Measuring the Earnings Returns to Lifelong Learning in the UK¹

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Abstract: This paper examines the earnings returns to learning that takes place following the conventional ‘school-to-work’ stage of the life-course. We operationalise such ‘lifelong learning’ as the attainment of certified qualifications in adulthood, following the completion of the first period of continuous full-time education. Using data from the British Household Panel Survey (BHPS) for the period 1991-2006, our approach and findings represent an important addition to the existing evidence base. By using annual data, we are able to employ the fixed effects estimator, which eliminates the problem of time-invariant unobserved heterogeneity. Our dynamic specification uses a lag structure to consider how earnings returns evolve in the medium and longer run, while also controlling for wage trends which were evident *prior* to qualification attainment. Our results show a medium-run return for women of 10% on hourly wages. For men, initial suggestions of a similar positive return are eliminated once pre-qualification trends are taken into account. This suggests that adult learning has a causal effect on women’s subsequent earnings but, for men, any apparent gain is due to selection.

JEL Codes: I20, I21, J24

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1. Introduction

Economists have traditionally viewed educational investment as occurring in a discrete stage prior to entry into the labour market (Becker 1964). However, recent academic and policy debate has emphasised the importance of learning which continues throughout an individuals' working life, and possibly beyond (Schuller and Watson, 2009, Department for Business Innovation and Skills, 2009). The rationale for this focus on what has come to be referred to as 'lifelong learning' rests on the benefits that education and training in later life are argued to provide for both the individual and for society. For individuals, it is contended that the accumulation of human capital through education and training will yield economic returns, even in later adulthood (Department for Education and Employment, 1998). At the societal level, it is argued that a highly skilled and well-trained workforce is essential for achieving competitiveness in global markets and for enabling the transition to a knowledge-based economy (Leitch, 2006). Yet, despite the widespread currency of the notion that education and training will yield financial pay-offs to learners in later adulthood, the existing empirical evidence in support of this idea is, at best, mixed.

Lifelong learning, in its broadest sense, refers to the accumulation of knowledge and skills throughout a person's life, particularly beyond early adulthood (Fauré, 1972). For the purposes of this study we adopt a narrower definition based on 'certified learning' and consider qualifications obtained in adulthood, following the cessation of the first period of continuous full-time education. We do this for two primary reasons. The first is pragmatic; while it is extremely difficult to operationalise lifelong learning of an informal and nature (Field, 2006) an individual's qualification attainment can be measured. The second is a desire for our findings to connect directly with the educational policy context which has seen a growing emphasis on the importance of lifelong learning in countries throughout the worlds (OECD, 2007). In the UK, for example, recent Government policy was based on explicit targets for the number and level of qualifications to be achieved at a population level (HM Treasury 2007). It is of particular importance, therefore, to understand the economic returns to qualifications obtained by

adults, during a period in which accredited adult learning was prioritised and subsidised by the government.

Although the specific policy context for our research is the United Kingdom, this paper also speaks to the literature on the returns to human capital accumulation after the end of completed schooling, following papers in this tradition by Ashenfelter and Card (1985), Lynch (1991), Kane and Rouse (1995), Loewenstein and Spletzer (1999) and Heckman and Smith (1999). As we shall see, internationally, the evidence on the returns to human capital accumulation later in the life-course shows a positive effect with regard to earnings, although this varies depending on the specific learning that is undertaken. In the UK, the evidence is considerably less robust and a key contribution of this paper is to add clarity to the current mixed picture (Jenkins *et al.*, 2003; DeCoulon and Vignoles, 2007 and very recently Dorsett *et al.*, 2010). Our empirical analysis makes use of rich panel data, which measures earnings and qualification attainment at the individual level annually, over a 16 year period from 1991 to 2006. Applied economists have long been concerned about the biasing effect of unmeasured ability in the assessment of the returns to education (Griliches, 1977). The structure and sequencing of our data allows us to implement a considerably more robust defence against unobserved confounders than has been evident to date (see Harmon *et al.*, 2003: 146).

The remainder of the paper is structured as follows. In the next section we describe the system of schooling and qualification attainment in the UK during the period covered by our analysis and we review the existing empirical literature on earnings returns to adult learning. Section 3 provides detail of the data and key measures to be used in our analysis, while Section 4 describes our modelling and identification strategy. Section 5 presents our primary results and we conclude with a consideration of the implications and limitations of our findings for our understanding of the economic benefits of lifelong learning.

2. Background

2.1 The Policy Context: Education and Qualifications in the UK 1991-2006

Lifelong learning in this paper is concerned with the acquisition of both academic and vocational qualifications in a single country over a relatively long period of time. It is, therefore, necessary to provide a brief account of the policy context in which these qualifications were attained and a description of the sorts of skills and knowledge they were intended to accredit. The majority of UK academic qualifications are obtained as part of the initial progression through the education system, although they can be taken by anyone, at any time (for a fee). The first external examinations are the General Certificate of School Education exams (GCSEs) which are taken at the end of compulsory schooling, usually at age 16. Students are regarded as successful at this stage if they obtain five or more GCSEs at grades A-C. Currently 75% of the age cohort achieves this milestone, and they are described as qualified at National Qualifications Framework (NQF)² Level 2. Those who obtain GCSEs below this level are qualified at NQF Level 1. If students proceed to achieve A levels, which generally takes two further years, they are qualified at Level 3. Upon completion of A levels, students can opt to undertake degree level study, an option taken up by around 40% of the cohort in recent years (see Blanden and Machin, 2004, for a discussion of trends in University participation). Undergraduate degrees generally take three years to complete in England and Wales, while Scottish degrees take four years. Undergraduate degrees are classified as NQF level 4 and postgraduate qualification is categorised as NQF level 5. A levels and degrees are all available to adult learners through participation at colleges and universities, either on a part-time or a full-time basis.

The UK vocational qualifications system is very complex and diverse, with approximately 100,000 registered qualifications currently available.³ Of particular interest are National Vocational Qualifications. These are generally assessed through a portfolio of evidence and are mainly awarded at NFQ levels 1-3. Consequently, delivery approaches for these qualifications are diverse. They can be

² The NQF has now been replaced in 2010 by the Qualifications and Credit Framework which includes 8 levels of qualification. For interest, we have included some details from the new framework, including the exemplar learning time in the classification in Table 1.

³ The Register of Regulated Qualification (April 2011)

undertaken full-time or part-time and with or without college support. There is a large number of subjects available, with 1288 separate NVQs offered in 2003 (UK Department for Education and Skills, 2003). Many employers now require employees to hold particular NVQs, for example in health and safety, or in the use of specialist equipment, and we suspect that these will comprise a large part of the lifelong learning that we observe. Vocational qualifications can also be divided into the five NQF levels, which enables a simplification of the entire system and a rough approximation between academic and vocational qualifications. A summary of how this mapping works, with some examples, is provided in Table A1 in the Appendix.

As we noted earlier, the UK Government increasingly promoted adult attainment of qualifications from the late 1990s onward. For example, the 2001 'Skills for Life' initiative aimed to increase the qualifications of the lowest skilled, with a target of 2.25 million individuals obtaining a new qualification by 2010. Similarly, the Public Services Agreement Skills Target (HM Treasury, 2007) sets out a policy of educating 95% of all adults to level 1 standard, 90% to at least level 2, 68% to level 3 and 40% to level 4 and above by 2020. From 2003, students who did not already have a qualification at Level 2 were eligible to receive government funding to cover the fees on courses which would take them over this threshold.

The diversity of possible qualifications means that it is difficult to generalise about the costs which might be faced by individuals in obtaining them. Even for the same type of qualification, for example NVQ level 2, the cost will depend on the subject and the mode of delivery. Indeed, for many potential students, fee costs would be met by government subsidy. For other qualifications, direct and opportunity costs will sometimes be quite substantial, such as for a university degree. However, although we can be confident that a degree is a more costly undertaking than an NVQ level 1 qualification, no information is available regarding the actual costs, either in the survey data or from official administrative sources.

2.2 Theoretical Framework

The usual model of human capital accumulation is based on the idea that individuals make choices about initial education on the basis of their individual-specific costs and benefits (Mincer, 1974). In general these factors are considered fixed and are commonly captured by terms like 'ability'. Panel data methods are not suitable to resolve this omitted variable bias as earnings cannot be observed before education has taken place. As noted in the introduction, the investigation of the impact of adult qualifications does permit the use of panel data, but in this setup the nature of the choice being made has changed.

The seminal model of human capital accumulation (Becker, 1964 and Ben-Porath, 1967) explicitly focus on human capital accumulation that occurs in early-career for two reasons: first, because foregone earnings are lower at this point; and second, because early investment maximises the time available to enjoy wage returns. Therefore, qualifications which are obtained later in life must be considered in the light of an alternative model. As we have seen, qualifications are available to adults at any time, and the decision to take part in a given year must be a consequence of an increase in the present value of the qualification compared to last year. However, this economic model need not imply an earnings return to qualifications, as the benefits to the individual might be broader than this (see Feinstein and Hammond, 2004, among others for work on the wider benefits of learning).

An increase in an individual's expected present value can occur for two reasons, either because the perceived benefits have increased, or the perceived costs have fallen. Unanticipated changes in job characteristics are likely to be important, with new opportunities or an increased focus on accreditation in the firm being likely to increase the value of qualifications. Changes in personal circumstances will also likely play a role, with marriage or divorce changing the opportunities for career change or advancement. Costs are also likely to change through time, with family commitments altering the amount of time an individual can devote to study. As we have seen, government policy can also

change the financial cost of studying, for example, through the provision of subsidies for first qualifications at a given Level.

One obvious approach to dealing with the endogeneity of the qualification decision is to attempt to control for as many of these time-varying characteristics as possible. However, we must be aware that unobservables will also have a role and that the factors that influence learning decisions might be positively or negatively associated with the earnings trajectory. For example, an individual may obtain a qualification as part of a drive towards promotion, or alternatively as a defensive measure if their firm's fortunes are waning. A priori, the direction of the bias is unclear. We believe that our preferred estimation specification gives us the best chance of effectively dealing with biases which come from time-varying heterogeneity. More details are supplied in our methodology section.

2.3 Existing evidence on returns to lifelong learning

Studies which have examined returns to education in later adulthood can be divided into three distinct categories. The first is the programme evaluation literature, which aims to determine the extent to which government sponsored job training programmes (also called active labour market programmes) increase the probability of future employment, or of better wages for participants (Heckman and Smith, 1999; Smith and Todd, 2005 and Sianesi, 2008). Here the focus is on unemployed individuals who are seeking re-entry into the labour market through participation in training programmes, which are sometimes mandatory and may be linked to benefit receipt. The general evidence on returns to such programmes is mixed. Card *et al.* (2010) in a meta-analysis of 199 programme estimates conclude that many programmes exhibit weak and insignificant effects after one year, although two-year positive returns are evident.

The second category relates to the 'returns-to-training' literature, which predominantly focuses on on-the-job and work-based training (Krueger and Rouse, 1998; Loewenstein and Spletzer, 1999; Frazis and Loewenstein, 1999; Autor, 2001 and Booth and Bryan, 2005). Compared to our definition of

lifelong learning many individuals in the UK undertake training (around half of the workforce according to Booth and Bryan) and the learning that is undertaken tends to be rather specific and occurs over a limited time period. In addition it is generally provided by the employer.

Closest to our own study is the literature which examines the returns to learning events which take place in the formal education sector and result in nationally accredited qualifications. This kind of learning is generally associated with a longer duration of study, a more general curriculum aimed at transferring broader industry related knowledge, national certification, self-financing by individuals and lower rates of participation. For example, in contrast to the indicators used by Booth and Bryan (2005), we find that only around 5% of individuals obtained an adult qualification, as we define it, in any given year. The literature examining these types of learning events refer to them, interchangeably, as “adult learning” or “lifelong learning”, with the former terminology more common in the US context and the latter in the European context (see Kane and Rouse, 1995; Leigh and Gill, 1997; Grubb, 2002 and Jacobson *et al.*, 2005 for the US and Jenkins *et al.*, 2003; Dearden *et al.*, 2004; Wolf *et al.*, 2006; Jenkins, 2006 and DeCoulon and Vignoles, 2007 and 2008 for the UK)

For example, Leigh and Gill (1997) examine the returns to community college, distinguishing between attendance and certification, for adults aged 25 or older. Learning at such institutions is lengthy (two to four years of attendance) and is traditionally seen as a precursor to undertaking a university degree. However, community colleges also place strong emphasis on vocational study, with 75% of qualifications being vocationally orientated (Leigh and Gill, 1997:336). Leigh and Gill find evidence of wage returns in the range of 8-10% for older adults, both to those gaining a degree and those who did not gain a degree. Jacobson *et al.* (2005) also examine the return to community college, as measured through total accumulated college credits. Focusing on workers who have been permanently laid off, they find a return of 9-13% on long-term earnings for each year studied at community college.

An emphasis on vocational adult learning is also found in the recent UK literature, although the evidence on earnings returns is rather mixed. Jenkins *et al.* (2003) find little evidence of a positive effect on wages. Using data from the National Child Development Study (NCDS) they investigate the effect of qualifications obtained between the ages of 33 and 42 on earnings at age 42 and show that approximately 45% of individuals in the cohort undertook some formal training or education during this period⁴ but that the majority of learning was occupationally-related, with fewer people obtaining academic or vocational qualifications. Although a positive effect was observed for the probability of being in employment, no effect on wages was evident. Wolf *et al.* (2006) also find no evidence of wage returns to adult learning, using the NCDS, and conclude that qualifications for 'certified skills' do not lead to actual skill gains, and are not valued by employers. More recently, De Coulon and Vignoles (2007 and 2008) find an average return of 18% for qualification attainment between the ages 26-34 using the 1970 British Cohort Study for those aged, with a higher return for women (24%) than for men (12%).

The existing evidence from the UK thus provides a somewhat mixed account of the returns to learning in later adulthood. Moreover, these findings lack generality for several reasons. When drawn from the cohort studies they are limited to a particular age group, and have long gaps between surveys (Jenkins *et al.*, 2003, Wolf *et al.*, 2006 and DeCoulon and Vignoles, 2007 and 2008) this makes it difficult to rule out the possibility that earnings changed *before* new qualifications were obtained. Other studies have focused on qualifications at NVQ level 2, reflecting the focus of policy attention during the period (Dearden *et al.*, 2004; DeCoulon and Vignoles, 2008)

⁴Such incidence of adult learning is very similar to our rate of 5% per year.

3. Data and Measures

The data used in this study come from the British Household Panel Survey (BHPS). The BHPS is a general purpose household panel survey which collected its first wave of data in 1991, with an achieved sample of 5,505 households, containing 10,264 individuals aged 15 or above. The BHPS employs a stratified, multi-stage, random sample design, with annual face-to-face interviews conducted via computer assisted personal interview (CAPI).⁵ Our sample consists of the original sample members (OSMs), the children of the OSMs as they reach 16 and those who become permanent sample members (by virtue of having a child with an OSM). We exclude temporary sample members and all the booster samples which were added to the BHPS in later years. When referring to sample size, we distinguish between 'respondents' and 'observations'. Respondents are the individuals in the sample, while observations are the interviews conducted with respondents across waves. These sample selection criteria yield a total of 130,563 observations from 13,022 respondents across the 16 waves from 1991 to 2006.

We derive our explanatory variable of interest from information on qualifications obtained since the previous interview, approximately one year earlier. Respondents are asked if they have obtained any qualifications on a list of standard qualifications, plus a final category 'other technical, professional or higher qualifications'. This measure excludes, therefore, leisure and lifestyle courses which we would not expect to have an effect on earnings. Whether a qualification counts as an adult learning event in our analysis depends upon the age and previous employment status of the respondent at the time. For observations where the respondent is aged 30 or over, any qualification obtained since the previous interview constitutes lifelong learning. For observations where the respondent is aged 29 or under, qualifications obtained since the previous interview count as lifelong learning only if the respondent has had at least two previous contiguous observations during which they were in employment – i.e. they were not unemployed, retired, in family care, a full-time student, sick/disabled, on maternity leave or in

⁵ see Lynn (2006) for a detailed account of the BHPS sample design

government training.⁶ We apply this age-based definition so that adult learning is not ascribed to individuals who are still in the ‘school-to-work’ transition, such as those who obtain a degree after ‘gap years’, internships, and the like. Sensitivity analyses show that our results are robust to minor deviations either side of the 30 year age threshold.

We derive inflation-adjusted *usual* gross hourly earnings (referred to from now on as wages) as our measure of earnings:

$$y = \frac{(Y)}{\frac{52}{12} \times (Hr + \lambda HrO)} \quad (1)$$

where Y is usual gross monthly earnings (deflated by the 2005 Consumer Price Index), Hr is the usual number of hours worked per week excluding overtime, HrO is the usual number of overtime hours worked per week and λ is the overtime rate (set at 1.5). This definition is similar to the one used by Booth *et al.* (2005). The mean gross wages of our sample were £10.30 per hour for men (£8.44 median) and £7.83 per hour for women (£6.43 median).

As we require information on earnings we must drop those observations where the individual is not employed. We must also exclude the 8% of all observations who are self-employed and do not report earnings information and the 5% of employed individuals who do not report their earnings. Our analysis is restricted to individuals aged 16-65.⁷

⁶ Because our adult learning definition for observations aged 29 or below requires us to use prior information about an individual there is a possibility that this information is not observed – for example due to prior missing responses (no employment information) or individuals dropping and re-entering the survey. If this information is not observed we do not ascribe a lifelong learning event to the observation. This results in a conservative estimate of adult learning for young people.

⁷ These conditions imply that our eligible sample in the regressions will be reduced from 130,563 to 56,678 observations (27,666 men and 29,012 women) using BHPS waves 2 to 16.

4. Modelling strategy

It is standard to model individual wages at a point in time, t , as a function of education level and a vector covariates, $\mathbf{x}_i$ which might include gender, age, ethnicity, and union status.⁸ One can also include a dummy indicator for individuals who have recently obtained an additional qualification.

$$\ln y_{it} = A\bar{Q}'_{it}\gamma + Ed'_i\beta + \mathbf{x}'_{it}\lambda_x + \alpha_i + \varepsilon_{it} \quad (2)$$

In this specification γ is the return to gaining a qualification in adulthood, β is the usual estimate of the 'return to education', λ_x are parameters associated with the vector of controls, and ε_i is a normally distributed error term. There is a general concern in the returns to education literature that wages will be affected by time invariant 'ability', which can be represented as a fixed effect α_i in equation (2). If ability is unobserved *and* correlated with educational level, which is intuitively likely, then a biased estimate of the return to learning will result (Griliches, 1977). By using a fixed effects estimator which 'differences out' the unobserved individual effect it is possible to obtain unbiased estimates of the impact of adult qualification attainment on wages, in the presence of time-invariant unobservables:

$$\ln \ddot{y}_{it} = A\ddot{Q}'_{it}\gamma + \ddot{\mathbf{x}}_{it}\lambda_x + \ddot{\varepsilon}_{it} \quad (3)$$

where $\ddot{y}, \ddot{x}, \ddot{\varepsilon}, \dots$ indicates deviations-from-means.

However, whilst the fixed effects specification removes time-invariant unit heterogeneity, time-varying heterogeneity remains a potential problem as outlined in section 2. In light of this discussion we therefore control for marital status, whether there are children in the household, firm type, firm size, managerial responsibilities, job satisfaction, cohort effects, union memberships and (previous) labour

⁸ for a discussion for such variables see Polachek and Siebert (1993: 82-87)

market status. We also include time dummies to account for any macro-level change in the incidence of adult learning over time.⁹

In contrast to cross-sectional data, the annual waves of measurement in the BHPS enable us to guard against the possibility of reverse causality by regressing wages in the *current* period on qualification attainment in *previous* periods. By including lags of qualification attainment, we are able to estimate the timing of the effects of qualification attainment on wages.

$$\ln \ddot{y}_{it} = \sum_{k=0}^K A\ddot{Q}_{it-k}' \gamma_k + \ddot{x}_{it} \lambda_x + \ddot{\varepsilon}_{it} \quad (4)$$

Specification (4) now includes a series of lagged variables ($A\ddot{Q}_{it-k}$) which denote whether individual i obtained a qualification at time $t-k$, with K being the number of lags of the qualification dummy. Although the theoretical maximum number of lags in our dataset is 15, we set K equal to 5 in order to avoid small cell sizes. A limitation of this strategy is that we may miss long-run effects which take more than 5 years to materialise.¹⁰ Where information is not available for the 5 previous lags (particularly a problem for the early years of data), we include a dummy to indicate that the lagged qualification variable is missing and set the adult qualification variable to zero. This allows us to keep the maximum possible number of observations but means that the estimates of the effects at higher-order lags and leads are less efficient.¹¹

⁹ For example, this may indirectly pick up Government Policy which became ever more encouraging of adult learning throughout our sample period

¹⁰ In addition to the effect of gaining a qualification on our outcomes for particular lags, we are interested in the total effect across all values of K . For instance, it might be the case that we observe small and non-significant coefficients for several of the lags but, when combined, these show a larger and statistically significant effect. The total effect of gaining a qualification across all lags is known as the long-run multiplier and is calculated as:

$$\sum_{k=1}^K \gamma_{it-k}$$

¹¹ Essentially, due to the ever decreasing cell sizes in higher-order lagged lifelong learning variables the estimated standard error will increase making point estimates less accurate. This is a further reason we decided to set the number of lags and leads to 5 as after this less and less information is added to by new further lags.

Despite the robustness of our identification strategy relative to existing studies, we may still falsely ascribe an effect of lifelong learning on earnings if we ignore the possibility of differential selection into learning. In particular we are concerned about the possibility of a ‘pre-programme dip’ (or trend), which is commonly encountered in the evaluation of training programmes (Ashenfelter, 1978; Heckman and Smith, 1999). If individuals self-select into lifelong learning in order to compensate for falling earnings or alternatively as part of their career progression, estimates of the effect of adult qualifications on earnings after the learning event will be biased. To address this issue we add ‘lead’ indicators of lifelong learning in specification (4):

$$\ln \ddot{y}_{it} = \sum_{k=0}^K A\ddot{Q}_{it-k}' \gamma_k + \sum_{l=0}^L A\ddot{Q}_{it+l}' \gamma_l + \ddot{\mathbf{x}}_{it} \lambda_x + \ddot{\varepsilon}_{it} \quad (5)$$

where L is the number of leads used in the model. We set the maximum number of leads to 5, giving us a model with 5 lags and 5 leads of lifelong learning (we also include the contemporaneous lag for completeness). The introduction of leads into the model allows us to assess the pattern of earnings before lifelong learning occurred and, more importantly, to control for this. A similar approach has previously been applied by Laporte and Windmeijer (2005). An additional advantage of controlling for the leads of adult qualification is that, in some cases, wages might fall prior to qualification attainment, if individuals are paying for their training through forgone wages. It would be inappropriate to treat the cessation of forgone wages as equivalent to an increase in earnings.

One limitation of our approach, as with any fixed effects panel data estimator, is that random measurement error in the time-varying qualification variable will attenuate the regression coefficient toward zero (Griliches and Hausman, 1986). In the absence of appropriate instrumental variables it can be difficult to overcome this problem, although previous work by Swaffield (2001) on the BHPS has attempted to reduce this bias by averaging responses over time. Unfortunately, this approach is not a viable strategy in our lag and lead specification. We therefore argue that our estimates of the earnings

returns to lifelong learning should be regarded as lower bounds, although we note evidence which suggests that the data-collection procedures in the BHPS mean that problems of measurement error are kept to a minimum (Lambert, 2006; Dale, 2006 and Kan and Pudney, 2008).

5. Results

Before setting out our modelling results, we present some descriptive statistics on the distribution of adult qualification events by age. Figure 1 shows the distribution all new qualifications by age, differentiating the learning we attribute to adults, by our previous definition. As we would expect, the highest concentration of new qualification achievement occurs at 18 to 21. This corresponds to qualifications obtained at the end of continuous full-time schooling. The incidence of 'lifelong learning' is very low for young people but increases steadily up to the age of 30, after which we classify all qualifications obtained as being 'lifelong learning'.

Insert Figure 1: Distribution of qualification attainment and 'lifelong learning' by age

A significant number of observations remain in the 'long tail', which indicates that learning events continue to occur until age 50, after which the number of new qualifications obtained drops substantially. In total, we identify 5,427 lifelong learning events (2,510 for men and 2,917 for women) which corresponds to 4.5% of the sample across 15 annual waves.

In examining the proportion of lifelong learners by wave, it is noticeable that the proportion of individuals classified as lifelong learners increases up to around year 2000 (from 2% to 5%). This partly reflects the fact that more of the sample is eligible to be described as 'adult' learners, but is also likely to be due to the aforementioned 'lifelong learning' policy agenda in the UK during this period. There is, however, little evidence that increased public subsidy and the introduction of qualification targets at the population level in the 2000s had any effect in the latter part of the period.

Table 1 presents descriptive statistics about lifelong learners, broken down by gender. The first column shows the proportion of all lifelong learners in each category, while the second compares this with the proportion of all observations. We find that the majority of lifelong learners are employed, with 84% of male lifelong learners being in employment, compared to 64% of the population and 79% of female lifelong learners being in employment, compared to 59% overall. It seems then that lifelong learning is undertaken largely by the working population.¹²

Insert Table 1: Descriptive Statistics of Lifelong Learners

Of course, using a simple dummy to capture all lifelong learning events is likely to mask variability across the different types of learning undertaken. Table 2 breaks down the aggregate qualifications distribution into NQF levels 1-5.

Insert Table 2: Disaggregated learning qualifications

Examining the type of learning events observed reveals that the most frequently obtained qualification type is 'other', which includes accredited work-related qualifications that could not be allocated to a specific qualification type. No information is available to enable a determination of the relative frequency of qualification levels within this residual category, although we suspect that qualifications at levels 1 and 2 are most frequently represented. Correlating the achievement of 'other' qualifications with the work-related training variables in the BHPS shows correlations in the range 0.16-0.40 across

¹² Such findings contrast those of Jenkins et al. (2003) who suggest that unemployment is a strong determinant of lifelong learning and that such learning can be seen as a 'way back into employment'. We therefore also examine the descriptive findings from Table 1 in a multivariate model, where the probability of a lifelong learning event is regressed on prior labour market status and a vector of demographic controls. Both logit and fixed effect logit models show that the coefficients on current (and prior) unemployment status are insignificant, whereas the coefficients on current (and prior) employment status are positive and significant.

waves and gender.¹³ This correlation range is higher than the correlation with other NQF levels (NQF 1 to 5), where the range for all other levels is between 0.02-0.15. It would seem, then, that accredited work-related training forms an important part of the lifelong learning that we observe and is captured primarily in the 'other' category. Ideally we would follow De-Coulon and Vignoles (2008) in isolating lifelong learning which *raises* the highest qualification of individuals. Unfortunately the high prevalence of the 'other' qualification code in the data renders this unfeasible.

We now present results for models which assess the returns for *any lifelong learning event*. These are reported in Tables 3 and 4 for men and women separately. Both tables report models which use OLS (with cluster-robust standard errors) and fixed effects estimators.¹⁴ Given that our primary identification concern is related to the endogeneity of learning, we are particularly interested in the difference between OLS and fixed effects coefficients. Both Tables also include three different model specifications where the effect of lifelong learning is treated as: a) a contemporaneous event only b) a function of lagged events only c) a function of lags and leads of lifelong learning. This allows us to examine how the coefficients change as we change the model specification. Of particular interest is the comparison between the lags and the 'lags plus leads' models, as these allow us to assess the importance of time-varying heterogeneity.

The coefficients reported in Tables 3 and 4 are the estimated effect of individual lifelong learning, at time t , on current (log) hourly wages. We also report the cumulative impact at time period $t+5$.

Insert Table 3: Returns to Lifelong Learning for Men using any type of lifelong learning qualification

¹³ We include a 'correlation range' here as training variables in the BHPS suffer from coding discontinuities and do not allow for aggregation. We thus stratified our correlation with the NQF 'other' variable across wave and gender.

¹⁴ Hausman test's indicated rejection of random effect models in all regressions and our favoured specifications is therefore the fixed effect specification.

Table 3 suggests that the effect of lifelong learning on hourly wages for men is dependent on the model specification employed. The initial, naive, specification with no lags or leads suggests no significant impact of learning on log hourly wages in the same time period. This is not surprising, as we did not expect the returns to manifest themselves instantaneously. However, estimates do show that the OLS estimator suggests a negative return, whilst the fixed effects estimator suggests a positive return – a finding which is repeated throughout the results. This implies that those with lower wages are most likely to select into adult learning, in line with the findings of Dearden *et al.* (2004). Results from the lag models, suggest a statistically significant positive effect of lifelong learning on log hourly wages. The fixed effects specification shows positive and significant returns in the 2nd and 4th year following a lifelong learning event. Cumulatively, however, the net return to a lifelong learning event becomes statistically significant after 2 years, with an average net return of +3.6%.¹⁵ This cumulative effect increases each successive year until it reaches +8.9% after 5 years.¹⁶

However, the final specification with lags and leads suggests that there is a significant pre-programme trend. The final two columns in Table 3 show that the inclusion of leads into the model substantially changes the estimated coefficients for the lags. None of the lags are now statistically significant, whilst many of the leads are negative and statistically significant. The interpretation of the lead coefficients is that lower wages at time t makes qualification attainment more likely in the future.

Our results suggest that men who undertake lifelong learning were earning less in the years before the qualification was obtained, but were also on an upward wage trajectory. Whilst this is not the classical ‘dip’ described by Ashenfelter (1978) - where a sudden prior decrease in earnings leads to programme participation - it does suggest that our prior estimates of the lagged effects were actually part of a continuing earnings trend, rather than a causal effect of qualification attainment. Once this trend is controlled for (via the inclusion of the leads), we find that the estimated return to lifelong

¹⁵ The interpretation of dummy variables in a semi-log model is $\exp(\hat{\beta}) - 1$. We transform the coefficients using this formula and hence some reported coefficients in the text may not be identical with coefficients reported in the Tables (although they will be very close).

¹⁶ Experimentation with 10 lags suggests returns of up to +30% after 10 years. Results available upon request.

learning for men is reduced to zero. We consider this to be an important finding, as it reveals that there is an impact of time varying heterogeneity which is not captured by simply controlling for individual and job characteristics.

Insert Table 4: Returns to Lifelong Learning for Women using any type of lifelong learning qualification

Examining the coefficients in Table 4 suggests that the same pattern is not apparent for women. The inclusion of leads results in a small pre-programme effect using OLS but these leads are not significant in the FE estimation. This, too, is an important finding because it suggests that endogenous selection is a less important factor in explaining lifelong learning participation for women. Moreover, the coefficients on the lags in both the 'lag only' specification and the 'lag plus leads' specification remain positive and statistically significant, which suggests a causal wage return to lifelong learning for women.

Both the 'lag only' and the 'lag plus leads' specifications suggest a positive effect of lifelong learning on wages for women after 4 and 5 years, although, of the two, the lag plus leads specification suggests marginally lower returns.¹⁷ We can see that a lifelong learning event results in a 3% increase in hourly wages after 4 years and 5% increase after 5 years for women. Taking the 'lag plus leads' model as our preferred specification, the cumulative effect of a lifelong learning event on hourly earnings after 5 years is +10.3%. This return takes some time to materialise, however, with a discernable growth in log hourly wages occurring only 4 to 5 years after the learning event.¹⁸

So far, we have considered hourly wages as the dependent variable in order to proxy changes in individual productivity. However, the impacts of new qualifications might also be felt through changing labour supply decisions; an individual who has become more productive through learning may

¹⁷ It should be remember that in the presence of measurement error the fixed effects results could be considered as lower bounds.

¹⁸ Experimentation with 10 year lags and leads suggest the biggest individual gain is experienced 5 years after the learning event (with 4 and 6 years being the next highest) and that the cumulative return after 10 years is approximately +20% to hourly earnings.

choose to work more, or less, as a consequence, with very different implications for total earnings. Table 5 shows results for the fixed effects model with lags plus leads, for weekly hours worked and monthly earnings, alongside the hourly wage results already reported.

Table 5: Returns to Lifelong Learning for Women using any type of lifelong learning qualification – Disaggregation into Earnings and Hours.

Table 5 shows that the pre-programme trend for men is not a consequence of prior changes in hours worked, but is rather due to a difference in remuneration before the qualification event. For women, there continues to be little evidence of a pre-programme trend (in either hours worked or earnings). Both weekly hours worked and monthly earnings lags show positive and statistically significant coefficients (from time period t_0 and onwards for hours worked and time period t_{-1} and onwards for monthly earnings). For example, 2 years after a learning event, women work 2.3 hours more per week and experience a monthly earnings increase of 8%. The magnitude of the income improvement experienced by women is thus larger than when the focus is on hourly wages only. This finding might indeed be anticipated, given the evidence which shows that female labour supply is more sensitive to wage level than is the case for men (Killingsworth, 1983, Heckman 1993).

Due to limitations of sample size, we have treated all qualifications as equivalent measures of lifelong learning. We have found effects of lifelong learning on hourly earnings for women but it seems unlikely that the size of the return will be constant across the level of qualification obtained. We now relax this assumption by specifying separate variables for each level of qualification as presented in Table 2. We are limited, however by the small number of observations in some of the cells, so our results here are subject to large standard errors. We do not, therefore, report the point estimates from these models¹⁹ but present the estimated coefficients graphically and focus our discussion on the general pattern. Results for men and women are presented in Figures 2 and 3 respectively.

¹⁹ Available on request

Figure 2: Returns to lifelong learning by qualification level – Cumulative Effects for Men

Figure 3: Returns to lifelong learning by qualification level – Cumulative Effects for Women

Examining the returns to lifelong learning by NQF levels for men, we find that the pre-programme trend is apparent at all qualification levels, although to a varying extent. Cell sizes in the NQF level 3, 4 and 5 category are sparse but there is nonetheless a suggestion that for all 6 qualification levels, men experience rising earnings prior to a learning event. There is also a suggestion that NQF level 2 qualifications may be associated with improved hourly wages for men, although the coefficient is not significantly different from zero. There is no evidence of returns being greater for higher level qualifications.

The results for women show that a pre-programme trend is not evident at any qualification level, although there is a suggestion that women who obtain level 1 qualifications have lower wages beforehand, while for those who gain level 2 qualifications the reverse is the case. However, neither coefficient is statistically significant. Returns to lifelong learning are suggested for level 2 and level 5 qualifications, which have positive trend lines after a learning event. For other levels, we do not detect a clear upward trend. Qualifications classified as 'other', which are the most numerous, exhibit the cleanest pattern, with virtually no pre-programme effect and a statistically significant cumulative impact after 5 years. The size of this effect is nearly identical to the effect found when amalgamating qualifications across levels. This suggests that our earlier results are primarily driven by qualifications classified as 'other' in the BHPS questionnaire, which we believe are primarily at levels 1 and 2.

6. Conclusion

Human capital theory suggests that investment in education in later life should have productivity and wage gains, and as a consequence policy makers have become active in the promotion of lifelong learning. Yet, despite the widespread belief in the value of learning, the evidence in support of any economic benefit is both weak and inconsistent in the UK. In this paper, we have sought to add clarity to the debate about the benefits of such learning, by examining the impact on wages of qualifications obtained after early adulthood.

Our empirical work significantly extends the methodological robustness of recent UK research into the returns to adult/lifelong learning by exploiting the annual measurement cycle of the British Household Panel Survey (BHPS) over sixteen years. Our analysis differences out observable and unobservable time-invariant individual characteristics and controls for important time-varying factors that might influence learning choices. We also control for pre-qualification trends in earnings, and examine the effect of qualification attainment on earnings over 5 years, as opposed to observing it in a single year only.

Our results suggest that the return to adult qualifications to hourly wages is different for men and women. Estimated returns for men appear to be highly susceptible to the addition of lead qualifications dummies in the regression specification; when leads are included, earnings returns are no longer significant. The sign of the coefficients on the leads indicate that those who undertake a qualification have lower wages in the years prior to it, but that wages are on a positive trajectory. This suggests two possibilities, that productivity is genuinely lower but rising in the years prior to lifelong learning, or that individuals earn less because they are paying the cost of their learning investment through lower wages while studying. In our assessment, the first explanation is more likely than the second, as the majority of the qualifications that constitute lifelong learning are obtained over a fairly short time, ruling out long costs.

Similar results are not apparent for women, whose prior wage patterns do not appear to significantly influence selection into adult learning. We therefore interpret the results on the lagged

learning dummies as indicative of a causal effect of adult learning on women's hourly wages. Results suggest that a return of 10% can be expected after 5 years, although disaggregation into hours and earnings suggests that the impact of learning is apparent after 1 year. However, because both weekly hours worked and earnings increase, no apparent hourly wage effects are apparent until the long run. Our findings thus suggest high returns for women and no returns for men which appears to be consistent with recent UK work by De-Coulon and Vignoles (2008) who find a 24% return for women over an 8 year period (a rate of return similar to our findings) and no return for men. Moreover, using a similar methodology, recent results by Hällsten (2011) confirm that the earnings (and employment) effect of lifelong learning are also felt more strongly for women in Sweden.

Naturally it is interesting to consider why earnings returns to lifelong learning are apparent for women but not for men. A variety of explanations are indicated by our earlier discussion of the motivating factors underpinning the decision to undertake an adult qualification. In particular, we highlighted both family factors and job characteristics. One possibility is that child-bearing and caring responsibilities mean women are less likely to obtain qualifications the first time round, increasing the opportunities for women to benefit from productive investments later on. On the job characteristics side, it seems likely that the sectors in which women work are those where additional qualifications have been increasingly required such as childcare and personal care for the elderly. For example, Jenkins *et al.* (2007:48) argue that "...gender differences in returns to vocational qualifications often reflect occupational and sector segregation" and such an explanation may well be applicable in a lifelong learning context. However, sample size constraints do not allow us to test this hypothesis formally. Alternatively, it may be that the signalling component of certified qualifications carries more weight for women than for men or that women start the learning process from a lower skills baseline. Evidence by De-Coulon and Vignoles (2008) suggest that particular strong returns are associated for women with poorer cognitive abilities. In both cases we would expect the estimated return to learning to be higher for women than for men.

In short, it may be that the differences we find between men and women are due to genuine differences in choices between genders, or it might instead be that they are a function of the different industrial sectors in which men and women tend to work. We propose that this and further analysis of the determinants and motivations of adult/lifelong learning represent a potentially important direction for future research.²⁰

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²⁰ See for example recent work by Jepsen and Montgomery (2011)

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Figure 1: Distribution of learning and adult learning events by age

Source: BHPS, pooled Waves 2 to 16

Figure 2: Returns to adult learning by qualification level – cumulative effects for men

Source: BHPS
Estimates based on FE specification with controls

Figure 3: Returns to adult learning by qualification level – Cumulative effects for women

Source: BHPS
Estimates based on FE specification with controls

Table 1: Descriptive statistics of adult learners

	Men		Women	
	AQ	ALL	AQ	ALL
Employed _t	83.55	64.32	80.08	58.57
Employed _{t-1}	82.85	64.89	76.77	59.23
Employed _{t-3}	79.34	66.23	72.86	60.37
Employed _{t-5}	76.54	67.00	70.26	61.17
Union	26.05	15.12	28.65	14.87
Married	59.48	56.71	60.24	57.59
Manager	41.45	27.44	33.44	18.83
Dissatisfied with job	10.98	7.93	7.86	5.76
Private Sector	60.53	50.47	35.64	36.10
Small firm	31.81	28.03	40.71	33.06
Non-Small firm	68.19	71.97	59.29	66.94
Registrar General's Social Class - inapplicable	8.10	20.02	14.15	32.62
Registrar General's Social Class - professional	6.77	6.06	3.56	2.03
Registrar General's Social Class - managerial & technical	33.95	25.37	38.64	21.19
Registrar General's Social Class - skilled non-manual	11.39	10.33	23.34	24.62
Registrar General's Social Class - skilled manual	30.19	24.27	7.16	5.66
Registrar General's Social Class - partly skilled	7.33	11.13	11.18	10.53
Registrar General's Social Class - unskilled	1.86	2.59	1.96	3.32
Registrar General's Social Class - armed forces	0.41	0.24	0.00	0.03
Age - less than 20	2.92	8.93	1.22	7.85
Age - 20 to 30	21.60	19.56	15.62	19.21
Age - 30 to 40	33.14	22.95	34.94	23.80
Age - 40 to 50	26.01	22.57	30.96	22.72
Age - 50 to 60	13.61	18.81	14.57	19.06
Age - 60 to 65	2.71	7.18	2.69	7.36
Degree or higher	10.71	9.57	10.56	7.19
Teaching/Nursing/Other higher	24.56	17.88	23.65	14.11
A-levels	18.00	13.35	12.00	9.28
GCSE/O-levels	27.25	27.58	32.48	32.92
Other (lower) qualifications	10.35	14.17	11.08	15.79
No qualifications	9.12	17.45	10.24	20.71

Source: BHPS, Pooled Wave 2 to 16. Restricted to those age 65 or below. Education is a time invariant variable and is measured at the time of first observation (1991 for OSMs and the first year of PSMs status for PSMs) All other variables are time varying and are measured at the year of the AQ event. A-level qualifications refer to qualifications obtained in school at age 18 and GCSE/O-Level qualifications refer to qualifications obtained in school at age 16.

Table 2: Disaggregated adult learning qualifications

NQF Equivalent	Adult Qualifications	
	Observations	Individuals
NQF 1	840 (0.70)	671 (5.57)
NQF 2	489 (0.41)	403 (3.34)
NQF 3	298 (0.24)	242 (2.01)
NQF 4 (Vocational)	409 (0.34)	331 (2.75)
NQF 4 (Academic) & NQF 5	399 (0.33)	307 (2.55)
NQF Other	3,276 (2.73)	2,012 (16.69)

Source: BHPS, Pooled Waves 2 to 16
Numbers in parenthesis are percent of BHPS sample (120,639 observations or 14,062 respondents),

Table3: Returns to adult learning for men using any type of qualification

	Men		Men		Men	
	Log Hr Earnings		Log Hr Earnings		Log Hr Earnings	
	OLS	FE	OLS	FE	OLS	FE
<i>Individual Impact at Time t</i>						
Adult learning					-0.052***	-0.032**
(AQ _{t+5})					(0.013)	(0.010)
Adult learning					-0.044***	-0.034***
(AQ _{t+4})					(0.012)	(0.009)
Adult learning					-0.031**	-0.032***
(AQ _{t+3})					(0.010)	(0.009)
Adult learning					-0.040***	-0.048***
(AQ _{t+2})					(0.009)	(0.008)
Adult learning					-0.024**	-0.027***
(AQ _{t+1})					(0.008)	(0.008)
Adult learning	-0.020	0.005	-0.022*	0.004	-0.012	-0.009
(AQ _t)	(0.011)	(0.008)	(0.009)	(0.008)	(0.008)	(0.007)
Adult learning			-0.008	0.012	-0.003	-0.004
(AQ _{t-1})			(0.009)	(0.008)	(0.009)	(0.008)
Adult learning			-0.003	0.020*	0.001	0.004
(AQ _{t-2})			(0.010)	(0.009)	(0.010)	(0.008)
Adult learning			0.001	0.013	0.003	-0.005
(AQ _{t-3})			(0.011)	(0.010)	(0.010)	(0.009)
Adult learning			0.010	0.020*	0.011	0.002
(AQ _{t-4})			(0.011)	(0.010)	(0.011)	(0.010)
Adult learning			0.003	0.016	0.005	-0.004
(AQ _{t-5})			(0.014)	(0.011)	(0.013)	(0.010)
Constant	2.161***	1.852***	2.508***	2.134***	2.516***	2.162***
	(0.052)	(0.017)	(0.058)	(0.032)	(0.057)	(0.019)
<i>Long Run Effect</i>						
$\beta_{t-0} + \dots + \beta_{t-5}$			-0.020	0.085**	0.005	-0.016
			(0.043)	(0.034)	(0.041)	(0.025)
N	27666	27666	27666	27666	27666	27666
R2	0.452	0.264	0.464	0.285	0.465	0.287

Standard errors in parentheses; * p<0.05, ** p<0.01, *** p<0.001. Cluster S.E. for OLS. Observations aged greater than 65 are excluded. Controls include Age Groups, Marital Status, Child in Household, Union Membership, Private Firm, Small and Medium Size Company, Job Dissatisfaction, Prior Employment Status, Managerial Status, Time Dummies and indicators of missing values. The OLS models additionally include indicators for Education, Nationality and School Type. Controls are statistically significantly different from zero. Standard errors for the cumulative impact are calculated using the Stata post-estimation "lincom" command

Table 4: Returns to Adult Learning for Women using any type of qualification

	Women Log Hr Earnings		Women Log Hr Earnings		Women Log Hr Earnings	
	OLS	FE	OLS	FE	OLS	FE
<i>Individual Impact at Time t</i>						
Adult learning (AQ _{t+5})					-0.025*	-0.014
					(0.011)	(0.010)
Adult learning (AQ _{t+4})					-0.019	-0.006
					(0.011)	(0.010)
Adult learning (AQ _{t+3})					-0.006	0.002
					(0.010)	(0.009)
Adult learning (AQ _{t+2})					-0.026**	-0.008
					(0.009)	(0.009)
Adult learning (AQ _{t+1})					-0.021*	-0.014
					(0.009)	(0.008)
Adult learning (AQ _t)	-0.010	-0.005	-0.014	-0.001	-0.010	-0.005
	(0.011)	(0.008)	(0.009)	(0.008)	(0.008)	(0.008)
Adult learning (AQ _{t-1})			-0.012	0.004	-0.010	0.002
			(0.010)	(0.008)	(0.009)	(0.008)
Adult learning (AQ _{t-2})			0.002	0.013	0.005	0.011
			(0.011)	(0.009)	(0.011)	(0.009)
Adult learning (AQ _{t-3})			-0.001	0.010	0.001	0.012
			(0.010)	(0.010)	(0.010)	(0.009)
Adult learning (AQ _{t-4})			0.024*	0.030***	0.024*	0.029**
			(0.011)	(0.009)	(0.011)	(0.010)
Adult learning (AQ _{t-5})			0.047***	0.049***	0.048***	0.048***
			(0.013)	(0.011)	(0.013)	(0.011)
Constant	2.221***	1.643***	2.599***	1.866***	2.602***	1.872***
	(0.063)	(0.018)	(0.066)	(0.031)	(0.066)	(0.021)
<i>Long Run Effect</i>						
$\beta_{t-0} + \dots + \beta_{t-5}$			0.046	0.106***	0.059	0.098***
			(0.043)	(0.034)	(0.040)	(0.031)
N	29012	29012	29012	29012	29012	29012
R2	0.406	0.214	0.420	0.224	0.421	0.225

Standard errors in parentheses; * p<0.05, ** p<0.01, *** p<0.001. Cluster S.E. for OLS. Observations aged greater than 65 are excluded. Controls include Age Groups, Marital Status, Child in Household, Union Membership, Private Firm, Small and Medium Size Company, Job Dissatisfaction, Prior Employment Status, Managerial Status, Time Dummies and indicators of missing values. The OLS models additionally include indicators for Education, Nationality and School Type. Controls are statistically significantly different from zero. Standard errors for the cumulative impact are calculated using the Stata post-estimation "lincom" command

Table 5: Returns to Adult Learning using any type of qualification, disaggregation into earnings and hours.

	Men			Women		
	Hr Week Worked FE	LogMth Earnings FE	Log Hr Earnings FE	Hr Week Worked FE	LogMth Earnings FE	Log Hr Earnings FE
<i>Individual Impact at Time t</i>						
Adult learning (AQ _{t+5})	-0.553 (0.404)	-0.031** (0.012)	-0.032** (0.010)	-0.628 (0.384)	-0.030* (0.014)	-0.014 (0.010)
Adult learning (AQ _{t+4})	-0.612 (0.396)	-0.038*** (0.011)	-0.034*** (0.009)	-0.294 (0.332)	-0.012 (0.014)	-0.006 (0.010)
Adult learning (AQ _{t+3})	-0.027 (0.358)	-0.032** (0.010)	-0.032*** (0.009)	-0.165 (0.333)	-0.004 (0.013)	0.002 (0.009)
Adult learning (AQ _{t+2})	-0.159 (0.366)	-0.048*** (0.010)	-0.048*** (0.008)	-0.051 (0.323)	-0.009 (0.013)	-0.008 (0.009)
Adult learning (AQ _{t+1})	-0.049 (0.333)	-0.032*** (0.009)	-0.027*** (0.008)	0.095 (0.317)	0.002 (0.012)	-0.014 (0.008)
Adult learning (AQ _t)	-0.464 (0.327)	-0.018* (0.009)	-0.009 (0.007)	0.780* (0.337)	0.020 (0.013)	-0.005 (0.008)
Adult learning (AQ _{t-1})	-0.136 (0.340)	-0.005 (0.009)	-0.004 (0.008)	0.991** (0.327)	0.027* (0.013)	0.002 (0.008)
Adult learning (AQ _{t-2})	0.274 (0.377)	0.001 (0.010)	0.004 (0.008)	0.745* (0.358)	0.029* (0.012)	0.011 (0.009)
Adult learning (AQ _{t-3})	0.381 (0.388)	-0.000 (0.010)	-0.005 (0.009)	0.419 (0.399)	0.025 (0.013)	0.012 (0.009)
Adult learning (AQ _{t-4})	0.216 (0.400)	0.006 (0.010)	0.002 (0.010)	0.931* (0.395)	0.045** (0.013)	0.029** (0.010)
Adult learning (AQ _{t-5})	-0.065 (0.426)	-0.006 (0.012)	-0.004 (0.010)	1.002* (0.418)	0.059*** (0.014)	0.048*** (0.011)
Constant	46.285*** (1.057)	7.461*** (0.036)	2.162*** (0.019)	39.680*** (0.973)	7.117*** (0.045)	1.872*** (0.021)
<i>Long Run Effect</i>						
$\beta_{t-0} + \dots + \beta_{t-5}$	0.206 (1.434)	-0.022 (0.043)	-0.016 (0.025)	4.838*** (1.612)	0.205*** (0.059)	0.098*** (0.031)
N	27666	27666	27666	29012	29012	29012
R2	0.022	0.269	0.287	0.095	0.258	0.225

Standard errors in parentheses; * p<0.05, ** p<0.01, *** p<0.001. Observations aged greater than 65 are excluded. Controls include Age Groups, Marital Status, Child in Household, Union Membership, Private Firm, Small and Medium Size Company, Job Dissatisfaction, Prior Employment Status, Managerial Status, Time Dummies and indicators of missing values. Controls are statistically significantly different from zero. Standard errors for the cumulative impact are calculated using the Stata post-estimation "lincom" command

APPENDIX

Table A1: The National Qualifications Framework used in this study

NQF Equivalent	Type: Academic	Core competencies	Exemplar of Vocational Qualification
NQF 1	<ul style="list-style-type: none"> - GCSE's at grades D – G - CSE's at grades 2 - 5 - Scottish standard grade 4 – 5 - Other Scottish school qualification 	Application of basic knowledge and skills for routine and predictable work activities. Aimed at everyday situations.	Level 1 NVQ Award in Bakery / RSA Stage 1 Award in Typewriting skills
NQF 2	<ul style="list-style-type: none"> - GCSE's at grades A* - C (5 or more) - O levels grade A – C - O levels grade D – E - CSE grade 1 - Scottish standard grade 1 – 3 - Scottish lower or ordinary grades 	Skills that involve the application of a significant range of activities. Involves building intermediate knowledge in relation to subject area or area of work. First emphasis on team or group work.	Level 2 NVQ Certificate in Beauty Therapy / BTEC Diploma in Health and Social Care
NQF 3	<ul style="list-style-type: none"> - A Levels - AS levels - International Baccalaureate 	Skills and abilities that are complex, detailed and non-routine. Builds advanced knowledge, responsibility and autonomy. Guidance of others is often required.	NVQ level 3 Diploma in Hospitality Supervision / BTEC Ordinary National Diploma in Construction
NQF 4 (Vocational)	N/A	Recognises specialist learning in a broad range of complex, technical and professional activities with substantial autonomy and personal responsibility. Includes managing and developing others.	Postgraduate Certificate in Education / Bachelor of Science in Adult Nursing
NQF 4 (Academic) & NQF 5	<ul style="list-style-type: none"> - Diploma in Higher Education - First Degree (BSc or BA) - Post-graduate Degree (MSc, MA or MBA) - Doctorate (PhD, DPhil, MD) - Other Degree 	High level qualifications that require advanced levels of knowledge and work expertise. Aimed at professionals and managers who must apply fundamental principles in unpredictable and varied contexts.	Bachelor of Art in History / Master of Business Administration

Exemplar Types are taken from various sources including government publications, Further Education Colleges and the Qualifications and Curriculum Authority.