RESEARCH

A Cost-Benefit Analysis of Apprenticeships and Other Vocational Qualifications

Steven McIntosh
Department of Economics
University of Sheffield

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Department of Economics
University of Sheffield

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Executive Summary

- This research adds to the literature on apprenticeships in the UK by:
  - Focussing on government funded apprenticeship rather than traditional apprenticeships. For clarity the report uses the term Modern Apprenticeship to distinguish from traditional apprenticeship although the programme has been known simply as Apprenticeship[1] since 2004.
  - Considering changes over time.
  - Comparing the impact of apprenticeships to that of other vocational qualifications.
  - Including information on costs to the individual, the employer and the state in a full cost-benefit analysis.
- The estimates reveal substantial wage returns in 2004/5 to Modern Apprenticeships, of around 18% at Level 3 and 16% at Level 2, compared to individuals whose highest qualification is at Level 2, or at Level 1 or 2 respectively. It should be acknowledged, however, that the demand for Modern Apprenticeship places exceeds supply, so that employers may be able to choose the most able from the queue of applicants, meaning that a proportion of these wage returns may be due to ability differences, rather than the impact of the apprenticeship training itself.
- When the analysis differentiates between men and women, significant wage returns are observed for women for the first time in the study of apprenticeships in the UK, specifically of 14% to a Level 3 (Modern) Apprenticeship.
- Considering changes over time between 1996 and 2005, the estimated wage returns to apprenticeships are rising, particularly for Modern Apprenticeships.
- There is significant variation in the estimated wage returns to apprenticeships, depending on the sector in which the former apprentice works. For example, a Modern Apprenticeship increases the average wage of an individual working in construction by 32%, relative to an individual in construction whose highest qualification is at Level 2, whereas in the retail sector, there is no observed effect

1 Market research carried out with employers, young people and others in 2004 suggested that the prefix 'Modern' added little to people's understanding of apprenticeships. In particular the almost complete disappearance of ‘traditional’ time served apprenticeships had meant that there was far less of a possibility of confusion with the new programme. It was therefore decided at the re-launch of the programme in England later that year that 'Modern' should no longer be used when referring to the family of LSC funded apprenticeship programmes.

of apprenticeships on wages at all. However these sectoral results are subject to a number of further caveats, eg the extent to which selection bias applies is likely to vary across sectors, and will affect the results to varying degrees.

- The wage returns to apprenticeships, particularly Modern Apprenticeships are considerably higher than for other vocational qualifications, such as NVQs, BTECs and City and Guilds.[2]
- All of the apprenticeships and vocational qualifications considered are shown to be significantly positively related to the probability of the individual being in employment. However with the data available to us, we cannot say how much of this association is due to the employment-enhancing properties of the qualification, and how much is due to the fact that individuals studying for a vocational qualification, particularly apprenticeships, are much more likely to be in employment in the first place.
- When the lifetime benefits of completing the various apprenticeships or vocational qualifications in terms of higher wages and employment likelihoods are compared to the costs to all parties of delivering the qualification, there are significant surpluses of benefits over costs i.e. large positive net present values (NPVs) observed. This is particularly the case for Modern Apprenticeships, for which the NPV of benefits over costs is estimated to be around £105,000 at Level 3 and around £73,000 at Level 2, per apprenticeship. In terms of NPV per pound of state funding, these are around £17 and £16 respectively. These figures are substantially larger than for any of the other vocational qualifications considered, principally because of the higher wage returns that are apparent to apprenticeships. The internal rates of return (IRR) are also substantial for Modern Apprenticeships, at 35% and 39% at Level 3 and Level 2 respectively.
- The cost benefit analysis by sector reveals wide variation in results, but, for the five sectors considered, there are clear positive benefits. In addition to the caveats for the sectoral wage returns estimates, the cost data[3] are subject to small sample

[2] More optimistic returns to NVQs at Level 2 were found by Dearden *et al* (2004) compared to those observed here. The reason for this difference is because Dearden *et al* compared individuals with an NVQ2 to those individuals with no qualifications at all, whereas in this study, the comparison group for all Level 2 qualifications is those individuals who already have a qualification at Level 1 or Level 2. Thus the comparison group used here will be, on average, considerably better paid than the comparison group used by Dearden *et al.*

[3] The information on the costs of apprenticeships to employers is derived from Hogarth and Hasluck's (2003) study, which was based upon a sample of forty firms. The ability of such data to accurately measure differences in costs across sectors will be limited by this small sample size.

sizes and potentially large margins of error, so conclusions about the relative net benefits across sectors should not be drawn. However despite weaknesses in the data, there is an encouraging consistency in the magnitude of the net benefits calculated, for example all IRRs are at least 15%.

1. Introduction

This study aims to evaluate the cost effectiveness of apprenticeship training, and compare this to the cost effectiveness of other forms of vocational qualification provision. In particular, the wage benefits to individuals of completing an apprenticeship will be calculated. Data on the cost of provision of apprenticeship will then be imported from other studies, and combined with the wage benefits in a cost-benefit analysis. This work therefore represents a significant advance on existing research into the benefits of apprenticeship, because cost data is available and so a full cost-benefit analysis is possible, rather than looking simply at wage or employment probability differences. In addition, this is the first study to provide a detailed statistical analysis of the benefits of Modern Apprenticeship.

Apprenticeships have undergone something of a revival in the UK in recent years. Traditionally, apprenticeships were seen as providing the training for skilled manual workers, working first in artisan trades, and then later in manufacturing. In the latter part of the Twentieth Century, however, the apprenticeship system declined, as these sectors themselves became less important in the UK economy. Apprenticeship reached its low point in the 1980s when employers ceased to offer them in the numbers previously offered, due to recession, the removal of supports and the introduction of cheaper, less-valued alternative training schemes such as the Youth Training Scheme (YTS) and its successors.

In 1994, however, apprenticeships were reinvented and reintroduced as Modern Apprenticeships at Level 3 and National Traineeships at Level 2. This was due to the increasing recognition of the shortage of intermediate (Level 2 and Level 3) vocational skills in the UK, compared to a number of European countries. It was felt that the reintroduction of the rebranded Modern Apprenticeship would improve the image of work-based learning, and persuade more young people and employers to participate. The idea was that the content of apprenticeships would reflect the skills needs of firms, since they were devised by the employer-led National Training Organisations (now replaced by Sector Skills Councils). Thus, young people (apprenticeships were initially introduced for 16-24 year olds) knew that the skills that they acquired through apprenticeship would be in demand by employers.

As mentioned above, the new apprenticeships were intended to fill the economy's intermediate skills gaps at Level 2 and Level 3. Modern Apprenticeships were therefore designed so that participants would reach these levels. A Modern Apprenticeship leading to Level 2 became known as a Foundation Modern Apprenticeship, while one to Level 3 was called an Advanced Modern Apprenticeship. Recently, however, in 2004, these were renamed again as simply Apprenticeships and Advanced Apprenticeships respectively[4]. At the same time, some relaxing of the age limits occurred, allowing those aged 14-16 or 25 and over to participate.

The defining feature of apprenticeships is that they involve both on- and off-the-job training. Thus, most (85%) apprentices have a contract of employment with their sponsoring firm, and work in that firm, learning while they do so. The off-the-job component is supplied by 'learning providers'. These are typically either private training companies, employers themselves, or colleges of Further Education.

Current apprenticeships contain various elements, and all must be completed to obtain an apprenticeship certificate. These elements comprise a National Vocational Qualification (NVQ) at the appropriate level (2 or 3) for the apprenticeship, Key Skills, and any other mandatory or optional component that provides particular, occupational-specific skills. A separate technical certificate previously also had to be obtained in order to acquire a Modern Apprenticeship certificate, although this is no longer a requirement, and in some cases the technical parts of the training can be located elsewhere, for example in the NVQ. This change was made in order to better reflect employers' needs.

Apprenticeships today are very different to the old craft-based apprenticeships. The most obvious indicator of this is the range of sectors in which apprenticeships are offered. There are now more than 150 apprenticeship frameworks, and they can be found in many service sectors of the economy, as well as the more traditional manufacturing sectors.

[4] This report continues to use the term 'Modern Apprenticeship', as it differentiates current apprenticeships from traditional trade apprenticeships, and from apprenticeships in general.

2. Literature Review

A limited literature has considered the returns to apprenticeship in the UK. Most of the recent academic studies into Modern Apprenticeships have qualitatively assessed them, rather than quantitatively measured their value. A good example of such an assessment is Ryan and Unwin (2001). They consider information on the stock of current apprentices in 1998, and put the number at between 119,000 and 177,000, depending on the data source that they use. Such numbers equate to approximately one-half of one per cent of the UK workforce, which contrasts to the situation in Germany where the 1.7 million individuals on apprenticeship represent about 4% of the German workforce. Figures for 2005 reveal around 255,000 young people training on apprenticeships, and so the numbers involved have increased since the time period considered by Ryan and Unwin.

Ryan and Unwin also consider the quality of apprenticeship training, in terms of the length of the training and the acquisition of qualifications. In 1999-2000, the average duration of an apprenticeship was 17 months[5], which is slightly more than half the average duration of 32 months in Germany. Of those leaving apprenticeship at this time, around half had acquired a vocational qualification at Level 3 or above. Again, this compares unfavourably with Germany, where three-quarters of apprentices obtain such a qualification.

In terms of empirical estimates of actual wage returns to apprenticeship, there is only limited evidence for the UK and it relates to all apprenticeships, not specifically Modern Apprenticeships. McIntosh (2004) does consider this subject explicitly. His analysis of the Labour Force Survey (LFS) in the period 1996-2002 reveals that completing an apprenticeship increases the wages of men by around 5-7% (controlling for other qualifications held and personal characteristics). For women, however, there is no wage return at all to completing an apprenticeship. Further analyses reveal that this wage return to apprenticeship for men is doubled if they hold an NVQ at Level 3 or above as well as the apprenticeship. For men who leave full-time education with no qualifications, the value of an apprenticeship is higher than for men who do

[5] The average duration of apprenticeships in 2004/5 was just over one and a half years, suggesting a small increase in the duration of apprenticeships over time in the UK.

acquire GCSEs at school, though the value of combining an apprenticeship with an NVQ3 is higher for the latter group than the unqualified school leavers. For an apprenticeship to add value to the earning power of men with GCSEs therefore, it must increase their highest qualification to at least Level 3. Finally, an analysis of returns by sector reveals that apprenticeships are more likely to increase the earnings of men working in manufacturing industries rather than in the service sector.

No other study has focussed explicitly on the wage returns to apprenticeship in the UK, though others consider it as part of wider ranging studies. For example, Ryan (2001), in his review of work on school-to-work transitions, suggests that apprenticeships are associated with higher levels of pay in the UK, but only for men. Considering the impact of apprenticeship on the likelihood of being in employment, Ryan reports positive effects, particularly for moderate and low-achievers. In the US, Ryan reports that apprenticeships, which are almost exclusively restricted to young males there, tend to increase pay strongly. The evidence for France reported by Ryan suggests a positive employment effect in the early working lives of former apprentices, though the wage effect after five years in employment is actually negative.

Dearden *et al.* (2002) report the returns to apprenticeship as part of a wider study of returns to academic and vocational qualifications. However, if an individual obtains qualifications with an apprenticeship, Dearden *et al.* count this as the qualification only, and so the only wage returns to apprenticeship that they report are to apprenticeships with no other qualifications. They find a very small and statistically insignificant effect on wages in this case.

There has been more work done on the returns to apprenticeship in countries where such training is received by a wider proportion of the population, and in particular in Germany. For example, Clark and Fahr (2002) directly estimate the return to a year spent on an apprenticeship, and find this to be 8.2%, which is very similar to the estimated return to a year of general education in Germany.

Cooke (2003) considers the impact of apprenticeship in Germany on both initial starting wages in 1984, and also wage growth between 1984 and 1997. The results

reveal similar starting wages for former apprentices and non-apprentices, but significantly faster wage growth for former apprentices. When the individuals are differentiated according to previous school stream, there are no real differences in the results across streams.

Bougheas and Georgellis (2004) consider only those who have completed an apprenticeship in the German Socio-Economic Panel data set, between the years 1984 and 2000, and so do not compare the wages of former apprentices with those of non-apprentices. Rather, they consider the variation in average wage returns across former apprentices. Their results show that, amongst former apprentices, men earn more than women, while there is no significant variation in wage returns by level of prior qualification (as also found by Cooke above). Those who received their apprenticeship training in a large firm (more than 2000 workers) earn 9% if they continue to work in that firm after completion, compared to those stayers in smaller firms. Even if a former apprentice moves to a new firm after completion of an apprenticeship, they still earn 6.4% more if that apprenticeship had been undertaken in a large firm. The apprenticeship salary, as another indicator of apprenticeship quality, is also positively related to post-apprenticeship wages. Amongst those who leave the training firm, those who stay in the occupation in which they were trained earn 8% more than those who change occupation. Comparing the wages of those who stay in their training firm after completion of their apprenticeship to those who leave, the stayers earn more upon completion of the apprenticeship and start of full employment, although the growth of wages with years on the job is actually faster for movers.

Euwals and Winkelmann (2004) also consider a sample of former apprentices only, in Germany, using an administrative data set. They find that wages following an apprenticeship increase monotonically with the size of the training firm. They also proxy the quality of training by the training wage, and find an elasticity of post-training wages to training wages of 0.27. A long duration of training also leads to a higher post-apprenticeship wage. The same variables increased the average duration of the first job after an apprenticeship. Once they control for firm size and training quality in these ways, they find little difference in the earnings of individuals who stay in the same firm after completion of an apprenticeship, and those who move. The first

job of stayers is estimated to have a longer duration than the first job of movers, though the difference is not large. The fact that the wages and job duration are similar for stayers and movers, after controlling for training quality, is taken by Euwals and Winkelmann as evidence that German apprenticeship training is quite general and therefore transferable across firms.

Winkelmann (1997) compares vocational training in Germany to that in the United States. He shows that such training is far more widespread in Germany, with more than 70% of the workforce having passed through an apprenticeship. In comparison, in the US, 12% of workers report having undergone a formal company training program. Despite these differences in coverage, the actual value of training appears to be roughly equivalent in both countries, however. Thus, the estimated returns to both company training in the US and apprenticeship in Germany are in the range 4.4% to 11%.

Finally, to consider another country where apprenticeships are common, though not to the same extent as in Germany, Hofer and Lietz (2004) investigate the labour market effects of apprenticeships in Austria. Currently around 40% of young people in Austria join an apprenticeship, while one-third of the working population have completed an apprenticeship. The analysis compares former apprentices with high school graduates and unskilled workers. The results show that the likelihood of being unemployed for apprentices lies between the likelihoods for high school graduates and unskilled workers, although apprenticeship graduates appear to be more similar to the former than to the latter. In terms of wages, the results suggest that unskilled workers earn 10-12% less than former apprentices, while high school graduates initially earn no more than apprentices early in their careers, although a gap does open up in favour of high school graduates as they get older.

The next section of this report describes the estimated labour market impacts of apprenticeships and other vocational qualifications. This is then followed by a full cost-benefit analysis of these qualifications.

3. Labour Market Benefits

(i) Data

The analysis in this report uses data from the Labour Force Survey (LFS). Most of the analysis is undertaken using the 2004 and 2005 surveys, which are the most recent data available. Some analysis of changes over time is then performed, using data from 1996 to 2005.[6]

The survey for the LFS is undertaken every 3 months in each year. To increase sample sizes, we combine data from the four quarterly surveys into single annual surveys. An individual is present in the LFS for five successive quarters, in a rolling panel of respondents where $1/5^{th}$ are replaced each quarter. Each respondent is only asked to report their wages on the first and last occasions that they are interviewed (waves 1 and 5), and only keeping such respondents from wave 1 and wave 5 in an annual data set ensures that no individual is placed in the same annual data set twice. For the analyses where data for 2004 and 2005 are pooled, wave 5 respondents in 2005 are dropped, as they will already have been observed in wave 1 in 2004, and so will already be in the pooled data set. When all data from all the years 1996 to 2005 are pooled into a single data set, only wave 1 observations are used in each year, for the same reason.

There are two questions concerning apprenticeships that will be of use, specifically:

'*are you doing or have you completed a recognised apprenticeship?*'[7]

and if the answer to the above question is positive, then:

'*Does/did your apprenticeship form part of the Modern Apprenticeship Initiative.*'

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[6] 1996 is chosen as the starting year, as this is the first year that the LFS asked respondents to report *all* of their qualifications, rather than simply their highest three, and other qualifications held will be important control variables in the estimated wage equations.

[7] Prior to 2004, this question read '*are you doing or have you completed a recognised* ***trade apprenticeship****?*' The word 'trade' applied to apprenticeships was dropped from the questionnaire in 2004 and successive years. This change does not seem to have created a significant break in the series (see figure 1 below for a graph of average earnings for individuals who reply positively to this question, both before and after the change in wording, where no particular trend change is evident in 2004).

Thus, in all analysis that follows, individuals who have completed a Modern Apprenticeship form a subset of the group of individuals who have completed any recognised apprenticeship. Over the period considered from 1996 to 2005, those with a Modern Apprenticeship represent an increasing proportion of all those with any recognised apprenticeship, from 4% in 1996 to 7% in 2005, though clearly the vast majority of respondents in the LFS who say they have completed a recognised apprenticeship report that it is not a Modern Apprenticeship, because their training pre-dates the advent of Modern Apprenticeships.

In the years 2004 and 2005 only, there is a further question, dividing Modern Apprenticeships into Advanced and Foundation Level[8]. It is for this reason that the main results, for which a breakdown of results by level of apprenticeship was desired, will be based upon the data from 2004 and 2005. Pooling the two years rather than analysing separately increased sample sizes and in particular the number of former Modern Apprentices observed[9].

Given that they are the current form of apprenticeship, the results for the Modern Apprenticeship variables will be the most policy relevant. However, as noted above, far fewer respondents in the LFS report completing a Modern Apprenticeship compared to any recognised apprenticeship (as expected, given the relative age of the two systems), and so the results for the latter are the more statistically robust. Therefore, results for any recognised apprenticeships will be presented throughout the report, side-by-side with the results for current (i.e. Modern) apprenticeships.

[8] As described in the Introduction, the names Advanced Modern Apprenticeship and Foundation Modern Apprenticeship were actually changed in 2004, although the LFS continues to use these titles. In this report, the names 'Level 2 apprenticeship' and Level 3 apprenticeship' will be used to reflect current usage, based on the Foundation Modern Apprenticeship and Advanced Modern Apprenticeship questions, respectively, in the LFS.

[9] Nevertheless, the number of individuals with a completed Modern Apprenticeship in the constructed data set remains small, with about 340 having a Modern Apprenticeship as their highest qualification, which represents less than 1% of the used sample. Although statistically significant results are obtained with these small numbers, it should be borne in mind when considering the results that the estimated returns to Modern Apprenticeships have been obtained from a small number of observations.

(ii) Methodology

The results presented in this report are obtained from wage equations estimated by Ordinary Least Squares regression analysis. In such analyses, variation in wages across individuals is explained by whether or not they have a completed apprenticeship as their highest qualification (or other particular vocational qualifications, such as National Vocational Qualifications), as well as other control variables. It is important to include such control variables. If we did not, then the omission of any variable correlated with the likelihood of undertaking an apprenticeship, and which also affects wages, would bias the results. For example, men are more likely to do an apprenticeship than women. Men also earn more than women, on average. If we did not control for gender, thus holding it constant and so comparing like-with-like, then it could appear that an apprenticeship leads to higher wages, but those higher wages could simply be the result of former apprentices being more likely to be male, rather than the effects of the apprenticeship itself. The full list of control variables included in the estimated wage equations is gender, age (and its square, to control for non-linear effects in age), ethnicity, region, workplace size, and public or private sector. It is also very important to control for other qualifications held. If individuals undergoing an apprenticeship are more (or indeed less) likely to hold particular other qualifications, then the higher (or lower) wages of former apprentices could be due to the impact of those qualifications, and not the apprenticeship itself. It is therefore important to control for all other qualifications held, which the LFS allows us to do, since it asks respondents to report all qualifications that they hold.

It is very difficult, however, to control for all factors that might be associated with the receipt of apprenticeship training and that also influence wages, simply because data is not available for all the variables that we want. If such factors are not included in the wage equation, then they are not controlled for, and so the estimated coefficients will be biased. This is a problem that faces all empirical work that using cross-sectional data. One such factor often mentioned with respect to wage equations is ability. Since it is very hard to obtain data on natural ability, this is usually omitted from wage equations out of necessity, which can affect results. This could particularly be the case when considering apprenticeships. There is a queue of

potential apprentices for many apprenticeship places, meaning that employers can pick and choose whom they would like to train. On the assumption that, given the choice, they are likely to pick the most able to offer the apprenticeship to, then those selected onto apprenticeships will be of above average ability, and so the observed wage returns to apprenticeship will reflect this ability as well as the training itself. With the cross-sectional data available to us, there is little that can be done to correct for this problem. However, robustness checks will be performed, to determine how sensitive the estimated results are to different assumptions about the proportion of the observed wage return that should actually be attributed to the apprenticeship. Note that, since there is no binding limitation on the number of places available for the other vocational qualifications considered here, then selection by ability is less likely to be an issue in the case of those qualifications, and so robustness checks will only be performed for the various apprenticeship variables.

The interpretation of the estimated coefficients from the wage equation depends upon the control group used. In this case, we are interested in the wage gain from completing an apprenticeship, compared to what individuals would have earned had they not done the apprenticeship. It is assumed that individuals completing a Level 3 apprenticeship, or any apprenticeship of unknown level, would have had Level 2 qualifications (5 or more GCSEs at grade C or above or a vocational qualification at Level 2) before starting an apprenticeship, and so would have remained at Level 2 had they not obtained the apprenticeship[10]. Thus, the sample upon which the equation is estimated is all those in the LFS whose highest qualification is an apprenticeship[11], or whose highest qualification is at Level 2. Therefore the interpretation of the estimated returns to apprenticeship is the extra wages that an individual receives if they have completed an apprenticeship and this represents their highest qualification, compared to an individual with the same observed characteristics whose highest qualification remains at Level 2. At occasional points in the report, a Level 2 apprenticeship is

[10] Analysis of current apprentices in the 2005 LFS reveals that of those participating in a Level 3 apprenticeship, 60% have 5 or more GCSEs at grade C or above, and over 70% have some Level 2 qualification, once other Level 2 qualifications, particularly NVQ2s, are also considered.

[11] Actually, all those whose highest qualification is an apprenticeship *plus* those who have completed an apprenticeship and whose highest qualification is an NVQ3 are considered. This is because the NVQ3 qualification ranks above an apprenticeship in the highest qualification variable in the LFS, and so if an individual completes an apprenticeship and in so doing obtains an NVQ3, they would not be observed in the sample if it was restricted to those whose highest recorded qualification in the LFS is an apprenticeship.

explicitly considered, either any recognised apprenticeship with an NVQ2 qualification, or a Foundation Modern Apprenticeship (now just 'Apprenticeship'). In these cases, the control group is all those whose highest qualification is a Level 1 or a Level 2 qualification.[12,13]

Thus, the analysis is in terms of highest qualifications for the key qualifications of interest, while controlling for *all* qualifications held below this. Thus, not all individuals who have completed an apprenticeship are included in the estimated equation, but only the subset for whom their completed apprenticeship represents their highest qualification[14]. Any individual who holds a higher-ranked qualification, such as A levels, a degree or other Higher Education qualifications, is therefore excluded from the analysis. In particular, this means that the 8% of so of current apprentices who have already acquired A levels before they even train for a Level 3 apprenticeship (3% for Level 2 apprenticeships) are not included in the analysis, and so we cannot say anything about the returns (if any) to individuals who follow their successful acquisition of A levels with an apprenticeship. It was decided to focus upon individuals with apprenticeship as their highest qualification, rather than all individuals with an apprenticeship, as the wages of the latter group will largely reflect the higher qualification rather than the apprenticeship. Of course, we could attempt to control for this, by including indicators of higher qualification acquisition, but even then there is the fear that former apprentices who also have high level qualifications may have very different unobserved characteristics such as natural ability, which could influence the results.

In addition to the returns to apprenticeship, the returns to other vocational qualifications (again when held as highest qualification) are also presented below for

[12] Analysis of current apprentices in the 2005 LFS reveals that those participating in a Level 2 apprenticeship are split quite evenly between Level 1 and Level 2 in terms of their prior qualifications. For example, of current Level 2 apprentices, 40% have 5 or more GCSEs at grade C or above, and 41% have some GCSEs at grade C or above, but fewer than 5.

[13] There is a category of qualification simply entitled 'other' in which qualifications not covered by the main qualification questions, as well as foreign qualifications, are placed. As we do not know exactly which level these 'other' qualifications should be placed, this category is placed in both the Level 1 and Level 2 groups.

[14] Around 52% of all individuals with a recognised apprenticeship have this as their highest qualification, with figures of 61% for Level 3 (Modern) apprenticeships and 45% for Level 2 (Modern) apprenticeships. If the apprenticeship is not their highest qualification, then the higher qualification most often obtained is an HNC/HND in the case of Level 3 apprenticeships, and an NVQ3 in the case of a Level 2 apprenticeships.

comparison purposes. In these cases, the control group works in exactly the same way, for example using all those whose highest qualification is at Level 2 as the control group, when considering the returns to a Level 3 vocational qualification, and all those whose highest qualification is at Level 1 or Level 2 as the control group, when considering the returns to a Level 2 vocational qualification.

The dependent variable in the analysis is the log of real gross weekly earnings. It is usual in the wage returns literature to consider hourly earnings rather than weekly earnings, since the former are not in part determined by the number of hours worked per week. However, in the analysis being conducted here, the wage returns are to be used to calculate yearly earnings over the working lifetime of an individual with an apprenticeship, in order to determine the full benefits of the apprenticeship, to feed into the cost-benefit analysis. If the wage returns had been calculated using hourly earnings, it is not clear exactly how these hourly wage gaps should be transformed into annual wage gaps. For example, should they be multiplied by usual hours worked, actual hours worked in the survey week including overtime, actual hours worked in the survey week excluding overtime (all of which are available in the LFS) or just some indicator of average hours worked per year across all individuals? With a weekly wage gap, it is much more straightforward to determine an annual wage gap, by simply multiplying by 52 (corrected for the probability of remaining in employment, of course). Thus, weekly earnings are used.

In principle, it is possible to control for the fact that weekly earnings are partly determined by hours worked, by including a measure of hours worked as a control variable. However, the number of hours worked is a choice variable, determined by many factors including the dependent variable, wages, itself, and so to include such a variable would introduce endogeneity bias into the equation, and affect the results. The sample used is therefore restricted to full-time workers only, since there is much less variation in hours worked when full-time workers only are considered, compared to the case where part-time workers are included[15].

[15] Of course, restricting the sample to full-time workers only can create its own bias on the results, namely sample selection bias. The literature in this area seems to prefer this sample selection bias to the endogeneity bias mentioned above, since many papers consider full-time workers only, but few include choice of hours worked as an explanatory variable.

Once wage equations have been produced in all the cases described above, to obtain estimates of the wage returns to the various qualifications, employment equations are then estimated for each case, to determine the change in the likelihood of being employed for each of the qualifications considered, relative to the same control groups. These equations are estimated by probit regressions, which is a technique that takes account of the fact that the dependent variable in these equations (wherever an individual is employed or not) can only take the values 0 or 1.[16]

The data sample actually used is restricted in various ways from the full LFS sample. In addition to restricting the sample to full-time workers only, as described above, the analysis also focuses on England and those individuals not currently in education. Individuals with extreme values for wages are also omitted from the analysis.

(iii) Results – Wage Returns to Apprenticeships

a.) Raw Wages

Before estimating the empirical models described above, it is of interest to view the actual wage levels for individuals with the various qualifications, to first obtain a picture of what is happening to these wages. It was decided to focus on the average wages amongst those aged under 26. This is because the various qualifications are of various ages, and in particular the Modern Apprenticeships are relatively recent, and so anyone completing one must be, by definition, quite young, and certainly significantly younger than the average person in the labour market. If we did not control for age by only focussing on individuals below the age of 26, then the wages of former Modern Apprentices would appear to be low. This, however, would be due to their young age, rather than the apprenticeship itself, as earnings rise with age on average.

Figure 1 below shows the average wages for individuals aged under 26 whose highest qualification is one of the apprenticeships, and also average wages for those whose

[16] In terms of the LFS questions, 'being employed' corresponds to being an employee, self-employed, on a government training scheme, or an unpaid family worker (this definition fits most closely to the ILO definition of employment). Only full-time employment is considered, for consistency with the estimated wage equations, which were based on a sample of full-time workers only.

highest qualification is at Level 2 or Level 1 or 2 for comparison. The figure shows that wages for apprenticeships (the solid lines) have been rising relatively smoothly[17], and faster over this period than the wages of the comparison groups (the dotted lines), particularly in the second half of the period, since 2000. The average wages for Level 3 (Advanced Modern) apprenticeships, for which data are only available in 2004 and 2005 are even higher than the average Modern Apprenticeship wages, as would be expected. Thus, by 2005, an individual aged under 26 whose highest qualification was a Level 3 (Advanced Modern) Apprenticeship was earning 29% more than an individual whose highest qualification was at Level 2 (with the gap for all Modern Apprenticeships being 19%)

Figure 1: Changes in the Average Wages of Individuals Aged Under 26 Over Time, by Highest Qualification Level

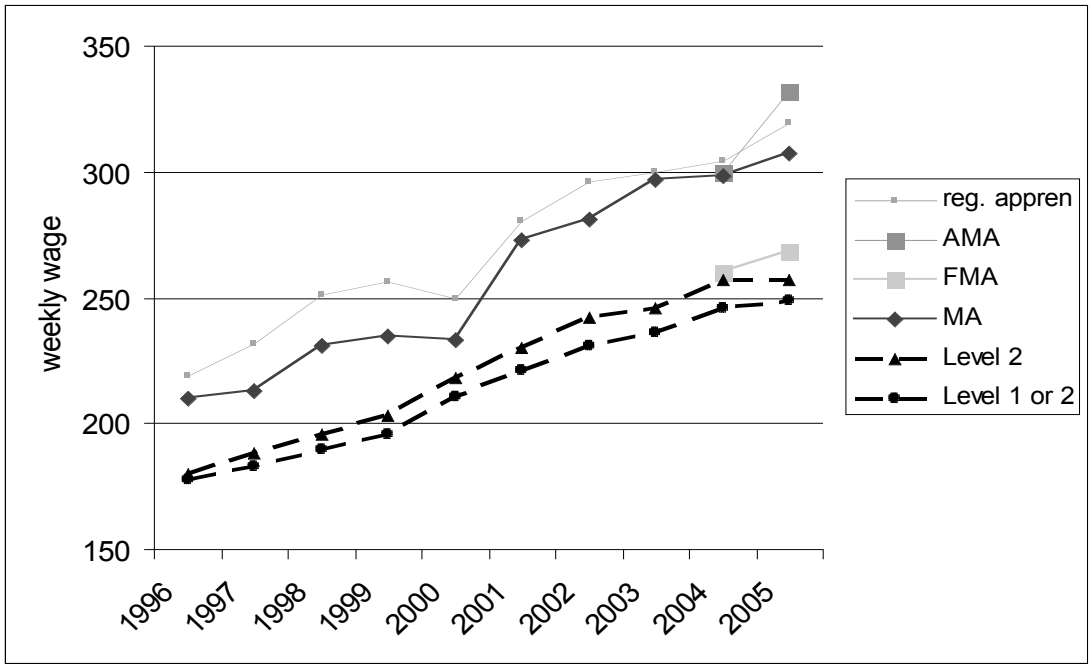


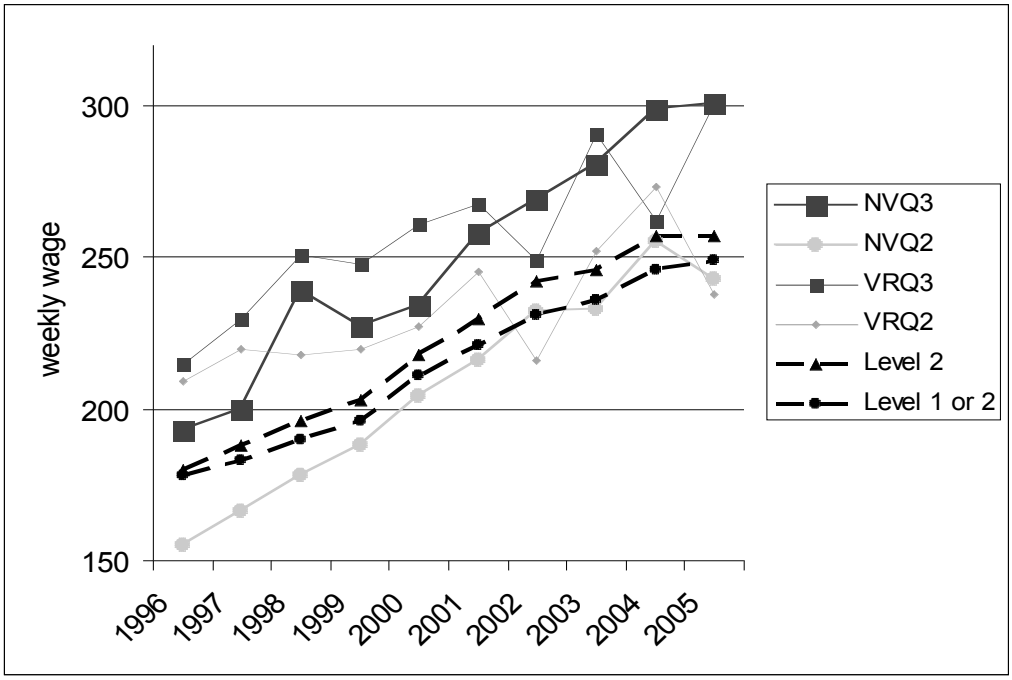
Figure 2 below presents similar results for NVQs and VRQs[18]. This figure shows that average weekly wages for those aged under 26 whose highest qualification is a VRQ have risen broadly in line with the Level 2 or Level 1 or 2 comparison

[17] The blip in the smooth rise in apprenticeship wages comes in 2000, when wages actually fall by a small amount. The reason for this is not clear. There are no changes to the relevant questions in the LFS questionnaire that might have caused this break in the series.

[18] VRQs are other vocational qualifications, specifically a BTEC ONC/OND and an Advanced Craft City and Guilds qualification at Level 3, and a BTEC first diploma and a Craft City and Guilds qualification at Level 2.

groups, though it is somewhat difficult to tell given the erratic nature of the VRQ wage profiles over time[19]. Average weekly wages for those aged under 26 whose highest qualification is a NVQ, on the other hand, have been rising faster than average wages in the comparison groups. In particular, in 1996, a young person whose highest qualification was an NVQ3 earned only slightly more than individuals in the Level 2 and Level 1 or 2 comparison groups, but by 2005 earned considerably more.

Figure 2: Changes in the Average Wages of Individuals Aged Under 26 Over Time, by Highest Qualification Level



b.) Estimated Wage Returns - Aggregate Results for 2004/5

Table 1 shows the overall (i.e. aggregated) results for all respondents in 2004/5. Being the full results for the most recent data available, the results in Table 1 will be the basis of the benefits information in the cost-benefit analysis of apprenticeship that follows. Each box in the table reveals the results from a different estimated regression equation. Results are presented for males and females separately, as is usual in the

[19] The likely cause of these erratic results is that few young people aged under 26 new acquire the VRQ qualifications, and so these average wage estimates are based upon relatively small samples.

wage equation literature, given the different influences on their wages. However, the main purpose of this wage equation analysis is to estimate the benefits of apprenticeships, to be compared to the costs in a later section. Since the costs of providing apprenticeship cannot be split by gender, and it cannot be pre-determined whether a particular apprenticeship place will go to a male or a female, the benefits should also be combined, and so such results are also estimated and presented in Appendix A[20].

The first result in the column for males reveals a return to all recognised apprenticeships (including Modern Apprenticeships) of 8% for men[21]. The comparison group in this case was all men whose highest qualification was at Level 2. Thus, the results suggest that, in 2004/5, a man who had, at some point in the past, completed a recognised apprenticeship, and holds this as his highest qualification, earns on average 8% more than a man whose highest attainment has remained at Level 2. As with all results in this report, this should be interpreted as holding constant other characteristics (age, ethnicity, region, public/private sector, workplace size and, crucially, other qualifications held).

The next row in Table 1 interacts the completion of a recognised apprenticeship with the receipt of a National Vocational Qualification (NVQ) at Level 3. The intention of this analysis is to reveal whether there is additional value to an apprenticeship if an NVQ is also acquired. Unfortunately, the LFS questionnaire only asks respondents to report all qualifications that they hold, and not when each was obtained or whether any were obtained together. Thus the interaction term in the table indicates individuals who have completed a recognised apprenticeship *and* have acquired an NVQ3, although we do not know that they were necessarily acquired by the individuals at the same time.

The results show that a man who has completed a recognised apprenticeship, but has not obtained an NVQ3, earns on average 7% more than a man who remains at Level

[20] Usually the wage returns for males and females combined lie between the returns estimated for males and females separately, although occasionally this is not the case. This is possible, given that the coefficients in the estimated wage equations are determined by the interactions between all of the explanatory variables in the estimated equation, and changing the sample can alter the inter-correlations between the explanatory variables.

[21] Calculated as $e^{\beta} - 1$, where β is the estimated coefficient in the table, in this case 0.079.

2. If the man also obtains an NVQ3 (strictly speaking, if he also holds an NVQ3, even if it was not obtained through the apprenticeship), then he will earn *an additional* 10% more than men who have remained at Level 2 (i.e. the total wage return to the apprenticeship-NVQ package will be 7%+10% = 17%)[22].

The next row in Table 1 performs a similar analysis, interacting the variable indicating completion of a recognised apprenticeship with the variable indicating receipt of an NVQ2. In this case, because we are considering the returns to a Level 2 qualification, the comparison group is changed, so that this time it is all men whose highest qualification is at Level 1 or Level 2. The results show that on average, a man who has completed a recognised apprenticeship but who does not hold an NVQ2 qualification will earn 8% more than men who have remained at Level 1 or 2. However, the additional acquisition of an NVQ2 has little further impact on the wage returns to the apprenticeship.

The next two rows in Table 1 present the results that are more relevant to current policy, given that they focus on the apprenticeships that have more recently been provided, namely Advanced and Foundation level Modern Apprenticeships. The results reveal that a man who has completed an Advanced Modern Apprenticeship earns on average 22% more than men whose highest qualification remains at Level 2. The equivalent wage return for a man who completes a Foundation Modern Apprenticeship, compared to men who remain at Level 1 or 2, is estimated to be 20% on average.

The final rows in Table 1 present the results for other vocational qualifications at Levels 2 and 3, for comparison purposes. Thus, a man with an NVQ3 earns 6% more, on average, than a man who remains at Level 2, while there are no positive wage benefits to obtaining an NVQ2, relative to remaining at Level 1 or 2, for men.[23] For other vocational qualifications such as BTEC and City and Guilds, aggregated into the

[22] Since Modern Apprenticeship are much more likely to include an NVQ than traditional trade apprenticeships, the fact that the returns to a recognised apprenticeship are higher when an NVQ is included is consistent with the evidence below that Modern Apprenticeships have a higher wage return than older apprenticeships.

[23] Indeed, the estimated coefficient for the NVQ2 variable is negative and statistically significant, suggesting that men with an NVQ2 actually earn *less* than men who remained at Level 1 or 2, though this outcome is likely to be a result of the unobserved characteristics of men who acquire an NVQ2

VRQ variables, the results show a 7% wage return to such qualifications for men at Level 3 relative to Level 2, but no statistically significant wage return at Level 2 relative to Level 1 or 2.

The results for women show generally lower wage returns, compared to those obtained by men. There are no significantly positive wage returns to recognised apprenticeships for women, whether obtained on their own or with NVQs at any level (though the returns are higher when an NVQ is obtained with the recognised apprenticeship). Indeed, taking the results literally, they imply that women whose highest qualification is a traditional recognised apprenticeship earn less than women whose highest qualification is at Level 2. It seems unlikely that completing an apprenticeship would actually lower a woman's wages, compared to what she was earning prior to the apprenticeship. More likely is that there are particular unobserved characteristics of the women who chose to undergo a traditional apprenticeship that negatively affect their earnings, compared to the women in the Level 2 comparison group[24].

When we turn to Modern Apprenticeships, which recall are available in a wider range of industrial sectors than the traditional craft apprenticeships, the results are better for women, at least at Advanced level, where wage returns of 14% are revealed, relative to women who remain at Level 2. The estimated wage benefits for women to a Foundation Modern Apprenticeship, are only 4% however (and not statistically significant). Considering the other vocational qualifications, the NVQ qualifications do not seem to have any positive impact on the earnings of women, either at Level 3 or Level 2. The BTEC and City and Guilds qualifications do raise female wages, by 6% and 5% at Level 3 and Level 2 respectively (the latter being statistically

being associated with lower earning power. More optimistic returns to NVQs at Level 2 were found by Dearden *et al* (2004) compared to those observed here. The reason for this difference is because Dearden *et al* compared individuals with an NVQ2 to those individuals with no qualifications at all, whereas in this study, the comparison group is those individuals who already have a qualification at Level 1 or Level 2. Thus the comparison group used here will be, on average, considerably better paid than the comparison group used by Dearden *et al*.

[24] Note that the poor wage returns to apprenticeships for women are not simply a consequence of women working in lower-paying sectors, since when we look *within* sectors later in this section, the wage returns to apprenticeships are typically lower for women than for men *in the sane sector*.

insignificant due to a larger standard error on the estimated coefficient, caused in turn by the low numbers of women with such qualifications).

c.) Wage Returns for those Aged Under 26

One of the limitations of using the estimated returns obtained above, to predict future returns to apprenticeships for current apprentices, is that the data sample used contains all people of working age, and therefore some of the apprenticeships observed may have been obtained a long time ago. This sub-section therefore repeats all of the analyses contained in Table 1, but for a sample of individuals aged under 26. Any apprenticeships observed in such a sample have necessarily been completed in the recent past, and are therefore more relevant for future policy. The downside of using such a sample, of course, is that the number of observations available with which to estimate the statistical relationships is much smaller, and so the results are less robust.

Looking at the estimated returns in Table 2, and comparing them to the equivalent ones in Table 1, it is clear that the returns to any recognised apprenticeships have changed more than the returns to current (Modern) apprenticeships. This was to be expected, given that the Modern Apprenticeship is a relatively recent development, and so any individual completing a Modern Apprenticeship would have done so relatively recently anyway, even in Table 1 when the age range of the sample was not restricted.

The results in Table 2 show that the estimated returns to a recognised apprenticeship *obtained relatively recently* are significantly higher than the returns observed for apprenticeships in the working population as a whole. This suggests that those individuals who have recently completed an apprenticeship will stand out more relative to those other young people who have perhaps under-achieved and remained at Level 2, whereas for older workers, the Level 2 comparison group will be a more heterogeneous group with higher average ability, given the much greater prevalence of leaving education at age 16 amongst the older cohorts. Thus, men aged under 26 who have completed a recognised apprenticeship earn on average 23% more than similar men who have remained at Level 2. Since most of these recent apprenticeships will have been Modern Apprenticeships anyway, it is not surprising

that the returns to recognised apprenticeships are more like the returns to Modern Apprenticeships in Table 2 than in Table 1. For young women, we observe positive returns, of 8%, to a recognised apprenticeship, where none previously existed for the population as a whole. This suggests that, although apprenticeships have historically not been of benefit to women, recently this is not the case, and a benefit has emerged.

The interactions between recognised apprenticeships and NVQs amongst young people show that there is an additional advantage of around 8% to obtaining an NVQ3 together with a recognised apprenticeship, though at Level 2, there is only a small additional advantage of an NVQ2 for young women, and none at all for young men.

As for Modern Apprenticeships, the returns for young people are similar to those for people of all ages, as expected given the age of the scheme. A Level 3 Modern Apprenticeship raises young men's wages by 23% and young women's wages by 22%. At Level 2, a Modern Apprenticeship raises young men's wages by 22% (relative to young men at Level 1 and 2 in this case), but has no wage benefit for young women.

The remaining rows of Table 2 show that the returns to NVQs are much higher amongst young people than for the population as a whole. Thus, young men with an NVQ3 earn 16% more than young men whose highest qualification is at Level 2. For women, there was no benefit at all of an NVQ3 in the population as a whole, but amongst young women, the wage return is estimated to be 5%. There are still no positive returns observed to NVQs at Level 2, however, even when the sample is restricted to young people.

Whereas the returns to NVQs are higher amongst young people than the population as a whole, the opposite is true for other vocational qualifications. It therefore seems that there has been a switch in popularity and value of vocational qualifications amongst young people, towards the newer NVQs and away from the more traditional BTEC and City and Guilds qualifications. The only statistically significant return to young people for any VRQ is for young men at Level 3.

d.) Changes in the Returns to Apprenticeships over Time

Table 3 presents the wage returns to apprenticeship for each year from 1996 to 2005 inclusive, separately for recognised apprenticeships and Modern Apprenticeships[25], and separately for males and females.

The clear story that comes out of Table 3 is the rise in the wage returns to apprenticeships over time, particularly for Modern Apprenticeships[26]. Thus, for a man who has completed a Modern Apprenticeship compared to a man whose highest qualification is at Level 2, wages were initially 5% higher in 1996, rising to around 10% in the years 1998-2001 inclusive, and then rising again, to reach 21% by 2005. There is also an apparent rise in the returns to a recognised apprenticeship over the period, although less marked, and coming mainly towards the end of the period. The estimated returns to a recognised apprenticeship mostly stay within a band of 5-7% for men until 2002, and then rise, reaching 10% by 2005.

For women, in no years are the estimated returns to a recognised apprenticeship positive and statistically significant. It could perhaps be argued that there are rising returns to recognised apprenticeships, since they are consistently negative and statistically significant in the early part of the period, and then insignificantly different from zero in the latter part of the period, although given the general lack of statistical precision in the female equations, not too much should be made of this. For Modern Apprenticeships, there is an increase in returns over time, however, since they are essentially zero until 2002, but after that around 5-7% (and statistically significant in 2005).

Therefore there does seem to be some evidence of rising returns to apprenticeships over time, which is at least consistent with the possibility of increasing quality of such training, or increasing value being placed on such training by employers.

[25] The distinction between Advanced Modern Apprenticeship and Foundation Modern Apprenticeship is not made in Table 3, because the question used to distinguish between the two was only first asked in 2004.

[26] This is consistent with the changes in the raw wage differentials over time, as shown in Figure 1 above.

e.) Wage Returns to Apprenticeships by Sector

This section considers the wage returns earned by former apprentices working in particular industries. Further caveats apply to the sectoral results in addition to those for the main analysis: (1) Ideally, we would have liked to estimate the returns to apprenticeship *by the sector that the apprenticeship was obtained in*, but given the absence of such information, we instead rely on current sector rather than training sector. (2) The balance of supply of, and demand for, apprenticeship places will vary across sectors. Therefore the extent of selection into the programme, and the degree of selection bias that the analysis does not account for, will vary by sector. (3) The nature of the comparison groups may be different across sectors, so, whilst their level of qualification is the same, the types of jobs done, and the economic conditions for those jobs, may be different.

The results in this sub-section were obtained when all ten years' worth of data available to us were pooled into a single data set. The estimated returns derived in this way are therefore average returns over the last ten years. This was done because the sectoral analysis necessarily reduced sample sizes, and there were insufficient observations with which to estimate the wage equations in many industries when only a single year's worth of data were used.

The results are shown in Table 4. The first row reveals that, in England as a whole, across all sectors, a man who completes a recognised apprenticeship earns, on average across the 10 years, 6% more than a man whose highest qualification remains at level 2. For a Modern Apprenticeship, this wage gap rises to 18%. With respect to women, we do not observe a positive and statistically significant return to either type of apprenticeship. Indeed the average returns to a recognised apprenticeship over this period are estimated to be negative and statistically significant.

These average figures differ significantly across sectors. The general picture is that the estimated returns to apprenticeship are higher in manufacturing industries than in service industries. For men, amongst the manufacturing industries, we observe double figure returns to Modern Apprenticeship, averaged over the whole period, in food

manufacture, machinery manufacture and in construction. The latter two industries, plus basic metal manufacture and fabricated metal manufacture, also attract average returns above 10% for recognised apprenticeships. In the service sector, few industries attract positive and statistically significant returns to apprenticeship. The exceptions to this are the 'recreation, culture and sport' sector, where very large returns of 42% to a Modern Apprenticeship are observed, a 15% return to Modern Apprenticeship in retail trade and a 10% return to recognised apprenticeships in car sales.
For women, as usual, it is difficult to find positive and statistically significant estimates. There is a very high estimated return to Modern Apprenticeships in the printing industry for women, though the high standard error on this estimated coefficient suggests that it is based on few observations. Also observed is a high return to Modern Apprenticeships in the 'other business' sector for women.

At the foot of Table 4, there are two groups of workers defined by their occupation (engineers and business administrators) rather than their industry, since information on these groups was required for the cost-benefit analysis that follows, and such workers could be found across a range of industries. The results suggest that apprenticeships in engineering raise male wages, particularly Modern Apprenticeships. On the other hand, Modern Apprenticeships do not benefit men working in business administration, although for women an affect is found.

(iv) Results – Employment Effects of Apprenticeships

This section briefly considers the impact of apprenticeships and other vocational qualifications on the likelihood of obtaining a full-time job. The main purpose of doing so is to aid the cost-benefit analysis that follows. Since such an analysis requires an estimate of the lifetime gains from acquiring an apprenticeship, we need to know the likelihood of individuals actually being in full-time work and so earning the wage benefits of apprenticeships described above. The analyses follow those of the wage benefits above, with the exception that there is no sectoral analysis, since if an individual is observed in an industry, then obviously they must be in work.

Table 5 reveals the core results, of the impact of qualifications on the full-time employment likelihood in the years 2004/5. A man with a recognised apprenticeship is

6 percentage points more likely to be in a full-time job than an otherwise similar man whose highest qualification is at Level 2. There is a strong additional effect if an NVQ at Level 3 is obtained, though not at Level 2. A Level 3 Modern Apprenticeship is associated with a 10 percentage point higher probability of full-time employment, with a 5 percentage point effect observed for Level 2. The other vocational qualifications have similar employment effects at Levels 3 and 2 respectively.

For women, traditional recognised apprenticeships are not associated with the likelihood of employment, but Modern Apprenticeships and many of the other vocational qualifications are, and to a greater extent than for men. Such a gender difference in employment effects is expected to be observed, given that more women are out of employment than men, and so there is more variation in the probability of employment for qualifications to 'explain'. Thus, for example, completing a Level 3 Modern Apprenticeship is associated with a 16 percentage point higher probability of being in a full-time job for women, with a similar size effect observed for an NVQ3. The impact of traditional vocational qualifications such as BTECs and City and Guilds on employment is, however, slightly smaller for women than for men.

Table 6 repeats the analysis of Table 5, but focuses on young people below the age of 26. As was found in the wage equations above, an apprenticeship sets young people apart from those whose highest qualification is at Level 2 (in most cases good GCSEs) in a way that is not the case for older workers, for whom good GCSEs were the normal route into employment for many. Thus, a recognised apprenticeship is associated with a 15 percentage points higher probability of employment amongst young men (17 percentage points amongst young women), with an 18 (19) percentage point effect observed for Level 3 Modern Apprenticeships for young men (women) and 13 (9) percentage points for Level 2 Modern Apprenticeships for young men (women). Similar large associations with employment probabilities are observed for NVQs, though as was observed in the wage equation, traditional vocational qualifications (VRQs) seem to have become less relevant to young people.

Finally, Table 7 considers changes over time in the employment effects of apprenticeships. The employment effect of recognised apprenticeships has been much steadier over time, compared to the increasingly strong wage effects observed above.

For Modern Apprenticeships, however, we do again observe the association with the likelihood of full-time employment rising over time, from 8 to 13 percentage points for men, and from 8 to 22 percentage points for women.

Before leaving this section, a comment on the interpretation of these employment results is required. When reporting these results, care has been taken throughout to report them as an 'association' between the qualifications and the employment probability, rather than a causal impact of the qualifications. The above results should not therefore be read that the acquisition of the various qualifications will change an individual's probability of employment by the given amounts. Partly this is due to the 'unobserved heterogeneity' argument present in most cross-sectional statistical studies (including the wage equation results above) that the individuals who manage to acquire the various qualifications may have unobserved characteristics that make them more likely to obtain employment (or earn higher wages) anyway, even without the qualification. The additional problem with the employment results, particularly for the vocational qualifications considered here, is the possibility of reverse causality, of individuals in employment in the first place being more likely to study for vocational qualifications. Examining the most recent LFS shows that over 80% of individuals who acquire the various vocational qualifications considered here during the year that they are observed in the LFS, were in employment *before* they acquired the qualification.

4. Cost Benefit Analysis

(i) Methodology

All of the analysis in the previous section was concerned with the benefits that apprenticeships and other vocational qualifications can produce in the labour market. This section evaluates these benefits by comparing them to the costs of providing the various qualifications. Throughout this section, we are considering public or social costs and benefits, rather than costs and benefits to private individuals.

The costs can be grouped into three categories; the resource cost to the state in terms of providing the qualification, the resource costs borne by the employer in terms of supplying the training (for apprenticeship only), and the value of the output that would have been produced, had the trainee been in full-time employment rather than acquiring the qualification. Net of these costs, we have to consider the value of what trainees produce whilst training.

Considering each of these costs in turn, the costs to the state for all qualifications were obtained from separate work conducted by the LSC. The figures used for the cost of each qualification are as follows:

	Level 2	Level 3
(Modern) Apprenticeship[27]	£4712	£6535
NVQ	£3240	£3119
VRQ	£3872	£9633

The costs for all apprenticeships, regardless of level, by sector are:

Sector	Cost
All apprenticeships	£5251
Construction	£6113
Engineering	£7329
Business Administration	£3899
Retail and customer service	£3755
Hospitality	£4107

[27] Since these costs data were supplied just for Modern Apprenticeships, only such apprenticeships, rather than all recognised apprenticeships, are considered in this section.

These sectoral costs are used at an aggregate level across qualification levels, because the wage benefits in different sectors were also estimated in aggregate form rather than by qualification level, since they were estimated using the 1996-2005 data set, which does not distinguish Level 3 and Level 2 apprenticeships.

Note that these cost figures represent the total state costs of providing the training for the learners. In order to obtain an annual cost, it is therefore necessary to divide the above figures by the duration of training in years. The average duration of a Level 3 apprenticeship is 130 weeks, of a Level 2 apprenticeship is 71 weeks, and of any apprenticeship is 86 weeks. Therefore if we are considering a Level 3 apprenticeship, we assume that the individual is training for two and half years, and the above costs are spread over this time period[28]. If we are considering a Level 2 apprenticeship, we assume that the individual is training for one and a half years. Finally, in the sectoral analysis when we are considering an apprenticeship regardless of level, then again we assume it lasts for one and a half years. In the absence of other information, it is assumed that NVQs and VRQs take the same amount of time to complete as an apprenticeship at the same level. For the length of apprenticeship by sector, the assumptions made, based upon observed duration in Hogarth and Hasluck's (2003) study of employer costs described below, are a duration of three and a half years in engineering, three years in construction, two years in business administration, one and a half years in hospitality, and one year in retail trade.

The resource costs borne by employers only occur in the case of apprenticeships, since we only consider NVQs and VRQs supplied in colleges. These employer costs include the wages of those supplying the training, such as supervisors and trainers, and any other costs such as those of materials and equipment supplied[29]. Subtracted from this cost must be the value of any output produced by the apprentice, since they will of course be working whilst training.

[28] It is assumed that the costs to the state occur evenly over the years of the training period. Although this may not be true in practise, allowing for the exact timing of the state costs will make very little difference to the final results.

[29] The wages paid to the apprentices themselves are not included because they are not a real social cost, but a monetary transfer between private economic agents.

The source of the employer cost information is Hogarth and Hasluck (2003). This report surveys 40 establishments across the same five sectors considered in this report, and listed in the table above. Thus the employer cost data is based on a small sample, which may not be representative of the total population. In addition, to obtain employer cost information for the whole economy, this report takes a weighted average of the employer costs in each of these sectors (weighted by number of apprenticeship completions), even though obviously there are many more sectors in the economy in addition to these five. It is therefore hoped that these five sectors are reasonably representative of the economy as a whole[30]. The resource costs borne by employers used in the cost-benefit analysis from this source are given in the table below[31].

	Level 3			Level 2		
	Training costs	Value of product	Net costs	Training costs	Value of product	Net costs
Construction	£6223	£20739	-£14516			
Engineering	£9723	£29885	-£20162			
Business Admin.	£3055	£20984	-£17929	£5719	£14106	-£8387
Retail	£2457	£24092	-£21635	£926	£8402	-£7476
Hospitality	£3948	£18150	-£14202	£1958	£13595	-£11637

Thus, in every sector at each level, the value of the output produced by apprentices is greater than the direct costs of training to the employer, producing the negative net costs to employers seen in the table. Of course, employers will actually pay wages to apprentices too, which will make these net costs positive again, though such wages are not included here because they are a private, not a social cost. The net employer resource costs are higher for Level 3 apprenticeships than Level 2, reflecting the fact that the value of output produced by a Level 3 apprentice is more than that produced by a Level 2 apprentice. This may in part be due to the possible higher ability of the former, but is mainly due to the fact that Level 3 apprenticeships are of longer duration. It might have been expected that the value of output of an apprentice in, say,

[30] Given the small sample, and the lack of coverage of the whole economy, these figures are unlikely to give an accurate picture of employer costs, but they are all that are available.
[31] The figures actually used in the cost-benefit analysis uprated the figures in this table by inflation, to give current employer costs, in 2004/5.

engineering would have been substantially above that in retail. The above table shows that this is not the case, however, and the value of output produced by apprentices is not too dissimilar in every sector. This is because, although engineering might produce a more valuable output than retail trade, apprentices in retail trade can work much closer to the output of a fully-trained worker, than is the case in engineering.

At the individual level, the alternative pay received by individuals in the relevant comparison group[32] (Level 2 or Level 1 and 2) has to be included as a cost during the training years, since this is an estimate of the value of the output which trainees would have produced had they not been trying to acquire further qualifications instead[33].

This should be net of the value of anything that individuals do produce whilst they are training. For those on apprenticeships, the value of output produced during the apprenticeship years has already been included in the net employer resource costs, as described above. For the other qualifications considered here, the earnings of individuals working part-time whilst studying in a college of Further Education for an NVQ or VRQ qualification were estimated from the LFS, corrected for the probability of such individuals actually earning anything at all whilst learning. These sources produced the following figures for average annual earnings whilst acquiring qualifications:

	Level 2	Level 3
NVQ	£2345	£3548
VRQ	£1580	£2100

Having described the costs-side of the analysis, it remains to describe how the benefits were calculated. The previous section estimated the average wage gap between holders of the qualifications of interest and the relevant comparison groups. In order to obtain an estimate of the full benefit of the various qualifications, age-earnings profiles must be estimated, to see how much more an individual with a qualification of interest will

[32] These wages in the comparison group are inflated to include non-wage labour costs, which are assumed to be 25% of the wage, and then corrected for the probability of someone at that qualification level actually being in employment and earning that wage.
[33] Note that any fee costs that individuals might be incurring (for example those aged 19+ undertaking certain qualifications at Level 3) are not included.

earn, compared to an individual in the appropriate comparison group, over their full working lifetime. Note that in this study we are considering social costs and benefits. We are therefore interested in the future stream of earnings, not from an income point of view to the former apprentice (which would be a private return) but because the extra wages paid to a former apprentice are assumed to be an indicator of the extra output that he or she can produce as a result of their training, which is a social benefit.

Firstly, the predicted wages of the comparison group were obtained from a regression of weekly earnings against age and age-squared, plus the other usual controls in a wage equation, with the age coefficients being used to estimate the earnings of the comparison group at each point in the life cycle. The estimated annual earnings at each age for the comparison group were then corrected for the probability that someone of that age with that highest qualification would actually be in employment and receiving such a wage. These employment probabilities were calculated from LFS data. Finally, the annual wages of the comparison group at each age were increased to include non-wage labour costs (assumed to be 25% of the annual wage), and to allow for real earnings growth over the lifetime (assumed to be 2% per year).

The predicted earnings for an individual with the vocational qualification of interest were then calculated for each year of the working life by taking the average earnings of individuals in the comparison group at that age, increasing them by the appropriate wage return estimated in the previous section[34], and then correcting for the likelihood of being in work by multiplying this wage by the comparison group's employment probability *plus* half of the estimated extra probability of being in work if the particular vocational qualification is held[35]. Finally, these estimated wages for apprenticeship,

[34] The wage return used in each case was the point estimate derived in the previous section and shown in Tables 1-4, even if this estimated wage return was statistically insignificant. Statistical insignificance means that the possibility of the true return being zero cannot be ruled out on statistical grounds, but neither can many other values be ruled out, and so there is no reason to take the return to be zero. In fact, the point estimate shown in the earlier tables is still the best estimate of the wage return that we have, even when statistically insignificant, and so will be used. The only exception to this rule is when the wage returns are estimated to be negative, for example for NVQ2 qualifications, because of the reservations about what such negative coefficients are actually telling us, as discussed above.

[35] Only half of the apparent gain in employment likelihood associated with each of the qualifications of interest is attributed to that qualification because not all of the estimated effect in the employment equations of the previous section can be interpreted as a causal effect of that qualification on employment, as described in the previous section. 50% is simply an assumption as to how much of the

say, at each age are also corrected for non-wage labour costs (25%) and annual real earnings growth (2% per year), to produce an age-earnings profile of future earnings of a former apprentice.

Finally, to obtain the estimate of the actual benefits of the apprenticeship (or other vocational qualification) this stream of future earnings, and also the age-earnings profile for the comparison group, were discounted to obtain the present value of these future earnings, and then the discounted wages of the comparison group were subtracted from the discounted wages of the apprenticeship group[36]. These benefits could then be set against the present value of all of the costs that were discussed above, to produce a net present value of the apprenticeship or vocational qualification. An internal rate of return was also calculated, as the discount rate required to make the present value of the benefits equal the present value of the costs.

For the sectoral analysis, a sector-specific comparison group was created, and a wage profile for such individuals was estimated. For example, considering an apprenticeship in construction, the comparison group was individuals *working in the construction industry* whose highest qualification is at Level 2. The alternative was to compare former apprentices in construction with *all* individuals whose highest qualification is at Level 2. However, when wage equations were estimated to compare the wages of former apprentices working in construction to those of individuals at Level 2 regardless of sector, the wage difference will depend partly on the productivity enhancing effects of the apprenticeship, as required, but also the extent to which wages in construction are above or below the sectoral average. Thus, in any sector with above (below) average wages, the returns to an apprenticeship in that sector compared to all individuals at Level 2 would be biased upwards (downwards). Thus, the former approach is adopted, and the interpretation of the sectoral results will therefore be the relative costs and benefits of taking an individual *already in a particular sector* and giving them apprenticeship training.

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employment effect is causal, though robustness checks are carried out in the appendix where different proportions are assumed.

[36] The discount rate was assumed to be 3.5% for the first 30 years of the working life, and then 3% thereafter in accordance with HMT 'The Green Book' guidance.

(ii) Results of the Cost-Benefit Analysis

a.) Main Results

Table 8 contains the results of the cost-benefit analysis described above. For each qualification and level being considered, three pieces of information are provided; the IRR (internal rate of return), the NPV (net present value, i.e. discounted future stream of benefits minus discounted future stream of costs) and the NPV per pound of state funding.

The results show very high benefits relative to costs for Modern Apprenticeships. This finding is a result of the very large wage benefits and employment benefits of these qualifications, as seen in Tables 1 and 5. Thus the estimated future stream of labour market benefits to former apprentices is far above the wages of individuals in the comparison groups (Level 2 or Levels 1 and 2 as appropriate). Therefore the future benefits far outweigh the costs incurred at the time of training, for any normal discount rate. The NPV of a Level 3 apprenticeship is estimated to be around £105,000, and that of a Level 2 apprenticeship around £73,000. The NPV per pound of state funding is around £17 and £16 respectively, and the IRR is 35% and 39% respectively. Clearly these are very large internal rates of return, way above any normal discount rate, but were inevitable given the scale of the benefits estimated in the earlier section of this report.

The results for the cost-benefit analysis of the other vocational qualifications are presented in the lower half of Table 8. These are in general smaller than the apprenticeship figures. The NVQ3 results are actually surprisingly quite high, since recall from the previous section that the wage return to such a qualification was just 2%. However, an NVQ3 was also associated with a 14 percentage point higher probability of employment. Even though only half of this employment effect is attributed to the NVQ3, it still creates a reasonably high NPV of around £34,000 and an IRR of 13%. Similarly, the NVQ2 qualification obtains an IRR of 9%, despite such qualifications having no positive effect on wages at all, because again a large association with employment was observed. The smallest figures in Table 8 are for the old VRQ qualifications at Level 2, for which the estimated NPV per pound spent is around £2, and the IRR is 7%.

b.) Sectoral Results

Table 9 contains similar results by sector. First we should consider the extent that conclusions can be drawn from the sectoral cost benefit analysis. The analysis by sector reveals wide variation in results, but, for the five sectors considered, there are clear positive benefits. In addition to the caveats for the sectoral wage returns estimates, the cost data are subject to small sample sizes and potentially large margins of error, so conclusions about the relative net benefits across sectors should not be drawn. However despite weaknesses in the data, there is an encouraging consistency in the magnitude of the net benefits calculated, for example all IRRs are at least 15%.

The results suggest the IRR is highest in the hospitality sector (118%). The IRR is estimated to be 54% in retail trade, 30% in construction and 18% in business administration. It is lowest at 15% for engineering. The highest NPV and NPV per pound of state funding are found in the construction sector, with the lowest NPV and NPV per pound spent is in retail trade.

The differing outcomes of the cost-benefit analysis across sectors are the result of differing wage returns to Modern Apprenticeships in the different sectors on the benefit side, and different employer and state costs on the cost side (in turn affected by the different durations of apprenticeships in the various sectors). Considering what is driving the sectoral results in Table 9, because the size of the wage benefits estimated in the earlier section are dominating the costs, then NPV is to a large extent determined by these wage benefits, and the ranking of sectors by NPV is almost the same as the ranking by wage returns. Thus, construction, which had by far the highest estimated wage returns, at 32%, has comfortably the highest NPV too, dwarfing that in any other sector. At the other end of the scale, the wage returns in retail were actually zero, and so this sector has the lowest NPV[37]. Also relevant are differences in the wages of the Level 2 comparison group in each sector. The more the comparison group earn, the greater will be the absolute difference between the wages of the former apprentices and the comparison group, for any given percentage wage returns (i.e. a 10% wage return on £200 per week is more in pounds and pence than a 10% return on £100 per week, for example). Thus, although the estimated wage returns are lower in engineering than in

[37] The fact that the NPV is positive at all in the retail sector is of course driven solely by the higher probability of being employed that is associated with apprenticeship.

hospitality (10% compared to 13%), the absolute value of the wage benefits in engineering, and hence its NPV, are significantly higher than in hospitality, because an individual qualified to Level 2 earns considerably more in engineering than in hospitality.

This is not to say that the cost side of the equation is irrelevant to the size of the NPV, however. For example, note that hospitality and business administration have very similar NPVs (£58,000 and £57,000 respectively), even though the estimated wage returns were 13% for hospitality and only 7% for business administration. The reason that business administration manages to achieve the same NPV as hospitality, despite these lower wage returns, is partly to higher average Level 2 wages in business administration, but also lower state and employer costs of apprenticeships in business administration.

Where the costs become much more important, however, is in the calculation of the IRR and the NPV per pound of state funding. Thus, when looking at construction, where the NPV is 3 times as large as the next highest sector, the NPV per pound spent is only twice as large. In terms of the IRR, construction, despite the huge NPV, actually has a lower IRR than both hospitality and retail (the latter of which had the lowest wage returns and NPV). The reason is the much higher costs, to both the employer and the state, in construction, as well as the longer duration which means a longer time elapses before a fully productive worker emerges, compared to any other sector bar engineering. Thus, even with a 32% wage return in construction, compared to a zero wage return in retail, the two IRRs are 30% in construction and 54% in retail, due to state costs in retail being only just over half of those in construction, the employer training costs in retail being under half those in construction costs, and the duration being only one year in retail compared to three years in construction. The impact of costs also make themselves felt in engineering, which has much higher employer and state costs than in any other sector, as well as the apprenticeship there being of the longest duration. The outcome is that the IRR in engineering is the smallest of all five sectors studied, and the NPV per pound spent the second lowest, despite engineering having the second highest NPV. The size of the costs is therefore clearly very important in determining the relative size of the IRRs across sectors.

The highest IRR, by some distance, is observed in hospitality, due to factors on both sides of the cost-benefit equation. Although much lower than in construction, the wage returns to apprenticeships in hospitality are the second largest of the five sectors considered, whilst on the cost side, the costs in hospitality are at the same low levels as observed in the other service sectors, comparing favourably to the costs incurred in engineering and construction. Both factors combine to produce the high IRR in hospitality.

c.) Sensitivity Checks

Finally, some additional tables in Appendix B show how sensitive the estimated results of the cost-benefit analysis are to changes in the assumptions of the model. In Tables B1 and B2, the state costs of funding the various qualifications are increased by 50% and 100% respectively. Since these costs are of course incurred in the first couple of years being considered, they are barely discounted, and so the impact on the NPV is to reduce it by approximately the same amount that costs have been assumed to increase. For very large NPVs, for example for the various apprenticeships, the effect is therefore barely noticed. However, when the NPV was only around £8,000 in the first place, as was the case for VRQ2 qualifications, the impact of doubling state funding costs is to reduce the NPV to around £4,000, i.e. to approximately halve it. The impact of doubling state funding costs is felt more by apprenticeships in terms of their IRRs. Since costs are much higher in the early period, the IRR is significantly reduced, for example from 35% to 28% with a 50% increase in state costs and to 23% with a 100% increase in state costs, for Level 3 Modern Apprenticeships (and from 39% to 29% and 24% respectively for Level 2 Modern Apprenticeships). The impacts on the much lower IRRs for the other vocational qualifications are much smaller. In terms of NPV per pound of state spending, these are of course significantly affected. Not only is the NPV reduced, but the amount of state spending is doubled, and so the NPV/£ figures in Table B2 must necessarily be less than half those in Table 8, for each qualification.

Next, we consider the possibility that the estimated wage returns to apprenticeship reflect both the beneficial effects of the apprenticeship itself *and* a higher innate ability of those selected to do an apprenticeship, because employers have a limited number of apprenticeship places, and so can choose who they want (presumably the most able) to fill those places. In Table B3 and B4, we therefore reduce the estimated wage returns

to the various apprenticeships to 75% and then 50% of their full value respectively. This is not done for the other vocational qualifications, however, because with no binding limit on places there is much less reason to suspect selection by ability. Since the wage returns are driving the high NPV to apprenticeships, as discussed above, reducing these wage returns does have a noticeable impact on their NPV values. For example, the NPV to a Level 3 Modern Apprenticeship is reduced from around £105,000 to £87,000 when only 75% of the estimated wage return is allocated to the apprenticeship itself, and to around £69,000 when only half of the estimated wage return is allocated to the apprenticeship itself (from around £73,000 to around £58,000 and £44,000 respectively for a Level 2 Modern Apprenticeship). Note that these NPV values at both Level 3 and Level 2 are still larger than the NPV to any other vocational qualification in Table 8, *when the latter are still allocated their full estimated wage returns.* Similarly, removing some of the wage effects of apprenticeships reduces their IRR values, but they still remain larger than those of the other vocational qualifications with full wage effects. In terms of NPV per pound of state funding, when the wage returns to apprenticeships are reduced to 75% of their estimated value, the NPV/£ is still higher for both Modern Apprenticeships than for any other vocational qualification. However, if only 50% of the estimated wage return to apprenticeships is allocated to them, then the NPV/£ falls to around £11 at Level 3 and around £10 at Level 2. This is slightly below the NPV/£ for an NVQ3 (with its full wage return) of around £12, but still higher than for any other vocational qualifications with their full wage effects.

Next, recall in the main results presented above, that the size of the impact of each qualification on the probability of being in employment was assumed to be 50% of the estimated association between each qualification and this probability as presented in Table 5. Tables B5 and B6 make different assumptions about this proportion of the employment effect actually attributable to the qualifications, specifically 75% and 25% respectively. Because the employment effects observed above were large, changes in this assumption do make quite large differences to the estimated results, as can be seen when comparing Tables B5 and B6 with the original results in Table 8. Thus, considering a Level 3 Modern Apprenticeship, the original NPV in Table 8 was around £105,000, but this increases to around £132,000 or falls to around £79,000 respectively when 75% and 25% of the observed employment effect is attributed to the apprenticeship, rather than the originally assumed 50%. The IRR also varies from a

high of 41% to a low of 29%, around the original result of 35%. The impact of varying this assumption is particularly large when the employment effect was the key component of the labour market benefits, as was the case for example for the NVQs. Looking at NVQ3, the original NPV was around £34,000 when 50% of the observed employment effect was attributed to the NVQ, which rises to around £54,000 when 75% of the observed employment effect is attributed to the NVQ, and falls to around £14,000 when only 25% of the observed employment effect is attributed to the NVQ.

Finally, in Table B7 we consider the total impact on the results of reducing the wage effect to 50% of its estimated value and increasing government funding costs by 50%, while keeping the employment effect at 50% of its estimated value as in the main results.[38] All of these factors have a negative impact on the results. Even when they are all considered together, however, the estimated NPV of a Level 3 Modern Apprenticeship is still around £66,000 (£7 per pound of state funding), while for a Level 2 Modern Apprenticeship it is around £42,000 (£6 per pound of state funding). The IRRs of Modern Apprenticeships under these assumptions are 21% and 20% at Levels 3 and 2 respectively. Thus, even when we significantly reduce the estimated benefits and increase the estimated costs, Modern Apprenticeships still appear to be a very cost-effective form of training.

[38] Table B7 only considers Modern Apprenticeships, as it was considered not appropriate to reduce the wage effects of the other vocational qualifications, as discussed above.

5. Conclusion

This study adds to the quite small UK literature on the benefits of apprenticeship, in a number of ways. Firstly, the study focuses on the more recent Modern Apprenticeships, rather than the traditional craft-based apprenticeships for which data have typically been available. The impact of this is that, for the first time in the literature, significant wage returns to apprenticeship are being observed for women, when Modern Apprenticeships are considered. Second, changes in the returns over time are considered. This analysis suggests that, over the ten year period considered, from 1996 to 2005, the wage returns to apprenticeships have been rising, particularly for Modern Apprenticeships. Thirdly, the returns are also compared to those observed for other vocational qualifications. Finally, and perhaps most importantly, cost information, to the individual, the employer and the state, is available, allowing the labour market returns to apprenticeship to be compared to such costs in a full cost-benefit analysis.

The limitations of the study should also be pointed out. On the benefit side of the cost-benefit analysis, it is unclear exactly how much of the large observed associations between apprenticeships (as well as the other vocational qualifications) and the likelihood of being in employment should actually be attributed to the qualifications themselves. With any research based on cross-section data, there is a worry that unobserved characteristics of individuals can be influencing the results, in this case making individuals more likely to pursue an apprenticeship *and* to be in employment. There is an additional worry in the present study, however, of reverse causality, in that those individuals already in employment are more likely to study for apprenticeships and other vocational qualifications in the first place. The sensitivity analysis presented above showed that the obtained results are quite sensitive to different assumptions about the proportion of the observed employment effects to be actually attributed to the various qualifications. Similarly, there is a suspicion that the high wage returns observed to apprenticeships are partly driven by the fact that, given limited apprenticeship places, firms can pick the most able applicants to fill these places, and so former apprentices have an above average ability and are accordingly paid more. This

is less likely to be the case for the other vocational qualifications considered, given that there is no binding constraint on the number of places available for these qualifications.

On the costs side of the analysis, the main worry is about the employer cost information used, as it based upon case study evidence of a limited number of firms, which might not be representative of all firms. This places an additional constraint on the ability to draw conclusions from the sectoral cost benefit analysis. In the absence of any other information on employer costs, however, this was all that could be done.

These limitations notwithstanding, the results presented above suggest a very large value being put on apprenticeships in the modern UK economy. Whether measured by net present value, net present value per pound of state funding or the internal rate of return, the value of Modern Apprenticeships is estimated to be significantly above that of other vocational qualifications such as NVQs, BTEC and City and Guilds. The driving force of these high discounted net present values is the high wage and employment effects of Modern Apprenticeships, observed in the benefits section of this report. It would appear that former apprentices earn considerably more than their peers who remain at best at Level 2. These wage benefits, as an indicator of the future productivity of apprentices, dwarf any costs incurred by the state and employers. In addition, employer training and supervisory costs are offset by the value of the output produced by apprentices. When these low costs are set against the very high estimated wage returns obtained above, it is not surprising that the cost-benefit analyses produce the high figures that they do. Even when only half of the estimated wage returns and employment effects are allocated to apprenticeships (because of the worries that the returns are partly reflecting higher natural ability), and when state costs are simultaneously increased by 50%, the net present value of apprenticeships at Level 2 or 3 are still larger than for any other vocational qualification with its full wage effect.

Thus apprenticeship certainly appears to add value, and be cost-effective. While these net benefits may not be quite so large if apprenticeships were less selective and undertaken by a larger and wider cross-section of young people, the evidence presented here certainly suggests that there is room for expansion of apprenticeship beyond its current availability.

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Table 1: Estimated Wage Return Coefficients for Vocational Qualifications at Levels 2 and 3 in 2004/2005

	Male	Female
Recognised Apprenticeship[a]	0.079***	-0.040*
	(0.010)	(0.023)
Recognised Apprenticeship[a]	0.066***	-0.059**
	(0.011)	(0.027)
Recognised Apprenticeship*nvq3[a]	0.094***	0.080*
	(0.020)	(0.043)
Recognised Apprenticeship[b]	0.074***	-0.072**
	(0.010)	(0.031)
Recognised Apprenticeship*nvq2[b]	0.038	0.156***
	(0.034)	(0.049)
Advanced Modern Apprenticeship[a]	0.202***	0.133**
	(0.039)	(0.066)
Foundation Modern Apprenticeship[b]	0.181***	0.038
	(0.038)	(0.066)
NVQ3[a]	0.057***	-0.018
	(0.014)	(0.014)
NVQ2[b]	-0.073***	-0.068***
	(0.013)	(0.014)
VRQ3[a]	0.071***	0.062***
	(0.011)	(0.020)
VRQ2[b]	0.019	0.049
	(0.024)	(0.030)

The table contains the coefficients from the estimated wage equations. The actual wage return is calculated as $e^{\beta} - 1$, where β is the estimated coefficient in the table above.

*** significant at 1% level. ** significant at 5% level. * significant at 10% level.

a = relative to Level 2, b=relative to Levels 1 and 2.

Table 2: Estimated Wage Return Coefficients for Vocational Qualifications at Levels 2 and 3 in 2004/2005, for Those Aged Under 26

	Male	Female
Recognised Apprenticeship[a]	0.205*** (0.027)	0.076** (0.033)
Recognised Apprenticeship[a] Recognised Apprenticeship*nvq3[a]	0.167*** (0.033) 0.075* (0.043)	0.042 (0.046) 0.077 (0.064)
Recognised Apprenticeship[b] Recognised Apprenticeship*nvq2[b]	0.170*** (0.037) -0.012 (0.067)	0.015 (0.087) 0.040 (0.102)
Advanced Modern Apprenticeship[a]	0.207*** (0.048)	0.196** (0.055)
Foundation Modern Apprenticeship[b]	0.202*** (0.047)	0.019 (0.071)
NVQ3[a]	0.146*** (0.029)	0.046* (0.025)
NVQ2[b]	-0.026 (0.024)	-0.004 (0.031)
VRQ3[a]	0.076* (0.039)	-0.041 (0.049)
VRQ2[b]	0.035 (0.060)	0.043 (0.075)

The table contains the coefficients from the estimated wage equations. The actual wage return is calculated as $e^{\beta} - 1$, where β is the estimated coefficient in the table above.
*** significant at 1% level. ** significant at 5% level. * significant at 10% level.
a = relative to Level 2, b=relative to Levels 1 and 2.

Table 3: Changes in the Wage Return Coefficients for Recognised Apprenticeships and Modern Apprenticeships Over Time, 1996-2005

	Male		Female	
	Recognised Apprent.	Modern Apprent.	Recognised Apprent.	Modern Apprent.
1996	0.059*** (0.015)	0.048 (0.049)	0.013 (0.030)	0.109 (0.086)
1997	0.057*** (0.011)	0.076** (0.039)	-0.049** (0.023)	-0.030 (0.065)
1998	0.049*** (0.011)	0.083** (0.040)	-0.048** (0.024)	-0.017 (0.074)
1999	0.065*** (0.012)	0.105** (0.042)	-0.031 (0.025)	-0.008 (0.047)
2000	0.065*** (0.012)	0.099*** (0.027)	-0.053** (0.025)	-0.028 (0.043)
2001	0.053*** (0.011)	0.101*** (0.029)	-0.047** (0.022)	-0.040 (0.041)
2002	0.072*** (0.011)	0.144*** (0.023)	-0.083*** (0.023)	-0.046 (0.049)
2003	0.080*** (0.012)	0.121*** (0.029)	-0.036 (0.025)	0.058 (0.056)
2004	0.073*** (0.013)	0.175*** (0.032)	-0.016 (0.024)	0.045 (0.048)
2005	0.095*** (0.012)	0.189*** (0.030)	-0.007 (0.030)	0.066* (0.039)

The table contains the coefficients from the estimated wage equations. The actual wage return is calculated as $e^{\beta} - 1$, where β is the estimated coefficient in the table above.
*** significant at 1% level. ** significant at 5% level. * significant at 10% level.
All coefficients are estimated relative to a group whose highest qualification is at Level 2.

Table 4: Estimated Wage Return Coefficients Using the Pooled Data Set, 1996-2005

	Male		Female	
	Recognised Apprent.	Modern Apprent.	Recognised Apprent.	Modern Apprent.
All sectors	0.056*** (0.006)	0.162*** (0.017)	-0.063*** (0.013)	0.045 (0.033)
Food manufacture	0.062* (0.035)	0.178 (0.123)		
Printing	0.083** (0.041)	0.034 (0.087)	-0.092 (0.078)	0.425** (0.213)
Chemicals	0.047 (0.045)			
Basic metal manufacture	0.099** (0.041)			
Fabricated metals	0.167*** (0.032)			
Machinery manufacture	0.131*** (0.026)	0.231*** (0.052)		
Motor vehicle manufacture	0.042 (0.029)			
Furniture manufacture	0.016 (0.046)			
Construction	0.097*** (0.018)	0.291*** (0.038)		
Sale of cars	0.093*** (0.027)		0.093 (0.114)	0.196 (0.212)
Wholesale trade	-0.001 (0.032)	-0.157* (0.092)	-0.099 (0.077)	-0.093 (0.111)
Retail trade	0.004 (0.028)	0.143* (0.079)	-0.065* (0.037)	-0.193** (0.180)
Hotels and restaurants	0.068* (0.041)	0.116 (0.118)	-0.069 (0.053)	0.173 (0.208)
Post and telecoms	0.032 (0.028)		-0.121 (0.114)	-0.021 (0.175)
Real estate	0.058 (0.064)		0.056 (0.128)	0.227 (0.144)
Computer activities	-0.121* (0.070)	-0.177* (0.106)		
Other business	-0.020 (0.036)	-0.052 (0.074)	-0.085 (0.057)	0.235** (0.103)
Public admin	-0.024 (0.021)	-0.088 (0.135)	-0.036 (0.037)	0.034 (0.121)
Education	0.029 (0.049)		-0.041 (0.052)	0.211 (0.200)
Health	-0.035 (0.034)	0.016 (0.124)	-0.046* (0.028)	0.025 (0.071)
Recreation		0.351** (0.156)		
Engineers	0.049* (0.029)	0.149 (0.121)		
Business admin.	0.079 (0.091)	-0.213 (0.132)	-0.056 (0.051)	0.172 (0.117)

The table contains the coefficients from the estimated wage equations. The actual wage return is calculated as $e^{\beta} - 1$, where β is the estimated coefficient in the table above.

*** significant at 1% level. ** significant at 5% level. * significant at 10% level.

All coefficients are estimated relative to a group whose highest qualification is at Level 2.

Where an element of the table if left blank, there were insufficient observations to obtain reliable estimates.

The shaded areas of the table show the sectors considered in the sectoral cost-benefit analysis of apprenticeships.

Table 5: Marginal Effect on the Likelihood of Full-Time Employment of Vocational Qualifications at Levels 2 and 3 in 2004/2005

	Male	Female
Recognised Apprenticeship[a]	0.060***	0.005
	(0.006)	(0.014)
Recognised Apprenticeship[a]	0.052***	-0.029**
	(0.007)	(0.015)
Recognised Apprenticeship*nvq3[a]	0.093***	0.239***
	(0.014)	(0.035)
Recognised Apprenticeship[b]	0.063***	-0.019
	(0.006)	(0.015)
Recognised Apprenticeship*nvq2[b]	-0.051*	0.026
	(0.032)	(0.038)
Advanced Modern Apprenticeship[a]	0.101***	0.162***
	(0.021)	(0.055)
Foundation Modern Apprenticeship[b]	0.046*	0.064
	(0.026)	(0.049)
NVQ3[a]	0.087***	0.154***
	(0.009)	(0.011)
NVQ2[b]	0.030***	0.085***
	(0.010)	(0.010)
VRQ3[a]	0.060***	0.049***
	(0.008)	(0.014)
VRQ2[b]	0.026	0.029
	(0.017)	(0.022)

*** significant at 1% level. ** significant at 5% level. * significant at 10% level.
a = relative to Level 2, b=relative to Levels 1 and 2.

Table 6: Marginal Effect on the Likelihood of Full-Time Employment of Vocational Qualifications at Levels 2 and 3 in 2004/2005, for Those Aged Under 26

	Male	Female
Recognised Apprenticeship[a]	0.154***	0.174***
	(0.017)	(0.034)
Recognised Apprenticeship[a]	0.143***	0.158***
	(0.021)	(0.042)
Recognised Apprenticeship*nvq3[a]	0.045	0.049
	(0.043)	(0.076)
Recognised Apprenticeship[b]	0.173***	0.311***
	(0.024)	(0.057)
Recognised Apprenticeship*nvq2[b]	-0.110	-0.236***
	(0.086)	(0.079)
Advanced Modern Apprenticeship[a]	0.178***	0.187**
	(0.023)	(0.071)
Foundation Modern Apprenticeship[b]	0.134***	0.094
	(0.040)	(0.066)
NVQ3[a]	0.115***	0.108***
	(0.021)	(0.025)
NVQ2[b]	0.037*	0.066***
	(0.021)	(0.021)
VRQ3[a]	0.032	0.079*
	(0.030)	(0.042)
VRQ2[b]	0.003	0.094
	(0.055)	(0.069)

*** significant at 1% level. ** significant at 5% level. * significant at 10% level.
a = relative to Level 2, b=relative to Levels 1 and 2.

Table 7: Changes in the Marginal Effect on the Likelihood of Full-Time Employment of Recognised Apprenticeships and Modern Apprenticeships Over Time, 1996-2005

	Male		Female	
	Recognised Apprenticeship	Modern Apprenticeship	Recognised Apprenticeship	Modern Apprenticeship
1996	0.044*** (0.007)	0.078*** (0.020)	-0.012 (0.013)	0.078 (0.052)
1997	0.051*** (0.007)	0.114*** (0.019)	-0.019 (0.013)	0.172*** (0.054)
1998	0.049*** (0.007)	0.081*** (0.019)	-0.033** (0.013)	0.106** (0.051)
1999	0.046*** (0.007)	0.088*** (0.018)	-0.011 (0.014)	0.178*** (0.043)
2000	0.060*** (0.007)	0.102*** (0.016)	-0.009 (0.014)	0.168*** (0.039)
2001	0.051*** (0.007)	0.095*** (0.016)	-0.010 (0.015)	0.093** (0.042)
2002	0.064*** (0.007)	0.114*** (0.015)	0.003 (0.015)	0.151*** (0.042)
2003	0.057*** (0.008)	0.109*** (0.016)	0.009 (0.016)	0.131*** (0.042)
2004	0.056*** (0.008)	0.072*** (0.021)	0.035** (0.017)	0.165*** (0.043)
2005	0.056*** (0.008)	0.131*** (0.015)	0.004 (0.017)	0.216*** (0.039)

*** significant at 1% level. ** significant at 5% level. * significant at 10% level.
All marginal effects are estimated relative to a group whose highest qualification is at Level 2.

Table 8: Cost-Benefit Analysis of Vocational Qualifications at Levels 2 and 3 in 2004/2005

	IRR	NPV	NPV/DfES £
Advanced Modern Apprenticeship[a]	35%	£105,190	£17.12
Foundation Modern Apprenticeship[b]	39%	£73,001	£16.22
NVQ3[a]	13%	£33,894	£11.55
NVQ2[b]	9%	£13,012	£4.20
VRQ3[a]	9%	£29,781	£3.29
VRQ2[b]	7%	£8,049	£2.18

a = relative to Level 2, b=relative to Levels 1 and 2.

Table 9: Cost-Benefit Analysis of Modern Apprenticeships by Sector 1996-2005

	IRR	NPV	NPV/DfES £
Construction	30%	£156,523	£27.41
Engineering	15%	£78,351	£11.56
Hospitality	118%	£57,994	£14.78
Business Administration	18%	£56,765	£15.32
Retail and customer service	54%	£31,928	£8.80

Appendix A: Wage Return Coefficients for Males and Females Combined

Table A1: Estimated Wage Return Coefficients for Vocational Qualifications at Levels 2 and 3 in 2004/2005

Recognised Apprenticeship[a]	0.072*** (0.009)
Recognised Apprenticeship[a] Recognised Apprenticeship*nvq3[a]	0.063*** (0.010) 0.060*** (0.018)
Recognised Apprenticeship[b] Recognised Apprenticeship*nvq2[b]	0.076*** (0.010) 0.028 (0.027)
Advanced Modern Apprenticeship[a]	0.163*** (0.034)
Foundation Modern Apprenticeship[b]	0.145*** (0.032)
NVQ3[a]	0.019* (0.010)
NVQ2[b]	-0.068*** (0.010)
VRQ3[a]	0.085*** (0.010)
VRQ2[b]	0.030 (0.019)

The table contains the coefficients from the estimated wage equations. The actual wage return is calculated as $e^{\beta} - 1$, where β is the estimated coefficient in the table above.
*** significant at 1% level. ** significant at 5% level. * significant at 10% level.
a = relative to Level 2, b=relative to Levels 1 and 2.

Table A2: Estimated Wage Return Coefficients for Vocational Qualifications at Levels 2 and 3 in 2004/2005, for Those Aged Under 26

Recognised Apprenticeship[a]	0.167*** (0.020)
Recognised Apprenticeship[a] Recognised Apprenticeship*nvq3[a]	0.125*** (0.027) 0.085** (0.036)
Recognised Apprenticeship[b] Recognised Apprenticeship*nvq2[b]	0.130*** (0.035) -0.013 (0.053)
Advanced Modern Apprenticeship[a]	0.207*** (0.038)
Foundation Modern Apprenticeship[b]	0.143*** (0.040)
NVQ3[a]	0.097*** (0.019)
NVQ2[b]	-0.016 (0.019)
VRQ3[a]	0.038 (0.031)
VRQ2[b]	0.035 (0.046)

The table contains the coefficients from the estimated wage equations. The actual wage return is calculated as $e^{\beta} - 1$, where β is the estimated coefficient in the table above.
*** significant at 1% level. ** significant at 5% level. * significant at 10% level.
a = relative to Level 2, b=relative to Levels 1 and 2.

Table A3: Changes in the Wage Return Coefficients for Recognised Apprenticeships and Modern Apprenticeships Over Time, 1996-2005

	Recognised Apprenticeship	Modern Apprenticeship
1996	0.065*** (0.013)	0.068 (0.043)
1997	0.051*** (0.010)	0.045 (0.033)
1998	0.046*** (0.010)	0.063* (0.035)
1999	0.063*** (0.011)	0.072** (0.035)
2000	0.056*** (0.011)	0.053** (0.023)
2001	0.054*** (0.010)	0.065*** (0.024)
2002	0.054*** (0.010)	0.092*** (0.021)
2003	0.069*** (0.011)	0.102*** (0.025)
2004	0.068*** (0.012)	0.129*** (0.027)
2005	0.092*** (0.011)	0.152*** (0.023)

The table contains the coefficients from the estimated wage equations. The actual wage return is calculated as $e^{\beta} - 1$, where β is the estimated coefficient in the table above.
*** significant at 1% level. ** significant at 5% level. * significant at 10% level.
All coefficients are estimated relative to a group whose highest qualification is at Level 2.

Table A4: Estimated Wage Return Coefficients Using the Pooled Data Set, 1996-2005

	Recognised Apprenticeship	Modern Apprenticeship
All sectors	0.050*** (0.005)	0.127*** (0.015)
Food manufacture	0.059* (0.032)	0.144 (0.114)
Printing	0.059* (0.036)	0.082 (0.091)
Chemicals	0.062 (0.041)	0.099 (0.137)
Basic metal manufacture	0.112*** (0.040)	
Fabricated metals	0.166*** (0.031)	0.165** (0.065)
Machinery manufacture	0.125*** (0.026)	0.240*** (0.053)
Motor vehicle manufacture	0.040 (0.028)	
Furniture manufacture	0.014 (0.040)	
Construction	0.097*** (0.018)	0.280*** (0.038)
Sale of cars	0.102*** (0.026)	0.281*** (0.044)
Wholesale trade	-0.002 (0.030)	-0.145* (0.081)
Retail trade	0.003 (0.022)	-0.001 (0.058)
Hotels and restaurants	0.043 (0.032)	0.119 (0.092)
Post and telecoms	0.024 (0.027)	-0.034 (0.086)
Real estate	0.073 (0.056)	0.382*** (0.107)
Computer activities	-0.093 (0.063)	-0.094 (0.087)
Other business	-0.036 (0.030)	-0.080 (0.094)
Public admin	-0.019 (0.018)	-0.055 (0.105)
Education	0.002 (0.035)	0.232 (0.163)
Health	-0.024 (0.021)	0.047 (0.065)
Recreation	0.097** (0.048)	0.319*** (0.123)
Engineers	0.046* (0.028)	0.094 (0.115)
Business admin	-0.025 (0.045)	0.064 (0.111)

The table contains the coefficients from the estimated wage equations. The actual wage return is calculated as $e^{\beta} - 1$, where β is the estimated coefficient in the table above.
*** significant at 1% level. ** significant at 5% level. * significant at 10% level.
All coefficients are estimated relative to a group whose highest qualification is at Level 2.
Where an element of the table if left blank, there were insufficient observations to obtain reliable estimates.
The shaded areas of the table show the coefficients used in the sectoral cost-benefit analysis of apprenticeships.

Table A5: Marginal Effect on the Likelihood of Full-Time Employment of Vocational Qualifications at Levels 2 and 3 in 2004/2005

Recognised Apprenticeship[a]	0.059*** (0.007)
Recognised Apprenticeship[a] Recognised Apprenticeship*nvq3[a]	0.043*** (0.007) 0.156*** (0.017)
Recognised Apprenticeship[b] Recognised Apprenticeship*nvq2[b]	0.055*** (0.007) -0.048* (0.027)
Advanced Modern Apprenticeship[a]	0.157*** (0.028)
Foundation Modern Apprenticeship[b]	0.074** (0.031)
NVQ3[a]	0.137*** (0.008)
NVQ2[b]	0.075*** (0.008)
VRQ3[a]	0.072*** (0.008)
VRQ2[b]	0.029* (0.016)

*** significant at 1% level. ** significant at 5% level. * significant at 10% level.
a = relative to Level 2, b=relative to Levels 1 and 2.

Table A6: Marginal Effect on the Likelihood of Full-Time Employment of Vocational Qualifications at Levels 2 and 3 in 2004/2005, for Those Aged Under 26

Recognised Apprenticeship[a]	0.188*** (0.017)
Recognised Apprenticeship[a] Recognised Apprenticeship*nvq3[a]	0.172*** (0.021) 0.057 (0.041)
Recognised Apprenticeship[b] Recognised Apprenticeship*nvq2[b]	0.248*** (0.026) -0.191*** (0.063)
Advanced Modern Apprenticeship[a]	0.207*** (0.031)
Foundation Modern Apprenticeship[b]	0.135*** (0.039)
NVQ3[a]	0.116*** (0.017)
NVQ2[b]	0.052*** (0.015)
VRQ3[a]	0.055** (0.026)
VRQ2[b]	0.045 (0.044)

*** significant at 1% level. ** significant at 5% level. * significant at 10% level.
a = relative to Level 2, b=relative to Levels 1 and 2.

Table A7: Changes in the Marginal Effect on the Likelihood of Full-Time Employment of Recognised Apprenticeships and Modern Apprenticeships Over Time, 1996-2005

	Recognised Apprenticeship	Modern Apprenticeship
1996	0.041*** (0.007)	0.111*** (0.024)
1997	0.043*** (0.007)	0.166*** (0.026)
1998	0.036*** (0.007)	0.115*** (0.025)
1999	0.040*** (0.007)	0.145*** (0.023)
2000	0.051*** (0.008)	0.152*** (0.021)
2001	0.047*** (0.008)	0.133*** (0.021)
2002	0.062*** (0.008)	0.173*** (0.020)
2003	0.058*** (0.008)	0.157*** (0.021)
2004	0.065*** (0.009)	0.136*** (0.025)
2005	0.053*** (0.009)	0.203*** (0.021)

*** significant at 1% level. ** significant at 5% level. * significant at 10% level.
All marginal effects are estimated relative to a group whose highest qualification is at Level 2.

Appendix B: Sensitivity Checks For Cost-Benefit Analysis Results

Table B1: Cost-Benefit Analysis of Vocational Qualifications at Levels 2 and 3 in 2004/2005: Increase Government Costs by 50%

	IRR	NPV	NPV/DfES £
Advanced Modern Apprenticeship[a]	28%	£102,118	£11.08
Foundation Modern Apprenticeship[b]	29%	£70,750	£10.48
NVQ3[a]	12%	£32,427	£7.37
NVQ2[b]	8%	£11,465	£2.47
VRQ3[a]	7%	£25,251	£1.86
VRQ2[b]	6%	£6,199	£1.12

a = relative to Level 2, b=relative to Levels 1 and 2.

Table B2: Cost-Benefit Analysis of Vocational Qualifications at Levels 2 and 3 in 2004/2005: Increase Government Costs by 100%

	IRR	NPV	NPV/DfES £
Advanced Modern Apprenticeship[a]	23%	£99,046	£8.06
Foundation Modern Apprenticeship[b]	24%	£68,501	£7.61
NVQ3[a]	11%	£30,961	£5.28
NVQ2[b]	7%	£9,917	£1.60
VRQ3[a]	6%	£20,724	£1.14
VRQ2[b]	5%	£4,350	£0.59

a = relative to Level 2, b=relative to Levels 1 and 2.

Table B3: Cost-Benefit Analysis of Vocational Qualifications at Levels 2 and 3 in 2004/2005: Reduce Wage Effects to 75%

	IRR	NPV	NPV/DfES £
Advanced Modern Apprenticeship[a]	31%	£86,951	£14.15
Foundation Modern Apprenticeship[b]	33%	£58,131	£12.91

a = relative to Level 2, b=relative to Levels 1 and 2.

Table B4: Cost-Benefit Analysis of Vocational Qualifications at Levels 2 and 3 in 2004/2005: Reduce Wage Effects to 50%

	IRR	NPV	NPV/DfES £
Advanced Modern Apprenticeship[a]	26%	£69,442	£11.30
Foundation Modern Apprenticeship[b]	27%	£43,791	£9.73

a = relative to Level 2, b=relative to Levels 1 and 2.

Table B5: Cost-Benefit Analysis of Vocational Qualifications at Levels 2 and 3 in 2004/2005: Increase Employment Effects to 75%

	IRR	NPV	NPV/DfES £
Advanced Modern Apprenticeship[a]	41%	£131,547	£21.41
Foundation Modern Apprenticeship[b]	44%	£85,627	£19.02
NVQ3[a]	17%	£53,801	£18.34
NVQ2[b]	12%	£24,082	£7.78
VRQ3[a]	10%	£40,957	£4.52
VRQ2[b]	8%	£12,460	£3.37

a = relative to Level 2, b=relative to Levels 1 and 2.

Table B6: Cost-Benefit Analysis of Vocational Qualifications at Levels 2 and 3 in 2004/2005: Reduce Employment Effects to 25%

	IRR	NPV	NPV/DfES £
Advanced Modern Apprenticeship[a]	29%	£78,834	£12.83
Foundation Modern Apprenticeship[b]	34%	£60,375	£13.41
NVQ3[a]	8%	£13,988	£4.77
NVQ2[b]	5%	£1,943	£0.63
VRQ3[a]	7%	£18,606	£2.05
VRQ2[b]	5%	£3,369	£0.98

a = relative to Level 2, b=relative to Levels 1 and 2.

Table B7: Cost-Benefit Analysis of Vocational Qualifications at Levels 2 and 3 in 2004/2005: Reduce Wage Effects to 50%, Employment Effects at 50%, and Increase Government Costs by 50%

	IRR	NPV	NPV/DfES £
Advanced Modern Apprenticeship[a]	21%	£66,369	£7.20
Foundation Modern Apprenticeship[b]	20%	£41,539	£6.15

a = relative to Level 2, b=relative to Levels 1 and 2.

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