9 per cent for women. The differences between men and women are highly significant. While there are statistically significant year-to-year differences they are small, and there is no statistically significant time trend for either men or women.

Figure 2 uses a more flexible specification which allows the effect of education on wages to work via the (highest) qualification that individuals,

in the LFS data, are observed to have. The figures show the estimated effects (controlling for the same other factors as before) of selected qualification levels over time. There are no significant differences over time and there are no significant gender differences in: the effects of O-levels (that is, 5+ GCSEs grade A-C, old CSE grade 1, as well as the old GCE grade 1-6) relative to having no qualifications; or in (first) degree relative to no qualifications; however, the returns to 2+ A-levels relative to no qualifications and relative to O-levels are significantly higher for men than women.⁶ The effect of O-levels relative to no qualifications is around 10 per cent, while the effect of 2+ A-levels relative to O-levels is around 15 per cent for women and 20 per cent for men, and the effect of degree relative to 2+ A-levels is around 20 per cent for women and 15 per cent for men.⁷

Another way of relaxing the assumption that the relationship between education and wages is not a simple linear one (with each year of education adding the same to wages as the next) is to allow each year of education to have a separate effect on wages. *Figure 3* shows the effect of each successive year of education (relative to leaving at 15, which many did pre-1973), again controlling for the age differences, union status etc. Both men and women seem to experience around a 50 per cent wage increase as education rises from leaving at 16 to leaving at 21. Although there is a dip in returns between 18 and 20 there are, in fact, relatively few individuals who leave education at those ages. Perhaps this dip reflects the value of the degree credential (which only accrues after the final year of study), or that those that do leave in that interval are not typical undergraduates because they may have failed to make the grade to progress from one year to the next.⁸ Beyond age 21 the financial return to additional education falls to essentially zero for women, which might be the effect of the type of postgraduate work women do. For example, they are much more likely to take a Postgraduate Teaching Certificate in Education, which is typically followed by a teaching career.

Have returns fallen?

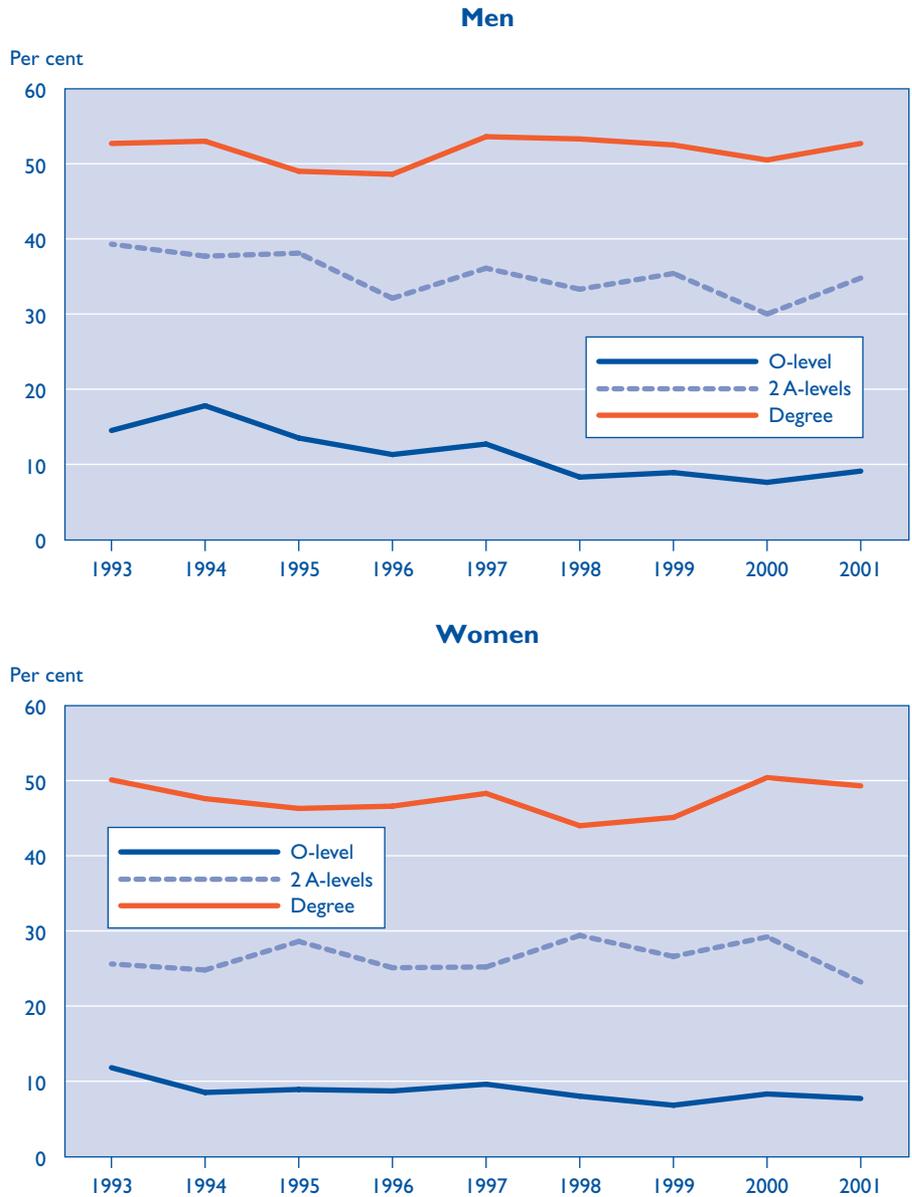
While, in *Figures 1* and *2*, it was seen that there are no significant time trends in the effects of education years or qualifications on wages it may still be possible that more recent cohorts experience lower rates of return. This might be because of the rapid expansion of post-compulsory participation, and participation in higher education, together with young graduates being an imperfect substitute in the labour market for graduates from earlier cohorts with experience.

To explore the issue that returns may have fallen across cohorts estimates of the effect of a degree versus 2+ A-levels are presented in *Table 1* for each birth cohort group separately. For example, the premium for a degree for a women was about 22 per cent for the oldest cohorts of women in the data (that is, those born in 1933-46) and little different for the youngest cohorts of women (born in 1969-77). Thus, it does not appear that the return to a degree relative to A-levels is any lower than in earlier cohorts. Indeed, arguably, the most recent cohort has experienced higher returns despite the increase in the supply of graduates since the late 1980s. However, *Table 2* shows the same breakdown for this simple model where wages are assumed to be a linear function of years of education. Here a fall in returns is seen for the most recent cohort, which, in the light of *Table 1*, suggests a marked fall in the returns for having A-levels compared with O-levels for the most recent cohort.

Variation between individuals

In addition to estimating the mean returns it is also possible to examine how this varies across individuals according to observable and unobservable characteristics. For example, it was found that the returns to a degree are somewhat lower for union members – perhaps reflecting the high levels of union membership in the public sector among graduates in low paying sectors, for example in teaching. *Figure 4* shows estimates of a statistical model that allows for the returns to education to differ across individuals both according to their observable

Figure 2 Proportional effect of educational qualifications on wages;^a England and Wales; 1993 to 2001



Source: Labour Force Survey

a Relative to having no qualifications.

characteristics (such as union status) and for unobservable reasons. This generalises the model used in *Table 2* to allow the effect of education to vary across individuals. The figure shows both the mean returns to a year of education for people from different birth cohorts and estimates of the 'confidence intervals' (that is, there is a 95 per cent probability that the actual returns would fall within the range spanned by the vertical line). The results suggest a large variance in the returns across individuals that occurs because

people differ from one another in ways that researchers cannot observe – but this variance does not appear to be any larger for more recent cohorts, and is arguably smaller.⁹

One possible source of unobservable difference across individuals is the type of degree-granting institution which LFS does not report. However, recent research by Naylor, Smith and McKnight (2002) uses the First Destination Surveys of the Higher Education Statistics Agency (for the 52 old universities) and finds some

Figure 3 Proportional effect of each year of education^a on wages by sex; England and Wales; 1993 to 2001



Source: Labour Force Survey

a Relative to leaving at age 15.

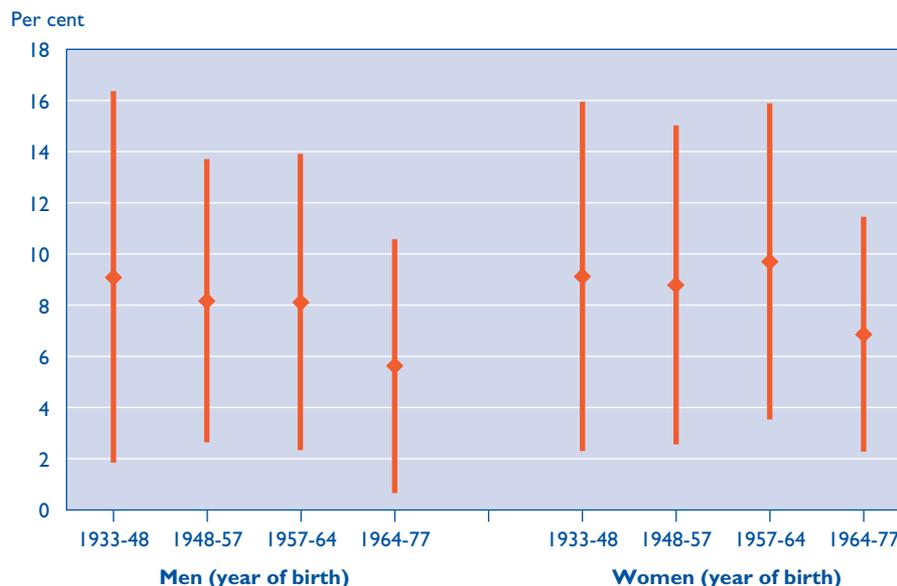
Table 1 Proportional effect of degree over two or more A-levels on wages by birth cohort and sex;^a England and Wales; 1993 to 2001

	Per cent			
	Born 1933-46	1947-57	1958-68	1969-77
Women	22	23	19	24
Men	11	12	10	16

Source: Labour Force Survey

a Figures are coefficients on degree dummy variable in samples with 2 or more A-levels, and can be interpreted as the percentage wage premium of having a degree relative to 2 or more A-levels only. These estimates control for differences associated with union status, age and other factors.

Figure 4 Mean and confidence intervals for the proportional effect of one year of education on wages by birth cohort; England and Wales; 1993 to 2001



Source: Labour Force Survey

variance in returns (albeit measured immediately after graduation), despite controlling in fine detail for subject studied, parental background, schooling experience, and exact A-level grades. However, this variance is not very large: more than 80 per cent of institutions lie within 5 per cent of the mean effect.¹⁰

It can, however, be seen how the returns to a degree differ by subject studied since this is recorded in LFS data. *Figure 5* shows the estimated proportionate effect of a first degree broken down by degree subject, all relative to having 2 A-levels (the effects of higher degrees are not reported) controlling for age, year, region, etc. There are large differences in coefficients (these figures also show the 95 per cent confidence interval around the point estimates as vertical lines) with Law, Health, Economics and Business, and Mathematics considerably higher than Arts, Education, and other Social Sciences.

Of course, these estimates fail to control for A-level score and this may explain some of the cross-subject differences since different subjects demand different A-level scores to gain admission. However, it is not clear that this would make these differences smaller. For example, university Arts courses have traditionally demanded quite high scores to gain admission, while maths and science have relatively low admission requirements.

The distribution of years of education and the minimum school leaving age

The overall conclusion is that, on average, the returns to education and, in particular, to proceeding from A-levels to a degree, are high¹¹ but the variation in this across individuals is also high. Part of this is due to subject choice, and some to other differences between individuals that cannot be observed in the data.

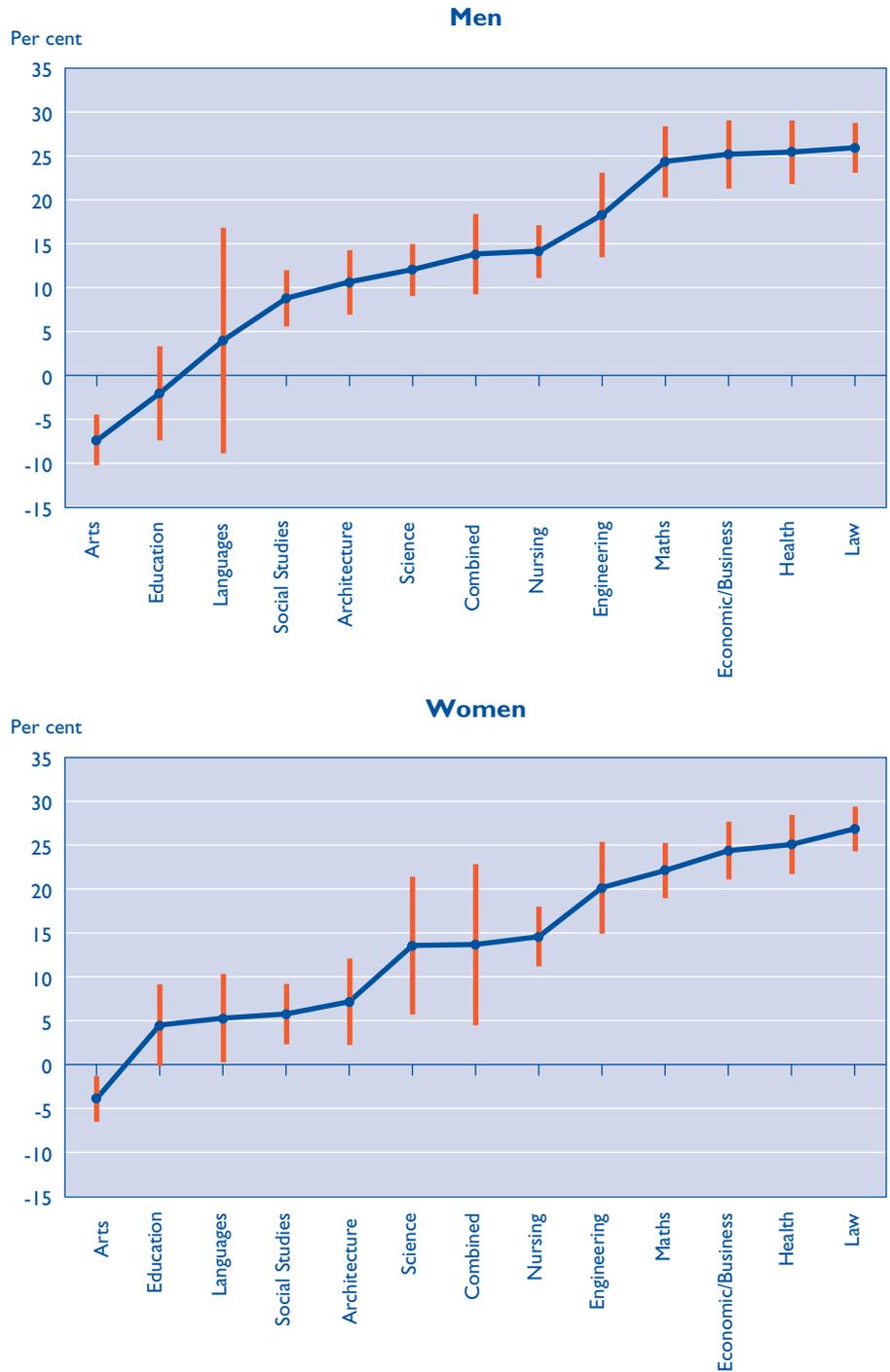
However, this does not resolve the question of whether this strong average effect arises because more education makes people more productive, or because more productive people choose to get more education so as to distinguish themselves from the less productive in the eyes of employers.

The former idea is known as the ‘human capital’ theory, since it presumes that education adds to productivity, while the latter is known as the ‘signalling’ theory, because it presumes that education simply signals pre-existing productivity. Both of these ideas imply that there will be a positive correlation between education and wages, yet only the human capital theory implies that it **raises** productivity.

To investigate this important issue it is necessary to look at it in a roundabout way. If people choose education in order to distinguish themselves from others then, if a low productivity group were to raise its education for some policy-induced reason, the more productive would also want to invest in more education in order to continue to distinguish themselves from the less productive. On the other hand, if education simply makes people more productive then educating one group more has no effect on the decisions of others.

An important and abrupt change happened at the bottom of the education distribution in England and Wales when the minimum school leaving age was raised from 15 to 16 in 1973.¹² This change, referred to as RoSLA (raising of the school leaving age), provides further evidence that can be exploited. The LFS data records that, prior to RoSLA, close to 25 per cent of each birth cohort left education at the minimum age of 15, while for birth cohorts that reached 15 after 1973 less than 5 per cent were recorded as leaving at 15. This abrupt change in school leaving behaviour was, of course, just part of a long-run trend towards later school leaving arising partly because of the move to comprehensive schooling and other gradual reforms to curriculum, examining and the like. To separate out the long-run trends from the abrupt change from RoSLA only the five birth cohorts immediately before RoSLA (that is, those born 1953-58) are compared with those in the five cohorts after RoSLA (those born 1959-1964). *Figures 6a* and *6b* show the distribution of education leaving age for these two cohorts; those that narrowly missed the reform and those that were just affected by it. It is clear from these that almost all those that left at 15 before 1973 left

Figure 5 Proportional effect of degree over two or more A-levels on wages by degree subject; England and Wales; 1993 to 2001



Source: Labour Force Survey

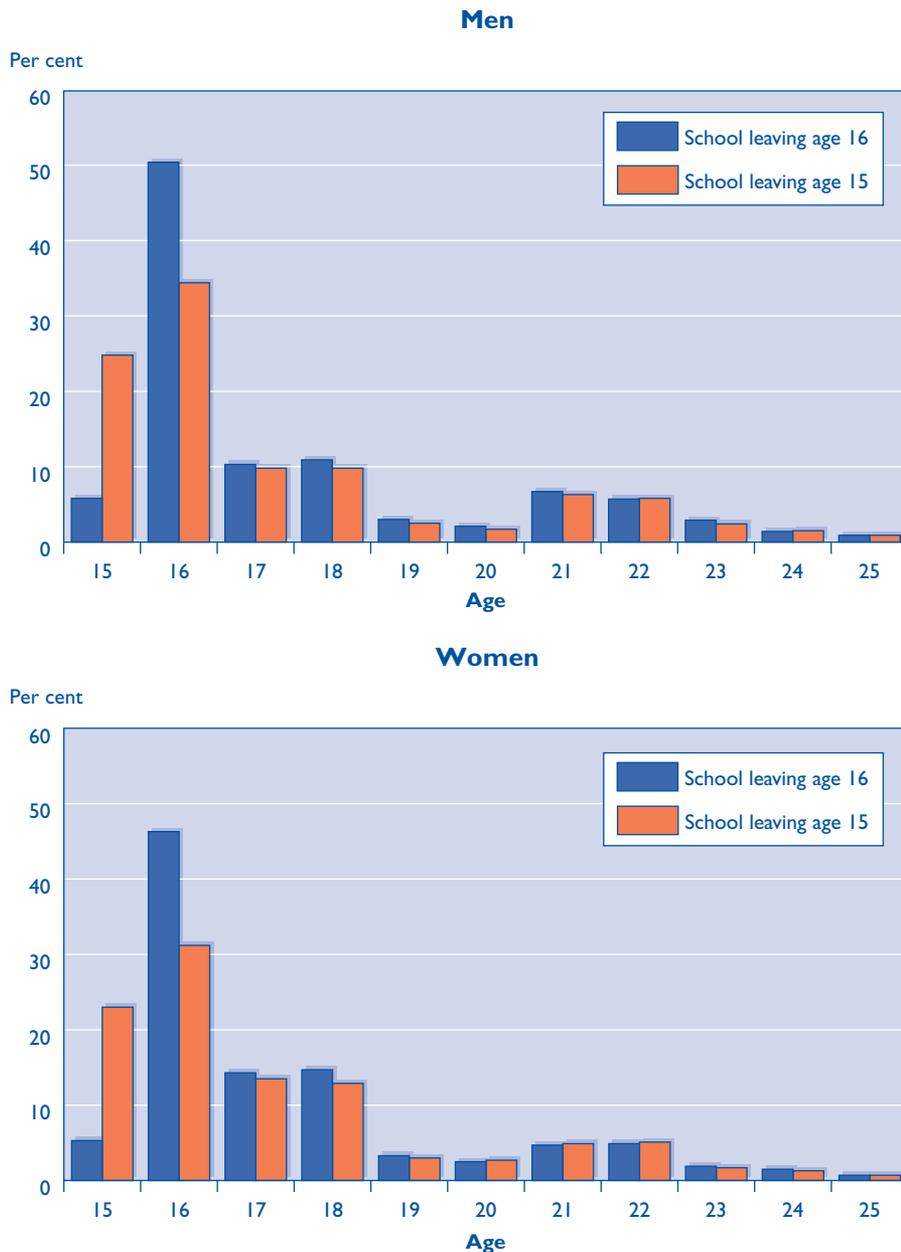
Table 2 Proportional effect of additional year of education on wages by birth cohort and sex;^a England and Wales; 1993 to 2001

	Per cent			
	Born			
	1933-46	1947-57	1958-68	1969-77
Women	8.9	8.7	8.9	5.7
Men	8.7	8.0	7.3	4.3

Source: Labour Force Survey

a Figures are coefficients on years of education variable and can be interpreted as the percentage wage gain associated with an additional year of education.

Figure 6 Pre- and post-RoSLA education leaving age distribution;^a England and Wales; 1993 to 2001



^a Data are for people born 1951-63.

Source: Labour Force Survey

at 16 after 1973 and there is essentially no change in the post-16 distribution. That there was no effect of RoSLA on the distribution above 16 is confirmed with detailed statistical tests.

This implies support for the human capital interpretation of the correlation between education and wages. This is because the alternative signalling model would predict that some of those that would have left at 16 would, after

RoSLA, now leave later, perhaps at 18, so as to continue to distinguish themselves to employers from those now leaving at 16. And those who would have left at 18 now need to signal their differences by leaving later – perhaps by going to university and leaving at 21. In other words, if signalling had any importance then we would expect RoSLA to induce ripples throughout the education leaving age

distribution. The fact that essentially no differences can be observed beyond 16 suggests no power to the signalling argument.

Conclusion

There are large average returns to education. There is a significant variance in returns across individuals. There is no evidence that the recent expansion in higher education has resulted in the financial returns falling – implying that the expansion in supply is just keeping up with growing demand. The effect of education on wages actually does work via higher productivity. However, while it has been shown that the private returns to education are large this is not enough to answer the question of the extent to which this education should, or should not, be subsidised.¹³

Further information

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Notes

- 1 Some potential wider benefits are evaluated in Feinstein (2002a, 2002b).
- 2 One might argue that we should allow for taxation. However, while taxes reduce the returns to the individual they also reduce the costs – if the tax system were a simple proportional one then the effects would cancel each other out. While the tax system is not proportional, the degree to which it is not is relatively minor – the tax allowances are quite small and most people pay tax at the standard rate. Thus, the effect of adjusting for the tax system would be minor. See OECD 2002 for estimates of the rate of return to education that takes on board taxes.
- 3 Although the LFS does not record where education took place, those recorded as having Scottish education qualifications have also been dropped.
- 4 The possibility that education and wages might be simultaneously determined has not been considered. These issues have been the concern of Blundell et al. (2002) and of Harmon and Walker (1996) for the UK, and of the review in Card (2000). So, while each of the estimates is open to criticism, it can be argued that, since they all point in the same direction, they together provide useful evidence.
- 5 The LFS only records the age when individuals left full-time *continuous* education. Thus, individuals who have had a break in their education will have their total education underrecorded and this would bias estimates of returns upwards. However, having compared the LFS with other datasets no significant discrepancies have been found. 'Gap' years have been dealt with by including controls for whether the years of education 'matched' the qualifications recorded in the data. Including gap year controls made little difference to any of the results. In practice, these control variables make no difference to estimates of the effects of education on wages.
- 6 The effect of a single A-level, not reported here, is somewhat higher for women than men. Other qualifications not reported are masters degrees, doctorates and other higher educational qualifications which are largely post-degree teaching qualifications – which have a somewhat higher return for men than women. Estimates of vocational qualifications are also not reported.
- 7 It is not known why the returns to a qualification differ – this is worthy of further research. There may be missing interactions with cohorts, or there may be differences in public sector employment by gender that are not accounted for here that might be causing the qualification effects to be different.
- 8 It would be difficult to evaluate the effect of a truncated degree course, since most factors that affect not completing a degree course (like low motivation or ability) invariably also affect wages in any event. Thus, it would not be possible to disentangle the effects of incomplete studies on wages from unobservable differences in motivation or ability. Moreover, the size of the affected sample is very small.
- 9 However, an increase in variance over time was found.
- 10 The issue of varying returns by institution type is the focus of Chevalier and Conlon (2002) using surveys of UK graduates from 1996 and 1998. They estimate the returns to undergraduates for four types of higher education institution: the so-called Russell Group (named after the organisational body representing the major research universities in the UK); 'old' universities, which are the remaining universities established before 1991; polytechnics which, after 1991, were granted university status; and 'other institutions', which include other degree awarding institutions in the higher education sector mostly representing teaching qualifications and colleges of art and music. They do find statistically significant wage premia associated with Russell Group institutions relative to new universities.
- 11 Indeed, the returns are underestimated, since the impact on employment status has been ignored. Moreover, much of the evidence that attempts to purge the estimates of the effects of unobserved differences between individuals suggests that returns are higher than the simple methodology used here suggests.
- 12 Scotland changed two years later. But Scotland has quite a different education system, and the proportion leaving school at the minimum age before the reform was small in any case.
- 13 The arguments for and against subsidies, especially in the context of higher education, are rehearsed in Trostel (2002) and Tuelings (2002), and some evidence can be found in Sianesi and van Reenan (2003) and Feldstein (2002a, 2002b). The common argument that low participation in higher education is due to low family income is examined in detail in Carneiro and Heckman (2002).

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