RESEARCH

Literacy, Numeracy and the labour market: Further analysis of the Skills for Life survey

John Grinyer

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Literacy, Numeracy and the labour market: Further analysis of the Skills for Life survey

1.1 Abstract

This paper examines the relationship between adult literacy and numeracy skills, participation on basic skills courses and subsequent labour market outcomes, namely private earnings and probabilities of being employed and participating in the labour market. This is achieved through secondary analysis of the 2003 Skills for Life survey. The survey interviewed over 8,000 respondents aged 16-65 in England during 2002-03, and measured their literacy and numeracy skills using two computer aided tests. We find significant positive correlations between both literacy and numeracy and earnings and that basic skills are good predictors of labour market participation, particularly for women. Using matching methods we find positive and significant effects on earnings from attending an adult literacy or numeracy course when looking at earnings three or more years after participation on the course. We estimate the returns to be larger for adults with no or few qualifications, who typify adults who do not attend such courses.

1.2 Introduction

The Skills for Life survey, commissioned by the Department for Education and Skills in 2001 with findings published in October 2003 is the largest assessment of literacy and numeracy levels in the adult population of England to date. It showed that 5.2 million adults of working age[1] have Entry level literacy skills and 15 million adults have Entry level numeracy skills.[2] Entry level broadly equates to below-GCSE G grade standards.

Headline results from the survey are given below:

Literacy		
	% of 16-65 year olds	Number of 16-65 year olds
Entry level 1 or below	3%	1.1m
Entry level 2	2%	0.6m
Entry level 3	11%	3.5m
(All Entry level 3 or below)	(16%)	(5.2m)
Level 1	40%	12.6m
Level 2 or above	44%	14.1m
	100%	31.9m

Base: all respondents with literacy score (7874)
Source for population figures: Census 01

[1] Defined as ages 16-65 inclusive
[2] The Skills for Life survey research brief can be downloaded from http://www.dfes.gov.uk/research/data/uploadfiles/RB490.pdf and the full (300 page) report can be downloaded from http://www.dfes.gov.uk/research/data/uploadfiles/RR490.pdf

Numeracy		
	% of 16-65 year olds	Number of 16-65 year olds
Entry level 1 or below	5%	1.7m
Entry level 2	16%	5.1m
Entry level 3	25%	8.1m
(All Entry level 3 or below)	(47%)	(15.0m)
Level 1	28%	8.8m
Level 2 or above	25%	8.1m
	100%	31.9m

Base: all respondents with numeracy score (8040)
Source for population figures: Census 01

The Skills for Life Strategy aims to raise the literacy and numeracy levels of 2.25 million adults in England by 2010 through encouraging participation in further learning. This paper is written with this policy in mind.

1.3 Outline of the paper

This paper is divided into five parts:

- Description of the Skills for Life survey, data issues and summary statistics.

  This section covers the design and methodology underlying the Skills for Life survey and the literacy and numeracy levels assigned to respondents, and presents basic descriptive statistics focusing on respondents' basic skills and labour market information.

- The determinants of literacy and numeracy.

  Setting literacy and numeracy levels as dependent variables we examine background variables that could potentially influence an individuals literacy and numeracy skills. We find highest qualification to be the best predictor of an individual's literacy and numeracy level. Ethnicity and parental background, in particular whether one parent stayed on in school past age 16, are also strong predictors.

- Estimating the association between literacy and numeracy skills and earnings.

  Following a brief review of previous research in this area econometric techniques are applied to the Skills for Life data to estimate the relationship between literacy, numeracy and earnings controlling on individual's observable characteristics. The results indicate a strong correlation between good basic skills and labour market success, and hint at the possible labour market returns of improving adult literacy and numeracy levels.

- Estimating the impact of participating in adult literacy and numeracy courses.

  Employing matching techniques we estimate the impact on individual earnings of participating in a post-school English or basic mathematics course on both treated and untreated groups. We find the time since course participation of key importance in determining the sign and scale of the effect on earnings.

- The impact of adult literacy and numeracy on employment outcomes.

  This section examines the relationship between adult literacy and numeracy and employment status, controlling on individual's observable characteristics. The probability of both unemployment and economic inactivity are analysed. The results indicate that both literacy and numeracy are associated with labour market status, with, as expected, the effect stronger for women.

The paper finishes with some concluding remarks.

2 Description of the Skills for Life Survey; summary statistics and data issues

2.1 The Skills for Life survey

The survey population was all adults aged between 16 and 65 and normally resident in England. Residents of institutions were excluded for practical reasons. BMRB[3] completed 8,730 first interviews although, in some cases, respondents did not fully complete tests and, in others, previously unidentified problems with the test programmes prevented final scores from being computed. In total, 7,873 respondents completed the literacy test and 7,517 respondents completed the numeracy test. 7,517 completed both. A follow-up survey recontacted 4,656 respondents and tested their computing (ICT) skills, with 4,464 assigned levels in both ICT assessments.

2.1.1 An overview of the basic skills tests

National Standard	Approximate school level equivalent
Entry 1	Key stage 1 (age 5-7)
Entry 2	Key stage 2 (age 7-9)
Entry 3	Key stage 2 (age 9-11)
Level 1	GCSE D-G (age 11-14)
Level 2	GCSE A*-C (age 14-16)

The tests were administered by an interviewer with questions – or 'items' – presented on a laptop computer screen. The interviewer could not 'help' the respondent in any way and was not allowed to read out any of the items. Once the background questionnaire was complete, the role of the interviewer was merely to enter answers indicated by the respondent during the course of the test(s). The respondent was not allowed to touch the computer to enter their own answers – all answers were relayed to the interviewer who entered them into the computer, and then checked that this was the answer the respondent wanted before moving on to the next item. The exception to this was the practical ICT assessment. Here the interviewer passed the laptop computer to the respondent so they could carry out a series of common computer operations without assistance.

Respondents were given a pen and paper to allow them to do "workings out" if they wanted. Calculators and dictionaries were not allowed.

Given the way that the tests were administered, it was not possible to test all literacy skills. Writing was only tested in a limited way (some questions involved checking spelling or grammar), but respondents did not have to do any written work. Listening comprehension was also not tested, as all questions were read by the respondent from the computer screen.

Both the numeracy and ICT assessments also relied on the respondent having basic literacy, as the questions were presented in English, and the respondent had to

[3] British Market Research Bureau

read the questions on the computer screen. Thus, a respondent who could not read would not be able to score highly on the numeracy test, even if their basic maths was reasonable. The numeracy test was devised to assess "practical numeracy" in the everyday sense, and this does generally require literacy as well. The practical ICT assessment was further limited by what could be achieved through a bespoke test programme. Most tasks mimicked typical Windows-based operations since this is the operation system most frequently encountered in daily life.

The question items varied in difficulty and each had a design level associated with the National Standards described above. Each respondent taking a test followed a unique (or near-unique) route through the items[4]. An adaptive algorithm calculated which item to go to next based on the results from the previous items the respondent had tackled. Nobody answered all the items.

The final literacy, numeracy and ICT levels were calculated differently. With the literacy and ICT awareness tests, the final 'level' was linked to the difficulty of questions tackled at the final stage (i.e. if the respondent tackled relatively difficult questions at the end, he/she was more likely to be classified at a higher level than someone who answered relatively easy questions at the end). The numeracy level was based on a weighted aggregate score of all items (e.g. successfully answering a Level 2 question scored 5 points, whereas successfully answering an Entry level 1 question scored 1 point). The practical ICT level was based simply on the number of tasks completed correctly with no differential weighting.

2.1.2 The background questionnaire

BMRB designed the background questionnaire to collect a broad set of relevant demographic and behavioural data. The earlier International Adult Literacy Survey provided a key starting point but other elements were also included. It was divided into 8 basic sections:

- Household structure
- Languages and ethnicity
- ICT skills and training
- Education history
- Self-assessment of skills in speaking, reading and writing English
- Any training taken to improve such skills
- Current/most recent employment
- Other social, economic and demographic data (including health, housing tenure, income etc.)

After the background questionnaire was completed, respondents tackled the literacy and numeracy tests in the first interview, and the two ICT assessments in the second interview (if selected to take part). In some rare cases, respondents were excused the tests.

[4] Except for the ICT tests where all respondents faced the same tasks

2.2 Summary statistics[5]

The analysis does not weight the data to be nationally representative and instead relies on the goodness of the sampling frame. As Figure 2.1 illustrates when comparing the SfL data with Government Actuary Department projections for the same period we see 30-somethings slightly over-represented at the expense of 16-25 year olds; a notoriously difficult group to reach in social surveys. However this under-representation is small and we don't consider it to significantly affect the results.

Figure 2.1

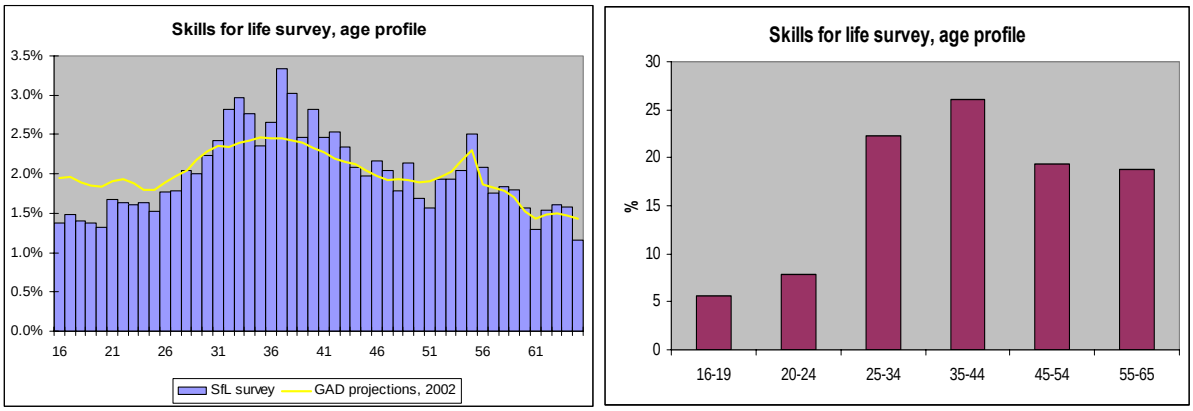
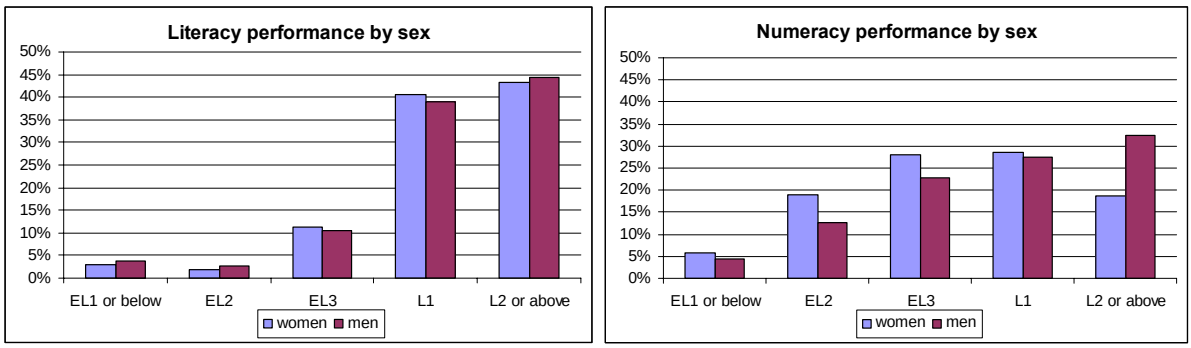


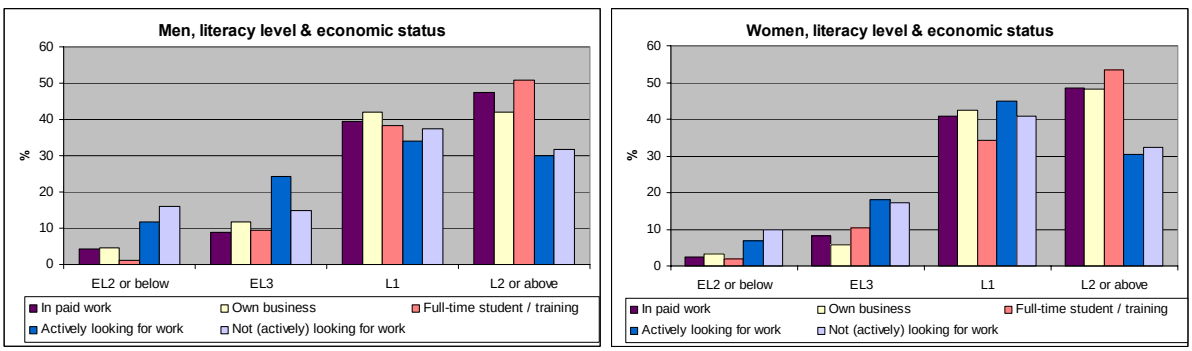
Figure 2.2 shows women and men perform near equally for literacy, but men significantly outperform women at numeracy.

Figure 2.2



Some very clear correlations between literacy, numeracy and labour market variables are apparent from some basic examination of the data.

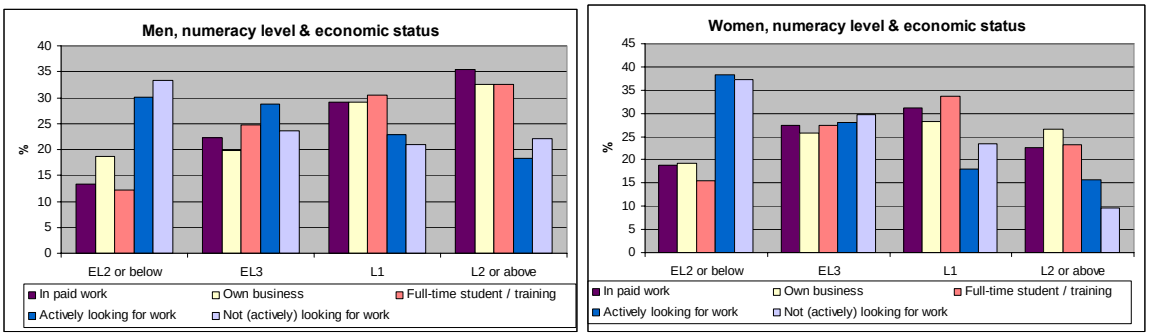
Figure 2.3



[5] For detailed statistics and descriptive analysis see the full Skills for Life survey report

A clear correlation between literacy and employment is demonstrated in Figure 2.3 with the majority of women at Entry level 3 or below not working, with the pattern repeated for men.

Figure 2.4



For numeracy and employment the correlation is even stronger, with 37% of economically inactive women having EL2 or below numeracy with only 10% at Level 2+. Again this pattern is repeated for men.

Figure 2.5

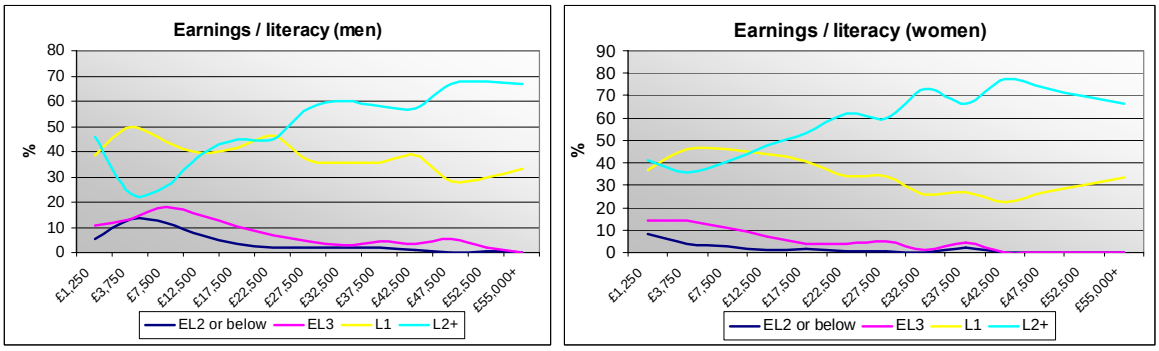
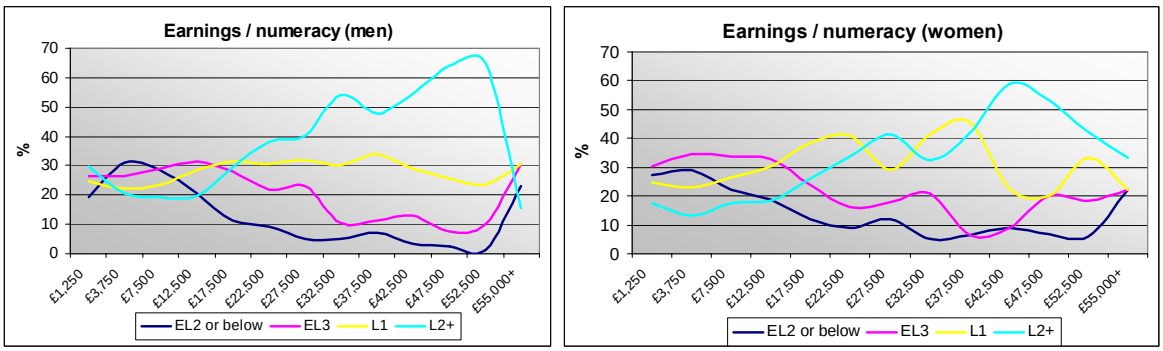


Figure 2.5 shows what percentage of men or women reporting annual earnings at each level where at each literacy level, so for men reporting earnings over £55,000 per year 67% were at Level 2+ literacy, 32% were at Level 1 literacy and less than 1% were at Entry level 3 literacy or below.

We can see Level 2 literacy is strongly correlated with earnings for both men and women. No women in the sample with Entry level literacy earned over £45,000 in the previous year, whilst for men there is a small trickle of high earning low-skilled adults.

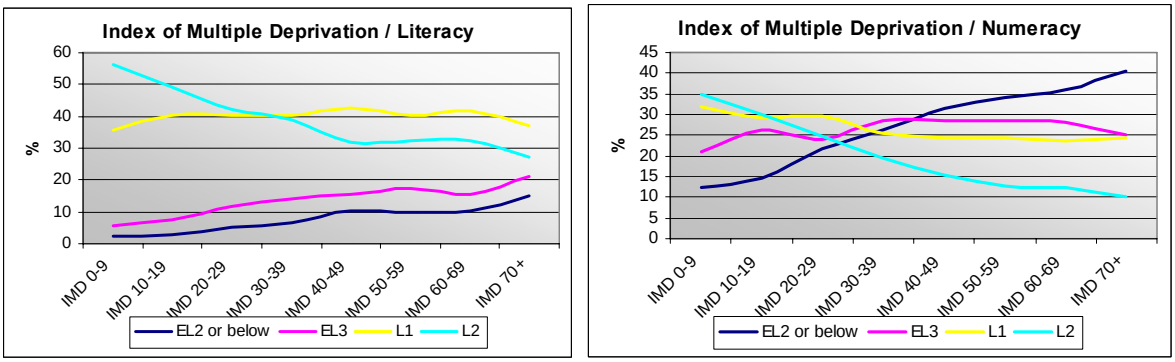
Figure 2.6



The numeracy / earnings relationship is equally strong with a clear upward earnings trend for both men and women with L2+ numeracy, mirrored by a strong

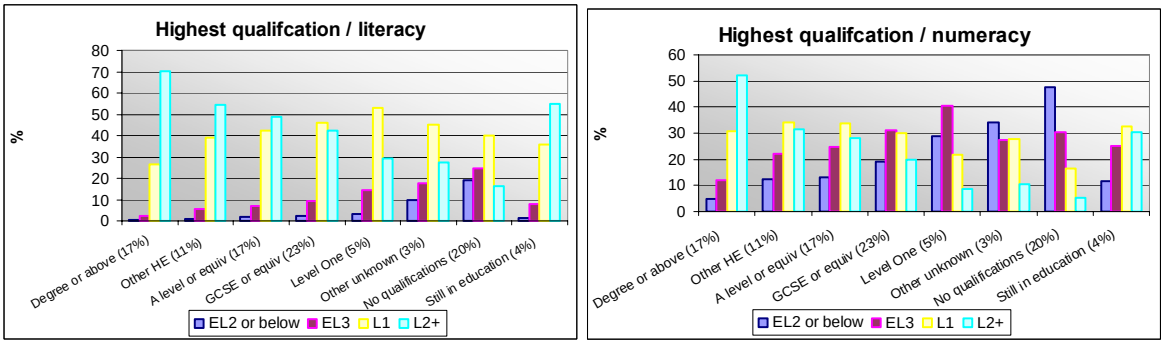
downward trend for those with Entry level numeracy skills.

Figure 2.7



Local deprivation is also correlated with both literacy and numeracy. Again the pattern for Level 1 is flat as you would expect given it covers the centre of the literacy and numeracy distributions. However poor literacy and numeracy skills are clearly found in the most deprived areas, with better skills found in more affluent areas.

Figure 2.8



Finally, as Figure 2.8 shows both numeracy and literacy skills decline as we go down the qualifications scale. The jump between A-levels and degree for numeracy is particularly stark and indicates that higher education helps to cement good numeracy skills.

2.3 Detailed summary statistics

	Variable	Mean	Standard deviation	Min	Max
Literacy level	Entry level 1-2	0.054	0.227	0	1
	Entry level 3	0.109	0.311	0	1
	Level 1	0.399	0.490	0	1
	Level 2 or above	0.438	0.496	0	1
Numeracy level	Entry level 1-2	0.214	0.410	0	1
	Entry level 3	0.258	0.437	0	1
	Level 1	0.281	0.450	0	1
	Level 2	0.187	0.390	0	1
	Above Level 2	0.061	0.238	0	1
Personal characteristics	Male	0.444	0.497	0	1
	Age	40.34	13.16	16	65
	English not first language (ENFL)	0.046	0.210	0	1
	Learning difficulties (inc. dyslexia)	0.044	0.205	0	1
	Poor health	0.054	0.226	0	1
Age group	16-30	0.249	0.432	0	1
	31-45	0.390	0.488	0	1
	46-65	0.360	0.480	0	1
Parental education	Neither parent educated beyond primary school	0.025	0.157	0	1
	Neither parent completed secondary school	0.121	0.326	0	1
	Most educated parent completed secondary school	0.535	0.499	0	1
	Most educated parent attended 6th form	0.073	0.260	0	1
	At least one parent attended university	0.128	0.334	0	1
	Parental education missing	0.118	0.323	0	1
Ethnicity	Asian	0.031	0.174	0	1
	Black	0.024	0.155	0	1
	East Asian	0.003	0.053	0	1
	White	0.933	0.249	0	1
	Other ethnicity	0.008	0.088	0	1
Qualifications held	GCSEs / O-levels (any grade)	0.685	0.465	0	1
	5+ GCSEs / O-levels grade A*-C or equivalent	0.464	0.499	0	1
	English GCSE / O-level grade A*-C	0.512	0.500	0	1
	Mathematics GCSE / O-level grade A*-C	0.415	0.493	0	1
	Vocational qualification Level 2 or below	0.235	0.424	0	1
	Vocational qualification Level 3 or above	0.180	0.384	0	1
	Any A-levels	0.278	0.448	0	1
	Degree	0.186	0.389	0	1
	Other HE qualification	0.100	0.300	0	1
	Higher Degree (inc PGCE)	0.019	0.135	0	1
	Other qualifications, level unknown	0.114	0.318	0	1
Highest qualification	Degree or above	0.172	0.378	0	1
	Other HE qualification	0.107	0.309	0	1
	A-levels / Level 3 or equivalent	0.167	0.373	0	1
	5 GCSEs A*-C / Level 2 or equivalent	0.229	0.420	0	1

	Below Level 2	0.049	0.215	0	1
	Other qualification, level unknown	0.032	0.175	0	1
	No qualifications	0.200	0.400	0	1
	Still in education	0.052	0.223	0	1
Children	Child under 4 in household	0.087	0.281	0	1
	Child age 5-16 in household	0.299	0.458	0	1
Labour market status	Employed	0.693	0.461	0	1
	Self employed	0.107	0.309	0	1
	Work part-time	0.249	0.432	0	1
	Job seeker	0.046	0.210	0	1
	Economically inactive (inc. students)	0.254	0.435	0	1
	Ever worked	0.951	0.216	0	1
Government Office Region	North East	0.114	0.317	0	1
	North West	0.109	0.312	0	1
	Yorkshire and the Humber	0.114	0.318	0	1
	East Midlands	0.097	0.296	0	1
	West Midlands	0.110	0.313	0	1
	South West	0.113	0.317	0	1
	East of England	0.096	0.294	0	1
	London	0.106	0.308	0	1
	South East	0.141	0.348	0	1
Adult Education	Attended post-school English or literacy course	0.098	0.297	0	1
	Attended post-school maths or numeracy course	0.075	0.264	0	1

3 The determinants of literacy and numeracy

3.1 Introduction

Section 2 demonstrates that there are some clear relationships between literacy, numeracy and personal characteristics. The Skills for Life survey collected considerable background information from respondents and consequently allows some insight into what factors are correlated with (and by extension possibly determine) literacy and numeracy levels. Clearly however many relationships between basic skills and other factors will run two ways, and this needs to be borne in mind when interpreting the results.

3.2 Methodology

The premise behind this analysis is that an individual's basic skills levels are a function of that person's characteristics and background. Such factors as educational history and work experience will undoubtedly influence someone's literacy and numeracy skills, as summarised below;

$$Basic\_skills\_level_i = f(age_i, education_i, parental\_background_i ..etc.)$$

which can be expressed linearly as;

$$Basic\_skills\_level_i = \alpha + \beta X_i + \varepsilon_i$$

where α is a constant, minimum level of literacy or numeracy skills (which could conceivably equal zero) and X_i a matrix containing information on the individual's background and contemporary characteristics.

The Skills for Life survey measures literacy and numeracy on a 5 point (rather than continuous) scale. To lessen the impact of left and right hand censoring (with right hand censoring being particularly high for literacy) and compensate for any non-linearities in the scales we use maximum likelihood interval regression rather than an ordered probit[6]. An alternative approach would be to regress on a simple binary indicator of literacy and numeracy (for example Entry level literacy = 0; Level 1 and above = 1) but this method would sacrifice some of the richness of the data and complicate the interpretation of the results.

We control for age, sex, ethnicity, highest qualification, good GCSE / O-level English or mathematics pass[7], parental background, labour market status, Index of Multiple Deprivation for household's ward, lone parent, any children, English not first language, poor health, and whether participated in post-school English or mathematics course. Furthermore we estimate separate regressions for men and women so to better pick up gender differences.

[6] In practice the results are very similar between the two approaches

[7] Additionally controlling for GCSE /O-level English or maths passes may confound the results for other qualification variables. Excluding the GCSE controls increases the coefficients on the qualifications variables by an average of 16% (literacy) and 26% (numeracy). See Table 3.2 for detailed results.

3.3 Summary results

Table 3.1 gives selected results from the analysis. To give an example of how to read the table take the coefficient for 'Male' under 'determinants of literacy' (-0.051). This shows that men have 0.051 (5.1% of a level) lower literacy than women. However the standard error (-0.027) is large relative to the size of the coefficient (-0.051) and hence we cannot be certain at a 95% level of confidence that the effect is not in fact zero. For degree or above the coefficient is 1.139, hence degree holders have literacy 1.139 levels above those with no qualifications, this result is significant to 1% (indicated by two asterisks) hence we can be sure that this effect is different from zero.

Table 3.1

Interval regression on 5 point literacy and numeracy scale	Determinants of literacy			Determinants of numeracy		
	Both sexes	Male	Female	Both sexes	Male	Female
Male	-0.051			0.332		
	-0.027			(0.028)**		
Age	0.011	0.031	-0.005	0.013	0.004	0.02
	-0.009	(0.015)*	-0.011	-0.009	-0.015	-0.012
Highest qualification (base: no quals)						
Degree or above	1.139	1.153	1.135	1.143	1.234	1.071
	(0.057)**	(0.085)**	(0.076)**	(0.054)**	(0.083)**	(0.072)**
Other HE qualification	0.815	0.957	0.727	0.715	0.777	0.682
	(0.055)**	(0.089)**	(0.070)**	(0.055)**	(0.094)**	(0.069)**
A levels / Level 3 or equivalent	0.764	0.747	0.784	0.684	0.724	0.652
	(0.050)**	(0.075)**	(0.067)**	(0.048)**	(0.074)**	(0.063)**
5+ GCSEs / O-levels grade A*-C or equivalent	0.63	0.633	0.634	0.479	0.454	0.495
	(0.046)**	(0.072)**	(0.059)**	(0.044)**	(0.072)**	(0.054)**
Below Level 2	0.605	0.580	0.623	0.330	0.362	0.313
	(0.058)**	(0.099)**	(0.071)**	(0.060)**	(0.102)**	(0.074)**
Other qualifications, level unknown	0.426	0.554	0.301	0.342	0.331	0.350
	(0.076)**	(0.119)**	(0.099)**	(0.078)**	(0.117)**	(0.105)**
Still in education	1.079	1.084	1.012	0.903	0.921	0.870
	(0.084)**	(0.125)**	(0.113)**	(0.085)**	(0.133)**	(0.111)**
Whether GCSE / O-level English (literacy) maths (numeracy) grade C or above	0.299	0.310	0.295	0.558	0.563	0.553
	(0.033)**	(0.049)**	(0.044)**	(0.033)**	(0.053)**	(0.042)**
Parental background (base: Neither parent educated beyond primary school)						
Neither parent completed secondary school	0.166	0.167	0.176	0.145	0.254	0.073
	-0.095	-0.144	-0.127	-0.096	-0.148	-0.124
Most educated parent completed secondary school	0.192	0.104	0.271	0.16	0.206	0.132
	(0.090)*	-0.135	(0.120)*	-0.091	-0.138	-0.117
Most educated parent attended further education	0.381	0.209	0.525	0.39	0.326	0.435
	(0.100)**	-0.15	(0.134)**	(0.101)**	(0.155)*	(0.129)**
At least one parent attended university	0.399	0.277	0.502	0.43	0.479	0.403
	(0.096)**	-0.144	(0.130)**	(0.097)**	(0.148)**	(0.125)**
Parental education missing	0.013	-0.041	0.061	-0.039	0.049	-0.112
	-0.095	-0.141	-0.127	-0.094	-0.143	-0.122
Employment status (base: inactive)						
Employee	0.088	0.13	0.053	0.172	0.259	0.118
	(0.035)*	-0.071	-0.041	(0.036)**	(0.073)**	(0.042)**

Self employed	0.036	0.074	0.004	0.156	0.249	0.074
	-0.056	-0.086	-0.081	(0.058)**	(0.091)**	-0.085
Job seeker	-0.043	-0.016	-0.052	-0.019	0.103	-0.084
	-0.066	-0.099	-0.094	-0.068	-0.099	-0.104
Respondent ever worked?	0.245	0.027	0.357	0.074	-0.024	0.140
	(0.076)**	-0.137	(0.090)**	-0.07	-0.132	-0.083
Index of multiple deprivation [base IMD 70+ (very deprived)]						
IMD 0-9	0.338	0.343	0.313	0.347	0.507	0.257
	(0.094)**	(0.147)*	(0.122)*	(0.095)**	(0.163)**	(0.116)*
IMD 10-19	0.291	0.316	0.247	0.295	0.408	0.237
	(0.091)**	(0.143)*	(0.118)*	(0.092)**	(0.158)**	(0.113)*
IMD 20-29	0.166	0.28	0.051	0.201	0.382	0.08
	-0.092	-0.144	-0.119	(0.093)*	(0.159)*	-0.115
IMD 30-39	0.145	0.156	0.108	0.117	0.183	0.085
	-0.094	-0.147	-0.12	-0.094	-0.161	-0.114
IMD 40-49	0.095	0.095	0.078	0.100	0.227	0.021
	-0.096	-0.149	-0.123	-0.095	-0.163	-0.117
IMD 50-59	0.151	0.137	0.133	0.087	0.115	0.087
	-0.107	-0.169	-0.137	-0.105	-0.178	-0.131
IMD 60-69	0.097	0.091	0.062	-0.043	-0.015	-0.035
	-0.110	-0.174	-0.141	-0.112	-0.183	-0.142
Lone parent	-0.081	0.162	-0.045	-0.047	-0.232	-0.007
	-0.049	-0.192	-0.052	-0.049	-0.165	-0.054
Child under 4 in household	0.085	0.245	-0.030	0.114	0.304	-0.053
	-0.049	(0.080)**	-0.062	(0.050)*	(0.085)**	-0.064
Child aged 4-16 in household	0.055	0.108	0.000	0.104	0.183	0.015
	-0.036	(0.054)*	-0.048	(0.036)**	(0.055)**	-0.05
Ethnicity (base: white)						
Black	-0.428	-0.248	-0.532	-0.679	-0.833	-0.591
	(0.088)**	-0.149	(0.108)**	(0.086)**	(0.134)**	(0.110)**
Asian	-0.372	-0.303	-0.413	-0.409	-0.236	-0.539
	(0.090)**	(0.130)*	(0.124)**	(0.091)**	-0.139	(0.122)**
East Asian	0.128	1.019	-0.334	0.478	0.826	0.288
	-0.281	(0.452)*	-0.325	(0.185)**	(0.339)*	-0.203
other ethnicity	-0.187	-0.352	-0.012	-0.222	-0.466	0.001
	-0.155	-0.23	-0.2	-0.151	(0.203)*	-0.204
Learning difficulties (inc dyslexia)	-0.791	-0.832	-0.74	-0.781	-0.774	-0.797
	(0.072)**	(0.100)**	(0.104)**	(0.063)**	(0.089)**	(0.089)**
English not first language (ENFL)	-0.498	-0.566	-0.457	-0.355	-0.374	-0.332
	(0.080)**	(0.131)**	(0.100)**	(0.082)**	(0.132)**	(0.102)**
ENFL and poor English speaking skills	-1.154	-1.531	-0.983	-1.043	-1.273	-0.93
	(0.272)**	(0.295)**	(0.368)**	(0.195)**	(0.244)**	(0.253)**
Self reported poor health	-0.209	-0.238	-0.179	-0.131	-0.026	-0.181
	(0.060)**	(0.100)*	(0.076)*	(0.062)*	-0.104	(0.078)*
Engaged in post-school English (literacy) maths (numeracy) course	-0.004	0.035	-0.03	0.558	0.563	0.553
	-0.046	-0.069	-0.061	(0.033)**	(0.053)**	(0.042)**
Constant	3.245	2.885	3.534	2.31	2.555	2.383
	(0.234)**	(0.384)**	(0.286)**	(0.243)**	(0.405)**	(0.303)**
Observations	7,511	3,338	4,173	7,511	3,338	4,173
Robust standard errors in parentheses						
* significant at 5%; ** significant at 1%						

3.3.1 Results: Literacy

As one may expect the greatest influence on literacy comes from educational background. Those with degrees are on average over one literacy level above those with no qualifications when controlling for other factors.

The effect of parental background also appears strong, with the effect significantly greater for women than men. The greatest effect is from having one parent engage in post-16 education, being correlated with a 1/10th (men) and 1/4th (women) higher literacy level over just having the most educated parent complete secondary school. Perhaps surprisingly this result is greater than the marginal effect of having a parent attend university over participating in further education, which appears to have a zero effect for women (-0.023 of a level [= 0.502 – 0.525]) and only a small effect for men (0.069 of a level [= 0.277 – 0.209]). This suggests an important result for policy makers interested in intergenerational effects on literacy and numeracy: it is staying on post-16 that makes the difference on your children's literacy and numeracy, not going into tertiary education. This finding appears to be particularly strong for women.

For women whether they have ever worked has the largest effect for all the employment variables, with those that have enjoying a third of a level higher literacy. However this relationship is likely to run both ways; poor literacy hampers employment and a lack of employment experience hampers the development of literacy skills. For men whether the respondent has ever worked has an approximate zero value with being in current employment having the larger correlation at 0.13 for employees and 0.074 for the self employed.

Local deprivation is also likely to be a two-way relationship, with those with poor skills not having the opportunities to relocate to less deprived areas as measured by the Index of Multiple Deprivation. However the effect is relatively small with those in the least deprived areas only having 1/3rd of a level higher literacy than those in the most deprived areas.

Having children present in the household is significantly correlated with male literacy, but surprisingly has no effect for women. Though the effect isn't large no convincing argument presents itself to explain this. Perhaps this relationship picks up otherwise unobserved differences between men who live with their children and those that either don't live with their children or do not have any children. A further, perhaps optimistic explanation would be that men living with children improve their own literacy skills through greater exposure to school learning materials, reading with the child and helping with homework.

Ethnicity has a very strong effect. Being in a Black or Asian ethnic group is strongly correlated with poorer literacy skills, in particular for women. The size of the effects are surprising given we are controlling for other factors such as education and English as a first language. For example Black women have literacy half a level below an observationally equivalent white woman, and south Asian women are 4/10ths of a level below.

English not first language (ENFL) speakers are half a level below first language speakers, though ENFL respondents who self-report poor English speaking skills are an additional 1 level lower.

As one may expect learning difficulties are significant explanatory factors of literacy skills, with those with learning difficulties an average 3/4ths of a level

lower literacy. Poor health is correlated with 1/5th of a level lower literacy.

Interestingly when controlling for the factors listed above, men appear to have slightly worse literacy than women, though this effect is small at around 1/20th of a level and is only significant at the 10% level.

Finally, respondents who reported attending an adult learning English course appear to have the same level of literacy as similar individuals who have not attended such a course. Removing GCSE English from the equation does not affect this finding, removing doubt that this variable may be picking up the variation (e.g. the literacy course resulted in a GCSE English certificate).

3.3.2 Results: numeracy

A similar pattern is repeated for numeracy as for literacy. Highest qualification has the largest effect, with someone holding a degree likely to have numeracy skills one level higher than a similar individual with no qualifications. Overall the effect of holding a particular qualification on someone's numeracy is about 20% less than the effect on their literacy. However this is explained by the greater effect GCSE maths has on numeracy levels. Someone with grade C or above mathematics is likely to have half a level higher numeracy than someone without, regardless of highest qualification held. This compares to around one third of a level for GCSE English.

Overall parental background has approximately the same effect on numeracy as for literacy though the effect is stronger for men and weaker for women. Local deprivation appears to have a similar effect on numeracy as it does on literacy, though the effect on numeracy appears to be stronger for men.

Employment is more strongly correlated with numeracy than literacy, with those employed or self employed having numeracy 1/6th of a level higher. The relationship between never working and poor numeracy is also strong, in particular for women, with those who have never worked possessing numeracy skills 4/10ths of a level lower.

As for literacy, the correlation between living with children and adult numeracy is strong for men (a quarter of a level) but not for women.

The relationship between ethnicity and numeracy is again very strong. Perhaps most shocking is the finding that being of Black ethnic origin appears to have a greater effect on your numeracy than having a learning difficulty. Black men in particular fair badly having on average ¾qtrs of a level lower numeracy, for Asian women the effect is 3/10ths of a level, whilst for Asian men the result is not significant.

Learning difficulties are also associated with lower levels of numeracy, at around half a level, contrasting against ¾qtrs of a level for literacy. Poor health is not associated with significantly worse numeracy skills.

Having English as a second language is associated with 1/3rd of a level lower numeracy reflecting that you still need some English language skills to succeed at numeracy. However this effect is smaller than the equivalent effect for literacy, indicating the greater universality of mathematics.

Gender, as the raw results would suggest, has a significant effect on numeracy performance, with men performing around 1/3rd of a level higher than women.

Having attended a numeracy course, as with literacy, has no discernable effect on an individual's numeracy level. Removing GCSE mathematics from the equation, as with literacy and GCSE English, does not affect this finding.

3.4 Conclusions

The analysis presented provides some interesting results. Highest qualification appears to be the best predictor of an individual's literacy and numeracy level, with parental background and local deprivation having larger effects than current employment status, though whether someone has ever had a job is also a strong predictor. Unsurprisingly not speaking English as your first language or having learning difficulties is associated with lower skills though more surprising are the strong ethnicity effects.

Table 3.2: Results excluding good GCSE / O-level English / mathematics pass

Interval regression on 5 point literacy and numeracy scale	Determinants of literacy			Determinants of numeracy		
Highest qualification (base: no quals)						
Degree or above	1.366	1.378	1.366	1.535	1.643	1.449
	(0.052)**	(0.078)**	(0.069)**	(0.049)**	(0.074)**	(0.067)**
Other HE qualification	1.01	1.135	0.937	1.01	1.13	0.944
	(0.051)**	(0.084)**	(0.063)**	(0.054)**	(0.089)**	(0.067)**
A levels / Level 3 or equivalent	0.94	0.905	0.979	0.934	0.974	0.904
	(0.046)**	(0.070)**	(0.060)**	(0.046)**	(0.071)**	(0.061)**
5+ GCSEs / O-levels grade A*-C or equivalent	0.803	0.783	0.825	0.69	0.668	0.704
	(0.042)**	(0.068)**	(0.052)**	(0.042)**	(0.070)**	(0.052)**
Below Level 2	0.591	0.562	0.612	0.302	0.329	0.29
	(0.058)**	(0.099)**	(0.071)**	(0.061)**	(0.102)**	(0.075)**
Other qualifications, level unknown	0.431	0.556	0.31	0.349	0.334	0.366
	(0.077)**	(0.120)**	(0.099)**	(0.078)**	(0.118)**	(0.105)**
Still in education	1.263	1.251	1.209	1.208	1.229	1.172
	(0.082)**	(0.124)**	(0.109)**	(0.086)**	(0.135)**	(0.113)**
Observations	7,511	3,338	4,173	7,511	3,338	4,173
Robust standard errors in parentheses						
* significant at 5%; ** significant at 1%						

3.5 Determinants of literacy and numeracy; detailed results

The results presented below match those in Table 3.1 above. Here we present coefficients for *all* the control variables.

Interval regression on 5 point literacy and numeracy scale	Determinants of literacy			Determinants of numeracy		
	Both sexes	Male	Female	Both sexes	Male	Female
Male	-0.051			0.332		
	-0.027			(0.028)**		
Age	0.011	0.031	-0.005	0.013	0.004	0.02
	-0.009	(0.015)*	-0.011	-0.009	-0.015	-0.012
Age squared	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
Age between 16-30	-0.058	0.095	-0.147	-0.062	-0.094	-0.034
	-0.054	-0.09	(0.067)*	-0.058	-0.097	-0.071
Age over 46	0.093	0.001	0.168	0.074	-0.044	0.155
	-0.058	-0.089	(0.077)*	-0.058	-0.092	(0.076)*
Highest qualification						
Degree or above	1.139	1.153	1.135	1.143	1.234	1.071
	(0.057)**	(0.085)**	(0.076)**	(0.054)**	(0.083)**	(0.072)**
Other HE qualification	0.815	0.957	0.727	0.715	0.777	0.682
	(0.055)**	(0.089)**	(0.070)**	(0.055)**	(0.094)**	(0.069)**
A levels / Level 3 or equivalent	0.764	0.747	0.784	0.684	0.725	0.652
	(0.050)**	(0.075)**	(0.067)**	(0.048)**	(0.074)**	(0.063)**
5+ GCSEs / O-levels grade A*-C or equivalent	0.630	0.633	0.634	0.479	0.454	0.495
	(0.046)**	(0.072)**	(0.059)**	(0.044)**	(0.072)**	(0.054)**
Below Level 2	0.605	0.580	0.623	0.33	0.362	0.312
	(0.058)**	(0.099)**	(0.071)**	(0.060)**	(0.102)**	(0.074)**
Other qualifications, level unknown	0.426	0.554	0.301	0.342	0.331	0.350
	(0.076)**	(0.119)**	(0.099)**	(0.078)**	(0.117)**	(0.105)**
Still in education	1.079	1.084	1.012	0.903	0.921	0.870
	(0.084)**	(0.125)**	(0.113)**	(0.085)**	(0.133)**	(0.111)**
Whether GCSE / O-level English (literacy) maths (numeracy) grade C or above	0.299	0.310	0.295	0.558	0.563	0.553
	(0.033)**	(0.049)**	(0.044)**	(0.033)**	(0.053)**	(0.042)**
Parental background (base: Neither parent educated beyond primary school)						
Neither parent completed secondary school	0.166	0.167	0.176	0.145	0.254	0.073
	-0.095	-0.144	-0.127	-0.096	-0.148	-0.124
Most educated parent completed secondary school	0.192	0.104	0.271	0.16	0.206	0.132
	(0.090)*	-0.135	(0.120)*	-0.091	-0.138	-0.117
Most educated parent attended further education	0.381	0.209	0.525	0.39	0.326	0.435
	(0.100)**	-0.15	(0.134)**	(0.101)**	(0.155)*	(0.129)**
At least one parent attended university	0.399	0.277	0.502	0.43	0.479	0.403
	(0.096)**	-0.144	(0.130)**	(0.097)**	(0.148)**	(0.125)**
Parental education missing	0.013	-0.041	0.061	-0.039	0.049	-0.112
	-0.095	-0.141	-0.127	-0.094	-0.143	-0.122
Employment status (base: inactive)						
Employee	0.088	0.13	0.053	0.172	0.259	0.118
	(0.035)*	-0.07	-0.041	(0.036)**	(0.073)**	(0.042)**
Self employed	0.036	0.074	0.004	0.156	0.249	0.074
	-0.056	-0.086	-0.081	(0.058)**	(0.091)**	-0.085

Govt sponsored employment training	0.297	-0.012	0.768	0.171	0.317	-0.133
	-0.193	-0.25	(0.267)**	-0.226	-0.298	-0.36
Unpaid work for business	-0.073	0.211	-0.267	0.09	0.099	0.16
	-0.194	-0.314	-0.242	-0.217	-0.371	-0.262
Job seeker	-0.043	-0.016	-0.052	-0.019	0.103	-0.084
	-0.066	-0.099	-0.094	-0.068	-0.099	-0.104
Respondent ever worked?	0.245	0.027	0.357	0.074	-0.024	0.140
	(0.076)**	-0.137	(0.090)**	-0.07	-0.132	-0.083
Index of multiple deprivation [base IMD 70+ (very deprived)]						
IMD 0-9	0.338	0.343	0.313	0.347	0.507	0.257
	(0.094)**	(0.147)*	(0.122)*	(0.095)**	(0.163)**	(0.116)*
IMD 10-19	0.291	0.316	0.247	0.295	0.408	0.237
	(0.091)**	(0.143)*	(0.118)*	(0.092)**	(0.158)**	(0.113)*
IMD 20-29	0.166	0.28	0.051	0.201	0.382	0.08
	-0.092	-0.144	-0.119	(0.093)*	(0.159)*	-0.115
IMD 30-39	0.145	0.156	0.108	0.117	0.183	0.085
	-0.094	-0.147	-0.12	-0.094	-0.161	-0.114
IMD 40-49	0.095	0.095	0.078	0.100	0.227	0.021
	-0.096	-0.149	-0.123	-0.095	-0.163	-0.117
IMD 50-59	0.151	0.137	0.133	0.087	0.115	0.087
	-0.107	-0.169	-0.137	-0.105	-0.178	-0.131
IMD 60-69	0.097	0.091	0.062	-0.043	-0.015	-0.035
	-0.110	-0.174	-0.141	-0.112	-0.183	-0.142
Lone parent	-0.081	0.162	-0.045	-0.047	-0.232	-0.007
	-0.049	-0.192	-0.052	-0.049	-0.165	-0.054
Child under 4 in household	0.085	0.245	-0.030	0.114	0.304	-0.053
	-0.049	(0.080)**	-0.062	(0.050)*	(0.085)**	-0.064
Child aged 4-16 in household	0.055	0.108	0.000	0.104	0.183	0.015
	-0.036	(0.054)*	-0.048	(0.036)**	(0.055)**	-0.05
Ethnicity (base: white)						
Black	-0.428	-0.248	-0.532	-0.679	-0.833	-0.591
	(0.088)**	-0.149	(0.108)**	(0.086)**	(0.134)**	(0.110)**
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East Asian	0.128	1.019	-0.334	0.478	0.826	0.288
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other ethnicity	-0.187	-0.352	-0.012	-0.222	-0.466	0.001
	-0.155	-0.23	-0.2	-0.151	(0.203)*	-0.204
Learning difficulties (inc dyslexia)	-0.791	-0.832	-0.74	-0.781	-0.774	-0.797
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English not first language (ENFL)	-0.498	-0.566	-0.457	-0.355	-0.374	-0.332
	(0.080)**	(0.131)**	(0.100)**	(0.082)**	(0.132)**	(0.102)**
ENFL and poor English speaking skills	-1.154	-1.531	-0.983	-1.043	-1.273	-0.93
	(0.272)**	(0.295)**	(0.368)**	(0.195)**	(0.244)**	(0.253)**
Self reported poor health	-0.209	-0.238	-0.179	-0.131	-0.026	-0.181
	(0.060)**	(0.100)*	(0.076)*	(0.062)*	-0.104	(0.078)*
Engaged in post-school English (literacy) maths (numeracy) course	-0.004	0.035	-0.03	0.558	0.563	0.553
	-0.046	-0.069	-0.061	(0.033)**	(0.053)**	(0.042)**
Constant	3.245	2.885	3.534	2.31	2.555	2.383
	(0.234)**	(0.384)**	(0.286)**	(0.243)**	(0.405)**	(0.303)**
Observations	7,511	3,338	4,173	7,511	3,338	4,173
Robust standard errors in parentheses						
* significant at 5%; ** significant at 1%						

4 Estimating the association between literacy and numeracy skills and earnings

4.1 Introduction

Investigation into the earnings returns to additional years of schooling and formal qualifications has advanced significantly in the past decade. These returns are of interest to the policymaker as, so the logic goes, a positive private return is likely to reflect individuals being rewarded in the labour market for their higher productivity. More productive individuals should then aggregate up to a more productive economy, for the benefit of all.

Studies investigating returns to skills rather than qualifications are less prevalent. This discrepancy is in large part due to the absence of good data on workers skills levels, and the difficulties in classifying different skills types, from job and sector specific skills, interpersonal and soft skills, to literacy and numeracy skills.

Unlike formal learning that results in a qualification, the returns to which can be estimated using cross sectional data, measuring the returns to *acquiring* basic skills can not be satisfactorily estimated using a cross sectional dataset. This is because formal qualifications have either been taken by an individual or not, and those that have taken a qualification have all been taught approximately the same material at the same level. This differs considerably from the process through which individuals gain literacy and numeracy skills. These skills are a product of numerous background factors and experiences that vary across individuals and are hence considerably harder to measure and record. Consequently, armed only with cross sectional, one point in time data we can only examine, in line with previous research, the differences in earnings that can be explained by differences in literacy and numeracy skills across individuals, not the *returns* to improving literacy or numeracy skills as an adult. These earnings effects are estimated by examining differences in earnings between *observably* identical individuals with different literacy or numeracy test scores.

4.2 Previous research

Much of the existing research aims to help inform our understanding of the impact of an adult's basic skills on their labour market performance. However, with key policy question being 'what is the labour market impact of improving adult basic skills?' data limitations force much of the research examining the returns to literacy and numeracy to compare observably similar individuals with different literacy or numeracy levels in adulthood, and, controlling for other factors, attribute these differences to differences in wages or earnings. The coefficients estimated for 'good' skills are of great interest and hint at the cost to an individual of having poor basic literacy or numeracy skills, but crucially they do not tell us the impact of that individual *improving* their basic skills, the policy question we are looking to answer here.

McIntosh and Vignoles (2000)[8]

In this paper the authors use both the National Child Development Survey (NCDS) and International Adult Literacy Survey (IALS, 1996) data to assess the impact of literacy and numeracy on respondents' labour market outcomes, including wages.

[8] Reproduced in Dearden *et al* 2000

From the NCDS a 10% subgroup were followed up in 1995 and tested on their literacy and numeracy skills. The NCDS has the advantage of including test scores from when the respondents were 7 and 16 years old and hence can attempt to control for ability prior to schooling and ability prior to post-compulsory education and the entering of the labour market. This 10% subgroup totals 854 observations in total, all of whom were aged 37 when their literacy and numeracy were tested.

The IALS sample comprises a larger sample of 3,811 and covers people aged 16-65. There is no explicit prior ability measure though qualification data were collected. Excluding students and those without recorded earnings data leaves a usable sample of 1,533.

The paper tests a variety of specifications, with Level 1 literacy or numeracy being the key explanatory variable under scrutiny, proxied from the data that records literacy and numeracy levels on a 'very low, low… very good' scale. As discussed above the model being estimated attempts to attribute differences in wages to differences in basic skills, rather than estimating the benefits of an adult improving his or her basic skills.

McIntosh and Vignoles find some disparity of results from the two datasets, as shown in Table 4.1. In part this is to be expected due to the differences between the two datasets, the most significant of which are the wage (NCDS) vs earnings (IALS) and the constant age 37 (NCDS) vs 16-65 (IALS). The measures of literacy and numeracy also differ.

The most significant of these is the difference between the IALS and NCDS estimates for Level 1 literacy (IALS gives a coefficient of 0.114 whilst the NCDS returns 0.026 [highlighted], earnings/wage effects of 12.0% and 2.6% respectively[9]). It is impossible to say what is the primary cause of the difference between these two estimates, though part of the gap is likely to be the relationship between higher literacy skills and a higher probability of working longer hours.

Table 4.1 - Wage effects associated with Level 1 numeracy and literacy skills (McIntosh & Vignoles, 2000)

	(a)	(b)	(c)	(d)	(e)	(f)
Numeracy Level 1						
IALS Estimates	0.187	0.114			0.066	
	(0.050)	(0.044)			(0.043)	
NCDS Estimates	0.147	0.108	0.089	0.077	0.069	0.057
	(0.041)	(0.038)	(0.038)	(0.039)	(0.036)	(0.037)
Literacy Level 1						
IALS Estimates	0.152	0.176			0.114	
	(0.061)	(0.056)			(0.054)	
NCDS Estimates	0.148	0.085	0.071	0.047	0.026	0.013
	(0.044)	(0.040)	(0.041)	(0.042)	(0.039)	(0.041)
Controls						
Family background		X	X	X	X	X
Age 7 ability			X	X		X
Age 16 ability				X		X
Education level					X	X

Note: Results are for men and women combined. Dependent variable is log earnings. Standard errors are given in brackets.

McIntosh and Vignoles test a variety of specifications and consequently shows a range of returns, with estimates varying by specification (which controls are

[9] to convert a coefficient to an earnings or wage effect we use $e^{(coefficient)}-1$

included in the regression) and by dataset. Their preferred specification (c), controlling for family background and age 7 ability but not age 16 ability or education level, shows a 9% effect for Level 1 numeracy and a 7% effect for Level 1 literacy.

However, as the authors discuss, specification (c) may not the most appropriate specification to use and raises the important question of what education and ability characteristics the researcher should control for. It is widely accepted that both an individual's education level and 'ability'[10] will generate a wage return in the labour market. However, part of the return to education is likely to be through the impact that education has on the individuals' literacy and numeracy skills. Section 3 hinted at this with degree holders having literacy and numeracy over one level higher than people with no qualifications. Hence in the absence of extremely detailed information on people's education histories it is impossible to unpick the impact of literacy and numeracy on an individual's earnings from other unobserved differences in schooling (e.g. subjects studied at A level or class of degree).

Indeed one can extend this argument by saying that an individual's literacy and numeracy level is likely to be entirely explained by their unobserved ability, schooling, on the job training, work experience and adult learning; If this is the case how, if perfectly controlling for these characteristics, would basic skills across individuals differ? If all differences between individuals' literacy and numeracy skills can be attributed to these determining factors then there is no source for variation between individuals. Hence any literacy or numeracy 'effects' on wages or earnings exist only because the data on unobserved ability, schooling, on the job training etc. are imperfectly measured.[11]

There is no easy method to resolve this situation. At the two extremes you can either;

- control for nothing, which will overstate the earnings effects for literacy and numeracy as you will be picking up the non-literacy and numeracy returns from qualifications and work experience

- or control for everything (given perfect data) which will give a zero literacy and numeracy effect

Faced with imperfect data the researcher is forced to lie somewhere between these two extremes. Which controls to include in your analysis boils down to how important you consider literacy and numeracy to be in explaining the returns to education or ability. If, for example, one feels the majority of the returns to a degree are reaped through improved literacy and numeracy, then not controlling for education should not cause concern, and if education were included its coefficient should be small. However, if one feels the returns to a qualification are reaped mainly through non-literacy and numeracy routes then education should be included. The returned coefficients, however, will still be biased by how well (or poorly) the controls work.

[10] defined as unobservable characteristics that influence earnings over and above other factors (e.g. motivation, interpersonal skills etc.)

[11] This theory can be informally tested: the more information included in the analysis on unobserved ability, schooling, on the job training, work experience and adult learning the smaller the literacy and numeracy effects should be, and indeed McIntosh and Vignoles' results show this to be the case

Figure 4.1

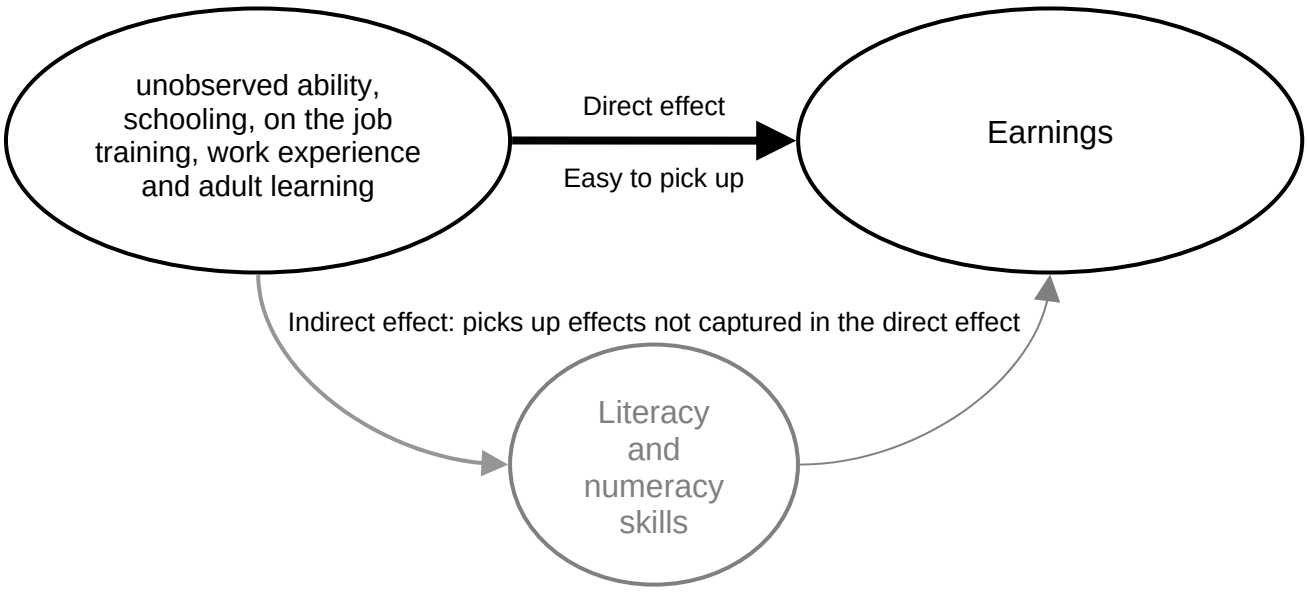


Figure 4.1 illustrates how literacy and numeracy test scores fit into earnings equations. The test scores are picking up otherwise unobserved characteristics in the left-most circle – for example unobserved ability or on-the-job training, two characteristics that are often not recorded in the available datasets. Hence the researcher can not be sure whether literacy and numeracy test scores are merely proxying these otherwise unobserved characteristics, or whether they generate an economic return in their own right.

McIntosh and Vignoles' other specifications (d), (e) and (f) which control for combinations of early ability and education unsurprisingly show smaller coefficients. For Level 1 literacy these range from 1% (NCDS) to 12% (IALS) return, and for numeracy a 6-7% return. The large range on the literacy results has weakened the case for literacy and raised questions over whether measurement error is driving the results.

Machin, McIntosh and Vignoles (2001)

This analysis extends previous work by including 'soft skills' in their specifications. They exploit information gathered at age 16 and 37 by the NCDS on respondents' attitudes to school, life and their perception of themselves. Variables such as responses to attitudinal questions like "school is a waste of time", "I don't get on with my work" and "I feel in control of my life", together with teacher and parental assessments of the respondent were collected at age 16 and self reported assessments of respondents' people skills; trust of others, tendency to argue, attitudes towards achievement, need for control and caring skills were gathered at age 37.

Their paper reiterates the importance of the transmission mechanism through which early ability and soft skills impact on labour market outcomes; namely that there is both a direct effect on earnings and an indirect effect via qualification level. They find the indirect qualification effect to dominate. This conclusion is reached by the finding that most coefficients on attitudinal and ability variables are significantly reduced when highest qualifications are controlled for.

Machin *et al* (2001) find a wage premium of 9% for men and 4% for women for Level 1 numeracy over Entry level, and a 0% and 4% premium for Level 1 literacy

for men and women respectively when controlling for ability, soft skills and highest qualification. However none of these results are significant at a 10% level of confidence.

Furthermore, their paper makes greater use of the longitudinal nature of the NCDS by looking closer at the returns to *progression* of those in the NCDS by considering individuals who moved up the distribution between the age 16 tests and the age 37 tests (i.e. moved up one or more quintiles in the test score distribution). They find an interesting numeracy / literacy split: moving up the numeracy scale between the ages of 16 and 37 increases your probability of employment, whilst moving up the literacy scale brings in higher wages. However, this is not the case across the board. For males in the *lowest* two quintiles there is only a 2% wage premium, compared to an average premium of 8% suggesting that upward movements at the bottom of the scale are the least well rewarded.

Finally, Machin *et al* examine the determinants of increases in real earnings between 1981 and 1991 (a so called fixed effect model) to strip out any unobserved ability and motivational characteristics. The results are subject to large standard errors, and the authors admit this method is asking a lot from the data. Nevertheless one statistically significant pattern was observed: men who move up at the top end of the numeracy scale experience faster wage growth than those who move up at the bottom end of the scale.

McIntosh and Vignoles (2001) in Bynner et al (2001)

The third and most recent paper to exploit the NCDS data, this time alongside the 1970 Birth Cohort Study (BCS70), is by McIntosh and Vignoles (2001) in Bynner *et al* (2001). The BCS70 is similar in design and scope to the NCDS with the a 10% sub-sample of the BCS70 being given literacy and numeracy tests, this time at age 21. The usable sample size is 822. Though the NCDS and BCS70 basic skills tests are different the levels tested can be broadly mapped to Adult Core Curriculum standards as detailed in section 4.3 below.

Their results are summarised below. They show larger effects in the NCDS than those reported in McIntosh and Vignoles (2000). However, these differences are due to a different specification being tested: rather than analysing Entry level vs Level 1, they test Entry level vs Level 1 *and above*, thus capturing the returns to Level 2 and above skills and hence overestimating the returns to Level 1.

Table 4.2 - Wage premium associated with having Level 1 skills or above, as compared to having literacy or numeracy skill levels below Level 1

Controls	NCDS – Numeracy	BCS – Numeracy	NCDS – Literacy	BCS – Literacy
None	26%	16%	16%	9%
equivalent results from (2000)	*(15%)*		*(19%)*	
Education level	13%	12%	8%	6%
equivalent results from (2000)	*(7%)*		*(7%)*	
Mathematics and reading ability on entry into school (age 7), social class and parental interest, type of school, region	8%	10%	2.4%~	6%

~ - insignificant at 10% level

These results again show, as with the original McIntosh and Vignoles (2000) paper, the NCDS returning small and insignificant returns to literacy (2.4%) whilst the BCS returns a larger 6%.

4.3 Methodology

It is worth restating that we are attempting to estimate the benefit to an individual of raising their literacy and numeracy levels as defined by the National Standards ranging from Entry level 1 through to Level 2 and above:

Level 2+	GCSE pass A*-C or above
Level 1	GCSE pass D-G
Entry Level 3	Approx. level expected of an 11 year old (Key stage 2)
Entry Level 2	Approx. level expected of a 9 year old (Key stage 2)
Entry Level 1	Approx. level expected of a 7 year old (Key stage 1)

The Skills for Life survey, however, is cross-sectional, and thus it should be remembered that average earnings differentials are not the same as 'before and after' earnings of an individual undertaking a literacy or numeracy course and successfully upgrading their skills, which is of greater relevance to policy makers in this area[12].

We use maximum likelihood interval regression to regress log earnings over previous year against the individuals' literacy and numeracy levels. Interval regression[13] compensates for the banded and right censored earnings variable contained in the SfL data.

The survey records literacy and numeracy on a 5 point scale. However, for numeracy we create an extra level at the top end of the scale which proxies 'above Level 2'. We can do this for numeracy only as the scoring of the literacy test doesn't rely on a raw literacy score.

Finally due to the small numbers of SfL respondents at Entry level 2 literacy or numeracy we combine Entry levels 1 and 2 to create a four point scale for literacy, and a five point scale for numeracy.

Literacy and numeracy scales included in the regression analysis

	lowest ←				→ highest
Literacy	Entry level 2 and below	Entry level 3	Level 1	Level 2 and above	
Numeracy	Entry level 2 and below	Entry level 3	Level 1	Level 2	Above Level 2

We test three specifications: raw relationship, demographic controls, demographic controls and all qualifications, and present separate results for men and women. Students and respondents without English as their first language are excluded. Given the choice of parametric linear regression we further test sample-restricted models that remove groups from the upper end of the education scale (i.e. drop observations for those who have completed tertiary education) and restrict the sample to those either side of a level boundary (i.e. when testing the effect of

[12] see section 4.2 for a more in depth discussion of this issue
[13] *intreg* command in Stata 7

Level 1 literacy, we drop those with EL1, EL2 or L2+ literacy).

This method of dropping non-relevant observations has the benefit of better fitting the background controls to the group in question (potential basic skills learners) at the level in question (e.g. Entry level 3). The drawback is that the standard errors are likely to increase as the sample size per regression drops. Intuitively this means we are not interested in the benefits of having Level 2 literacy for degree holders (who are unlikely to attend a basic literacy course) nor do we want, say, the effect of the age control for low skilled people to be 'contaminated' by the age effect for degree holders.

Table 4.3 - sample restrictions in regression analysis

Level being analysed	Literacy levels in regression	Numeracy level in regression	Qualifications held
Literacy			
Entry levels 1 & 2	EL1/2, EL3	unrestricted	NVQ level 3 / A levels or below
Entry level 3	EL1/2, EL3		
Level 1	EL3 , L1		
Level 2+	L1, L2+		
Numeracy			
Entry levels 1 & 2	unrestricted	EL1/2, EL3	NVQ level 3 / A levels or below
Entry level 3		EL1/2, EL3	
Level 1		EL3 , L1	
Level 2		L1, L2	
Above Level 2		L2, above L2	

Box 4.1 - regression specification equations

Specification A – raw relationship

$$\ln w_i = \alpha + \lambda_l Lit_i + \eta_l Num_i + \varepsilon_i$$

Specification B – demographic controls

$$\ln w_i = \alpha + \beta X_i + \lambda_l Lit_i + \eta_l Num_i + \varepsilon_i$$

Specification C – demographic controls, *all* qualifications including GCSE maths and English grade A*-C

$$\ln w_i = \alpha + \beta X_i + \gamma Q_i^a + \nu GCSE_{math} + \upsilon GCSE_{Eng} + \lambda_l Lit_i + \eta_l Num_i + \varepsilon_i$$

additional interaction terms when including part-time employees in the sample:

$$\delta PT_i Lit_i + \phi PT_i Num_i$$

restrictions on the sample comprise:

$$i \notin students, English\_not\_first\_language, tertiary\_educated$$

(exclude students, English not first language respondents, and the tertiary educated)

$$\in \begin{cases} l_i = l \\ l_i = l-1 \end{cases}$$ (focus on specific literacy or numeracy level)

where w_i is nominal personal earnings over the previous year, α the constant term, X_i a vector of personal and demographic variables, Q_i^a a vector of dummy variables identifying *all* of an individual's qualifications, and ε_i the error term. Standard errors are computed using White's (1980) adjustment for hetroskedasticity. The additional interaction terms attempt to adjust for the likely correlation between low literacy and numeracy skills and the probability of working part-time.

Demographic controls comprise: age, age squared, gender, ethnicity dummies (white, black, Asian, east Asian, other), parental education (neither parent educated beyond primary level, neither parent completed secondary school, most educated parent completed secondary school, most educated parent attended 6th form, at least one parent attended university, parental education missing), self reported learning difficulties (including dyslexia), self reported poor health, and Government Office Region.

Qualification controls comprise dummy variables for: graduate/ post-graduate qualification, higher education below degree level, A-level / NVQ3 or equivalent, GCSE / O-level A*-C / NVQ2 or equivalent, GCSE D-G / below NVQ2, other qualifications (level unknown). The reference case is 'no qualifications'.

In the specifications we are interested in λ(lambda) and η (eta) – the effects respectively of literacy and numeracy on an individual's earnings. The subscript *l* indicates the level, from Entry level 1&2 to Level 2+.

Given we are concerned with λ and η, we don't have to be overly concerned with biased estimates of β and γ due to unobserved determinants of earnings that are correlated with educational choices.

However λ and η could be biased by other unobserved factors. Likely culprits include 'ability' however defined and communication and other 'soft' skills that may well be correlated with literacy and numeracy and influence earnings. However there is little that we can do to compensate for this. Indeed the literacy and numeracy assessments respondents sat are not too dissimilar from the type of aptitude tests some employers use to assess potential recruits, which would suggest any attempts to measure soft skills and ability is likely to be highly correlated to both their literacy and numeracy performance. A further adjunct to this area is that improving your basic skills through a basic skills course (which is what we are ultimately interested in) may well help an adult's soft skills in addition to their literacy and numeracy and hence it may be desirable to not additionally control for these attributes.

Early (childhood) ability is another key variable not captured in the SfL survey in contrast to the NCDS. In order to better capture the effect of changes in adult literacy and numeracy it may be necessary to control for childhood skill levels. The rational behind this depends on whether childhood skills influence earnings distinct from an individual's education and adult skills levels. Further results from McIntosh and Vignoles (2000) are presented in Dearden *et al* (2000). Table E.1 shows that ability at age 7 and 16 attracts a significant wage premium over and above other factors, including respondents' basic skills. Those in the top quintiles for age 7 and 16 maths ability enjoy an earnings premium of 10% and 5% respectively, even when controlling for their literacy and numeracy levels. Table 7.3 in Dearden *et al* shows the inclusion of age 7 ability lowers the premium to literacy and numeracy by about 17%. These findings suggest that early ability has an effect on earnings separate from an individual's literacy and numeracy skills, and hence the absence of early ability information may bias upwards any returns we find to literacy and numeracy in the Skills for Life survey data. However, dropping the tertiary educated group from the analysis may go part way to compensate for not controlling for early childhood ability.

4.3.1 Heterogeneous effects by age

By including an *age*skills* + *age*^{2}**skills* term in the analysis we can assess whether earnings effects alter by age (for example the effects for better literacy skills are higher for the young). To strengthen the analysis we use the data to simulate any age effects. In order to sustain a sufficient sample we group observations into successive 15-year age groups, and run separate regressions for each group. In practice this means running 46 regressions, one for each age group (16-31, 17-32, 18-33… 50-65, 51-65… 63-65, 64-65, 65). The 15 year band was chosen for practical considerations in order to sustain sample sizes of approximately 800. For ages over 50 we are forced to reduce the 15 year band, and hence the return for 50+ age groups are open to greater error. We use the same controls as in specification C.

4.4 Results

The range of specifications and sample restrictions we test with the data allows for several hundred different combinations to be analysed, each with a separate regression. Given this it is worthwhile summarising how the results from these numerous regressions determined the preferred specification.

4.4.1 The effect of control variables

Controlling for demographic differences between individuals lowered the earnings effect for literacy by around 10% and numeracy 25%. Further controlling for all qualifications held reduced effects by another 15% for literacy and 35% for numeracy.

Other specifications were tested[14] that examined different combinations of qualification and demographic variables (including highest qualification only, excluding GCSE English and maths results, excluding age cohort dummies). In general terms the more qualification variables included the smaller the effect on literacy and numeracy, as we would expect. However the differences are small.

As we would anticipate adding more information into a regression through including more control variables reduces the standard errors for $\boldsymbol{\lambda}$ and $\boldsymbol{\eta}$. In the analysis these standard errors are smallest for specification C.

4.4.2 The effect of sample restrictions

Dropping tertiary educated respondents substantially increases the earnings effects at lower levels. λ for Entry level 3 literacy rises 30% and EL3 numeracy 22% when excluding those with degree or HE qualifications. At higher levels the reverse is true: L2+ literacy falls 20% and L2 numeracy 40%, however for above Level 2 numeracy the effect increased 8%. Overall this restriction increases the standard errors for the basic skills variables by between 25-33%.

Of lesser impact is restricting the sample to those that straddle the basic skills level under investigation. Across all specifications the average difference from these sample restrictions was less than 1%. However, for L2+ literacy and numeracy when excluding tertiary educated respondents earnings effects fall by 10%, whereas for above Level 2 numeracy the earnings effect rose 10%. All these differences are far from being statistically significant. The effect on standard errors is small, increasing by between one and three percent.

4.4.3 Preferred specification

Given standard errors only rise negligibly when restricting the sample to those that straddle the basic skills level in question and that including tertiary educated people significantly biases the results the preferred specification includes the full set of controls, drops degree and HE qualification holders and only includes those that straddle the basic skills level under investigation. In practice this trade off between larger standard errors and fewer sources of bias only shifts one result from significant to insignificant at a 95% level of confidence.

4.4.4 Literacy

The key result is the earnings effect for Level 1 literacy. Respondents with Level 1 literacy have 12% higher earnings than similar respondents with Entry level 3 literacy. Results at other levels do not reach statistical significance due to the small numbers at Entry level 2 and below literacy which produce large standard errors, and the small coefficient to Level 2+ literacy which despite a small

[14] estimation results available from the author on request

standard error does not reach statistical significance.

Splitting the results by gender we see a 26% effect for women at Level 1 and a 9% effect for men (insignificant). This 26% holds even if part-time workers are excluded and hence it doesn't pick up the effect of part-time female workers working longer hours. All other results for literacy are insignificant when separately analysing men and women.

	Earnings effect between:	Both sexes	Male	Female
Literacy[15]	Entry level 2 or below			
	↓	10%	17%	14%
	Entry level 3			
	↓	12%*	9%	26%**
	Level 1			
	↓	2%	0%	7%
	Level 2 and above			

*significant at 5% level, **significant at 1% level

4.4.5 Numeracy

The analysis indicates that the greatest earnings effects are at the extremes of the scale. Entry level 3 numeracy attracts a 13% earnings effect, with a smaller 6% effect for Level 1. The effect for Level 2 numeracy is statistically insignificant. For above Level 2 we find the largest earnings effect at 19%, echoing the findings of previous research that show that reaching the top of the mathematics distribution is lucratively rewarded.

Disaggregating by gender shows significant differences between men and women. For men EL3 returns a 13% effect though for women it is a statistically insignificant 8%. This is reversed at Level 1 where the result for men is insignificant and for women is it 10%. The rewards for above Level 2 skills appear to be equal for both sexes though the female result is insignificant due to the small numbers in the sample at this level.

	Earnings effect between:	Both sexes	Male	Female
Numeracy	Entry level 2 or below			
	↓	13%**	13%*	8%
	Entry level 3			
	↓	6%*	2%	10%*
	Level 1			
	↓	4%	3%	8%
	Level 2			
	↓	19%**	17%*	25%
	above Level 2			

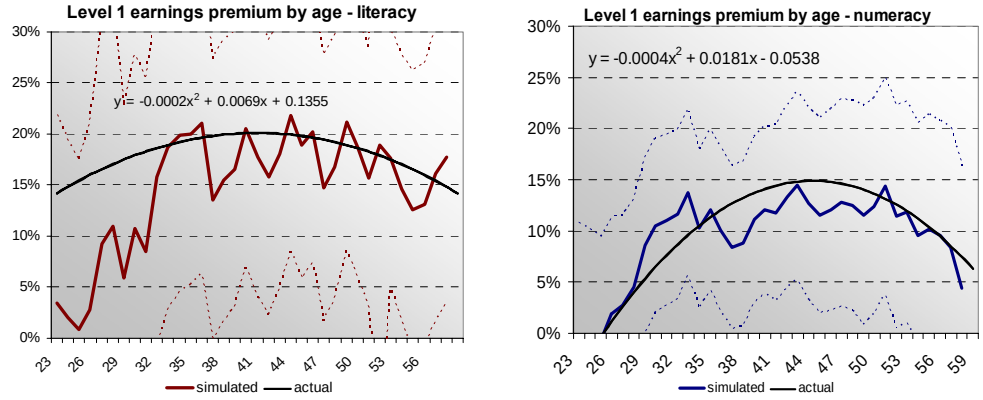
*significant at 5% level, **significant at 1% level

[15] full results are presented in the Annex 4-B

4.4.6 Heterogeneous earnings effects by age

Estimating a model that incorporates an *age*skills* + *age*^{2}**skills* term in the regression, and simulating a quadratic effect by using a rolling 15 year age band, and focusing on the Entry level / Level 1 threshold we find an interesting difference between literacy and numeracy earnings effects by age. As before we exclude the tertiary educated and restrict the sample to those that straddle the basic skills threshold in question.

Figure 4.2



As Figure 4.2 shows, both Level 1 literacy and Level 1 numeracy appear to have a quadratic age profile, with both peaking at around age 45 and then subsequently tailing off. The greatest difference between literacy and numeracy is for the young. The earnings effects for those aged under 30 are still strongly positive for literacy at around 15% but for numeracy we see small or negative earnings effects.

The simulated results have very wide 95% confidence intervals (indicated by the dashed lines) and could easily contain a flat or downward sloping profile for either literacy or numeracy. However the coefficients on *age*skills* + *age*^{2}**skills* are statistically significant for both literacy and numeracy giving us more certainty that this curved profile does exist.

4.5 Conclusions

The Skills for Life survey provides the first opportunity analyse the earnings premiums to different levels of literacy and numeracy with any level of precision.

As we are examining a cross section of adults at one point in time we can not say that the earnings effects reported here are equivalent to the private returns to an adult of improving his or her basic skills. The earnings effects show the differences in earnings that can be explained by differences in literacy and numeracy levels when (imperfectly) controlling for other background characteristics. To better focus on adults who are most likely to have low basic skills we exclude the tertiary educated from the analysis.

We find large earnings effects for both literacy and numeracy skills. There is a 12% premium for Level 1 literacy over Entry level 3 skills. The effect for Level 2 literacy appears to be negligible, and we do not find a statistically significant effect for Entry level 3 literacy over Entry level 2 and below.

For numeracy the results show a 13% earnings effect for Entry level 3 skills over Entry level 2 and below, and a further 6% effect for having Level 1 skills, the equivalent of a D-G grade at GCSE mathematics. However it is at the top end of the numeracy scale where the effects are largest, with a 19% effect for above Level 2 numeracy skills.

Gender differences are also significant for the returns to literacy, with premiums significantly larger for women than men. This difference is not repeated for numeracy.

The analysis by age suggests a quadratic profile for both literacy and numeracy skills, with earnings effects for the young being zero or negative for numeracy, though still positive for literacy.

5 The impact on earnings of participating in a literacy or numeracy course

5.1 Introduction

Literacy and numeracy courses are well established in the adult education sector and date back in various forms 50 years or more. However, explicit analysis of the impact of participation on earnings is lacking, in large part due to a paucity of data in the area. The Skills for Life survey allows us to address this gap.

The Skills for Life survey asked respondents:

> *Have you ever received any training or education in speaking, reading or writing English? Please don't include when you were at school.*

and

> *Have you ever received any training or education in basic maths or number skills? Please don't include when you were at school.*

Responses to these two questions allow us to investigate the impact of the participation in literacy and numeracy courses on respondents.

		English / literacy training						
		Never		Currently		Previously		Total
Maths / numeracy training	Never	7,317	*84%*	74	*1%*	592	*7%*	7,983
	Currently	32	*0%*	21	*0%*	13	*0%*	66
	Previously	399	*5%*	19	*0%*	263	*3%*	681
	Total	7,748		114		868		8,730

84% of the sample have never participated in non-school English or maths training, leaving 16% that have. Around 10% of respondents have attended a non-school English course, 8% a numeracy or mathematics course, and 3% have attended both. Negligible numbers state that they are currently receiving tuition.

The majority finished their training over 3 years ago:

Time since enrolment	Maths		English	
In the last 12 months	77	*11%*	67	*8%*
More than 12 months ago	88	*13%*	131	*15%*
More than 3 years ago	515	*76%*	667	*77%*
Don't know	1	*0.1%*	3	*0.3%*
Total	681		868	

Unfortunately we can not be sure of the route through which people received their mathematics or English training; through evening classes? at work? online? Nor can we be exactly sure at what level the training was pitched[16].

However, for those respondents that said they completed their course in the past

[16] the questionnaire only appended 'basic' to the question on numeracy courses hence English or literacy courses could be potentially at any level

3 years we do have information on their place and method of study:

Main teaching place	Maths course	English course
School / college or university	*51%*	*43%*
Adult education centre	*11%*	*12%*
Community building	*2%*	*5%*
Job centre / job club	*1%*	*1%*
At home	*7%*	*5%*
At work	*24%*	*32%*
Other	*5%*	*3%*

	Math course	English course
Classroom	*77%*	*82%*
One to one tuition	*25%*	*17%*
Internet	*5%*	*4%*
Coaching at work	*14%*	*11%*
Other / don't know	-	*14%*

Multiple-response question, columns do not total 100%

The majority learn via the traditional route of a classroom based college course, but around 1 in 4 learn at work, and for 1 in 20 some learning over the internet is involved.

5.2 Existing research

Previous research exists that has examined the impact of adult education on wages and wage growth. Jenkins *et al* (2002) uses the National Child Development Survey to examine differences in qualification levels between 1991 and 2000 and attributing changes in wages over the period to these differences. Their results are mixed; on average, acquiring formal qualifications between the ages of 33 and 42 did not yield higher wages, though for some groups this wasn't the case. The paper found that men with no qualifications at age 33 earned over 12% more if they engaged in (certified) adult education. Feinstein *et al* (2004) focuses on work related training, which, through cherry picking on the part of employers, appears to generate positive productivity and wage returns.

5.3 Estimating the impact of taking a course: Mahalanobis matching

Two outcome variables present themselves as being suitable for examining the impact of participating in a mathematics or English course: earnings and basic skills level.

Evaluating the impact of any non-compulsory educational investments (for example staying on in post-16 education or attending university) is hampered by the issue of self-selection. Similarly individuals that choose to attend literacy or

numeracy courses are likely to be systematically different from those that do not choose to take a course.

It is likely that the effect of taking a course on those that choose to take a course (the treated) will differ from the effect on those that *do not* choose to take the course (the untreated). Furthermore, the effect of the background controls on the earnings return is also likely to vary by treatment group.

Standard OLS regression, as performed in section 4, will struggle to unpick the assumed different effects of taking a literacy or numeracy course on the treated and untreated groups and instead return an average effect for both groups.

However, a technique now commonly used in the empirical education economics literature, *matching*, goes some way to improve this analysis. One form of matching technique predicts the likelihood of someone choosing to attend, in our case, a literacy or numeracy course (the respondent's *propensity score*), and compares his or her earnings with someone with the same propensity score but who *didn't* in fact attend the course. The average differences in earnings or wages between the matched pairs in the 'treated' and 'non-treated' groups are then reported.

One can go further and match on observables in addition to, optionally, their propensity score. Mahalanobis matching is one such technique. So for example individuals would be matched on their age, sex, educational background etc. in addition to their likelihood of participating in a basic skills course.

Matching techniques have the further advantage of estimating not just the average treatment effect (similar to the effect reported by OLS regression), but can split the effect into an 'average treatment effect on the treated' (those that have taken a course) and, of most interest to policy makers, the 'average treatment effect on the non-treated' – the estimated impact on those that haven't attended a course. The 'average treatment effect on the untreated' or ATU is estimated by looking at the group of non-learners, and matching to similar individuals in the learner group. This type of analysis gives an indication of the possible impact if typical non-learners undertook training. However it is important to note that ATU results rely on the key assumption that individuals do not select onto courses based on their *unobserved* individual gain from attending the course – in other words the treated individuals differ systematically from their untreated matches in some unobserved manner. This problem may bias upward the ATU results.

Our analysis matches on age, gender, education background, ethnicity, parental education, government office region, whether work part-time, health, learning difficulties, and literacy level (if testing numeracy courses) or numeracy level (if testing literacy courses).

Furthermore we exclude those that have participated in higher education to focus more directly on the policy relevant group.

5.3.1 Balancing characteristics between the treatment and control groups

The goal of matching is to *balance* the characteristics of the treatment and control groups so to minimise any bias that may affect the results. For example we find the proportions holding no qualifications differs significantly between the treatment and control groups. Successful matching aims to reduce these differences to zero. However reducing the differences for some variables is more important than others; for example the percentage holding no qualifications is more important than the percentage who's parents attended university. This is because holding no qualifications is more strongly associated with attending an

English or maths course than whether your parents attended university.

Indeed not holding any qualifications appears to be the characteristic most strongly correlated with *not* having ever attended an English or mathematics course. Reporting learning difficulties was also significantly correlated with both participating in maths and English courses. However, beyond these two variables mathematics and English courses do not share any other significant determinants.

Basic mathematics courses

Whereas only 9% of those that have attended a mathematics course (the treated) hold no qualifications, the equivalent proportion for the control group is 21%. Gender differences between the treatment and control groups also exist, with 59% of the treated being male, whilst only 48% are male in the control group. Smaller differences exist for other characteristics for the two groups. Matching does a good job in balancing these two key differences with the matched control group having 13% with no qualifications and 62% being male. Encouragingly the propensity scores for the treatment and control groups are balanced to within one percentage point.

Basic Maths course		**Mean**			
Variable	**Sample**	**Treated**	**Control group**	**% bias**	**% bias reduction**
No qualifications	Pre-matched	0.09	0.21	-31.9	
	Matched	0.09	0.13	-9.1	71.6
Male		0.00	0.00	0.0	
	Pre-matched	0.59	0.49	20.8	
	Matched	0.59	0.62	-6.0	71.2
Learning difficulties	Pre-matched	0.09	0.04	18.7	
	Matched	0.09	0.07	5.8	68.9
Propensity score	Pre-matched	0.10	0.07	64.4	
	Matched	0.10	0.09	25.3	60.7

English courses

The characteristics most significantly correlated with having previously participated in an English course are not holding any qualification, not having English as your first language, having some form of learning difficulty (including dyslexia) or having neither parent complete secondary education (which is negatively correlated). The difference between average propensity scores also narrows significantly between the treated and control groups.

English course		Mean			
Variable	Sample	Treated	Control group	% bias	% bias reduction
No qualifications	Pre-matched	0.15	0.21	-15.2	
	Matched	0.15	0.18	-8.2	46.3
English not first language	Pre-matched	0.14	0.02	45.2	
	Matched	0.14	0.13	6.1	86.4
Neither parent educated beyond primary school	Pre-matched	0.03	0.02	6.7	
	Matched	0.03	0.03	0.1	98.8
Neither parent completed secondary school	Pre-matched	0.08	0.13	-19.1	
	Matched	0.08	0.06	4	79
Learning difficulties	Pre-matched	0.08	0.04	18.9	
	Matched	0.08	0.07	5.1	72.8
Propensity score	Pre-matched	0.13	0.07	58	
	Matched	0.13	0.12	9.2	84.2

Overall Mahalanobis matching appears to work quite well in balancing the treatment and control groups. Other matching methods gave similar or worse balancing results.

5.4 Results

Looking at the raw earnings of respondents without higher education by whether they have participated in an English or maths course shows a clear pattern:

Table 5.1

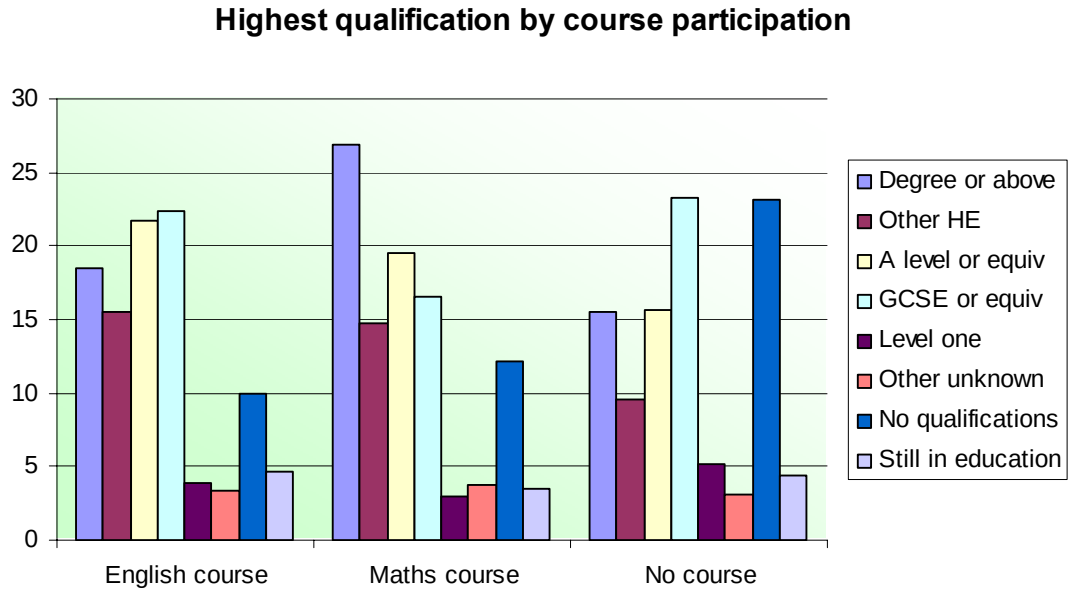
	Average earnings of full-time workers	95% confidence intervals		Average literacy level	Average numeracy level
No training	£18,200	£17,700	£18,700	4.02	3.22
Attended English / literacy course	£21,300	£19,100	£23,400	3.96	-
Attended Maths / numeracy course	£20,900	£18,600	£23,200	-	3.42

Respondents with no higher education and reported earnings data

Those who have taken a course report around 15% higher earnings than those that haven't conditional on being in full-time employment, but not controlling for any other factors.[17]

Numeracy levels are around 6% higher for those that have completed a maths course, but are 2% *lower* for those that have studied an English course. These results may reflect self-selection onto courses, which as Figure 5.1 shows may be the case with maths courses tending to attract higher qualified participants, however these differences in literacy and numeracy levels are not statistically significant.

Figure 5.1



As we see in Figure 5.1 the majority of English and maths course participants are tertiary educated, however the matching analysis that follows excludes this group. It is also interesting to note the high proportion of respondents reporting no qualifications that have not participated in any course.

17 Testing the OLS specification C in section 4 returns coefficients of 0% and 5% (both insignificant) for English and mathematics courses respectively.

5.4.1 Mahalanobis matching

The matching estimates imitate the raw effect on the literacy and numeracy level. The results for English courses are subject to large standard errors and are statistically insignificant from zero. However maths courses return a significant 15% return for the untreated group, a result significant at the 1% level.

The effect on individuals' literacy and numeracy scores is quite small, both for the treated and untreated groups, though this is almost always positive. Given the results from section 3, which showed for example, that degree holders only have numeracy one level above those with no qualifications it should not surprise us that we cannot pickup an effect here. This may also reflect the fact that we do not have information on pre-course basic skills levels and are hence imperfectly matching people on their pre-course basic skills. However we do match on individuals' GCSE performance which may be an acceptable proxy.

		Math course	Standard error	Bias-corrected 95% confidence intervals	
Average treatment effect on the treated	Earnings	0.034	0.087	-0.148	0.188
	Skill level	0.054	0.098	-0.159	0.213
Average treatment effect on the untreated	Earnings	0.150**	0.054	0.050	0.252
	Skill level	0.303**	0.074	0.172	0.455

On common support: treated 215, untreated 2,925
* significant at 5%; ** significant at 1%

		English course	Standard error	Bias-corrected 95% confidence intervals	
Average treatment effect on the treated	Earnings	-0.039	0.077	-0.145	0.169
	Skill level	0.043	0.085	-0.118	0.206
Average treatment effect on the untreated	Earnings	0.055	0.057	-0.057	0.138
	Skill level	0.017	0.065	-0.089	0.171

On common support: treated 249, untreated 2,951
* significant at 5%; ** significant at 1%

The size and significance of the ATU effects reflects the findings in section 4. The impact of numeracy skills on earnings again appears to be larger and more robust than the impact of literacy skills. Again, this highlights the concern that may be picking up unobserved ability effects that are correlated with good numeracy skills and the likelihood of participating in numeracy or mathematics adult education.

5.4.2 Average treatment on the treated

We also see an approximately zero average treatment on the treated (ATT) effects for both literacy and numeracy courses. This indicates that those that actually *do* participate on these courses do not have significantly different earnings to their matches that do not participate. However, as Figure 5.1 shows, the 'no course' group contains significantly higher numbers of people with no qualifications whereas those who take courses are already comparatively well qualified. This would suggest that the returns are highest for those with few or no qualifications, a group who are few in number in the treatment group.[18]

[18] Indeed this appears to be the case. Restricting the analysis to only those with no qualifications

5.4.3 Time since completing the course

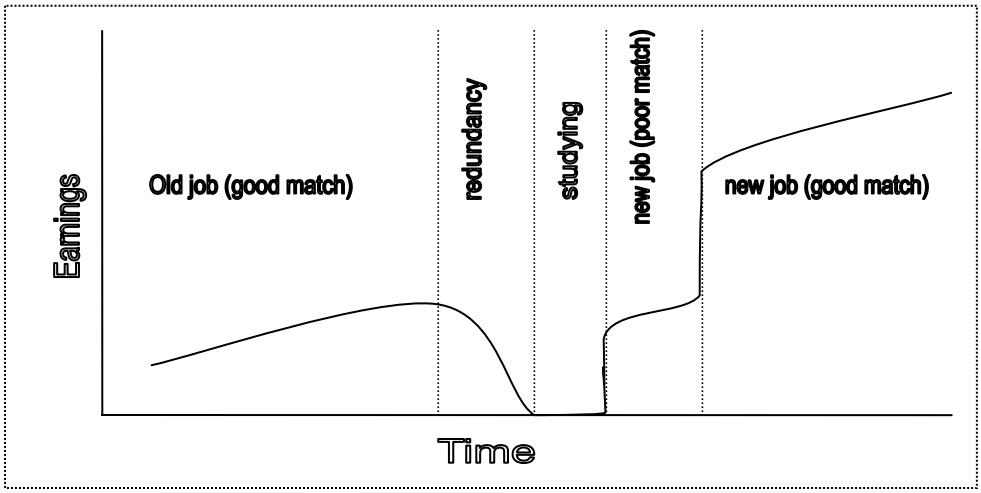
As previously discussed, we can separate the treatment group into two segments; those that completed their training over 3 years ago and those that finished less than 3 years ago. Around 75% of the sample fall into the first group, and 25% into the second.

This may give some insight into the longer term impact of courses, and their influence on labour market outcomes. There may be an Ashenfelter dip at play; the decision to undertake training reflecting a 'shock' to an individual (for example redundancy) and one may expect the years immediately after a period of training to be less well paid whilst the matching process of individual to job works through and the worker climbs back up the employment ladder.

Given much of this English and mathematics training may also be uncertified and hence unrecognised by employers (unlike, for example, a degree) the benefits may only be realised through improved on-the-job performance by the worker, which would take time to feed through to earnings through, say, promotion.

A stylised earnings / time profile is given in Figure 5.2.

Figure 5.2



Here we see a worker progressing in his or her old job, being made redundant (and hence earnings drop to zero), studying (here we see the learner doesn't work whilst studying), finishes studying and takes a comparatively poorly paid job, but over time finds a better job that pays more than his original job as well as his current job.

returns an ATT effect of 13% and 17% and a ATU of 0% & -25% for English and mathematics courses respectively. However less that 40 people fall into the treated groups and these results are not statistically significant.

Figure 5.3

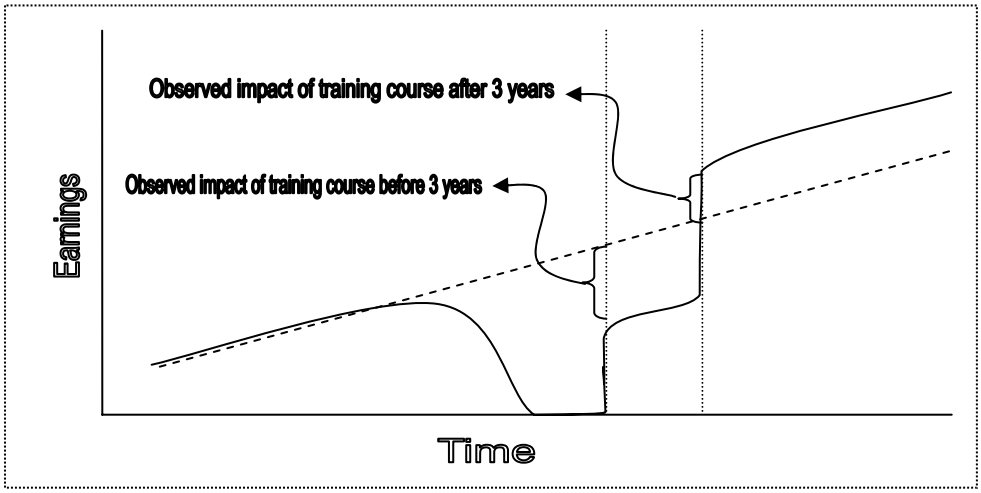


Figure 5.3 shows how measuring the impact of a training course too soon after the end of that training may pick up the impact of the shock that led to the training rather than the impact of the training itself.

This theory is supported by the data. The impact of a course taken over 3 years ago on earnings is positive, large and significant. For those that took a course less than three years ago the effect is generally negative, large but statistically insignificant (due to the small treatment sample). This would suggest an earnings over time profile as pictured in Figure 5.3.

Matching results: Courses taken over three years ago

		Math course over 3 years ago	Standard error	Bias-corrected 95% confidence intervals	
Average treatment effect on the treated	Earnings	0.135	0.091	0.004	0.395
	Skill level	0.071	0.108	-0.141	0.284
Average treatment effect on the untreated	Earnings	0.239**	0.063	0.106	0.346
	Skill level	0.313**	0.076	0.469	0.169

On common support: treated 154, untreated 2,809
* significant at 5%; ** significant at 1%

		English course over 3 years ago	Standard error	Bias-corrected 95% confidence intervals	
Average treatment effect on the treated	Earnings	-0.009	0.090	-0.197	0.111
	Skill level	0.078	0.098	-0.052	0.319
Average treatment effect on the untreated	Earnings	0.118	0.066	0.012	0.206
	Skill level	-0.061	.075	-0.059	0.207

On common support: treated 178, untreated 2,792
* significant at 5%; ** significant at 1%

Matching results: Courses taken under three years ago

		Math course under 3 years ago	Standard error	Bias-corrected 95% confidence intervals	
Average treatment effect on the treated	Earnings	0.000	0.162	-0.271	0.359
	Skill level	0.229	0.234	-0.109	0.947
Average treatment effect on the untreated	Earnings	-0.299**	0.086	-0.458	-0.119
	Skill level	0.150	0.197	-0.275	0.476

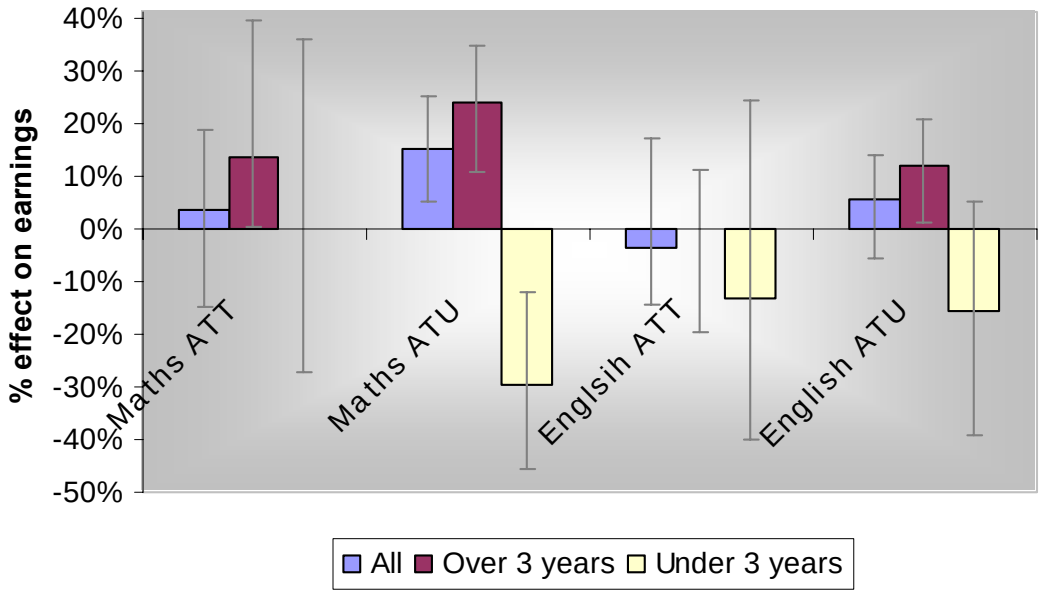
On common support: treated 48 , untreated 2,963
* significant at 5%; ** significant at 1%

		English course under 3 years ago	Standard error	Bias-corrected 95% confidence intervals	
Average treatment effect on the treated	Earnings	-0.134	0.158	-0.399	0.243
	Skill level	0.075	0.206	-0.328	0.490
Average treatment effect on the untreated	Earnings	-0.156	0.106	-0.393	0.049
	Skill level	-0.228**	0.113	-0.501	0.044

On common support: treated 57, untreated 3,002
* significant at 5%; ** significant at 1%

These results are summarised in Figure 5.4. It shows quite clearly that returns to courses taken recently (in the last three years) are estimated as negative, whilst those taken over three years ago are positive. However, due to data limitations the bias-corrected 95% confidence intervals (the whiskers in Figure 5.4) straddle zero for many results, and hence we cannot be certain the estimated effects are not in fact zero for all but maths and English courses taken over three years ago for non-learners.

Figure 5.4 – Treatment effects by course type and time since course



5.5 Conclusions

The Skills for Life survey provides, for the first time, an opportunity to examine the impact of participating in a post-school English / literacy or mathematics / numeracy course on earnings.

Those who have previously participated in courses tend to be higher qualified than those that have never attended. OLS analysis that includes participation on these courses (similar to that undertaken in section 4 but excluding the literacy and numeracy controls) return small and insignificant results (0%-4%) for the impact on earnings.

Matching estimation provides a more interesting picture, with the average treatment on the untreated effect for numeracy courses giving a 15% earnings return, though results for literacy courses are insignificant. However, disaggregating the treatment group by time since participating on the course (using a more than / less then three years ago threshold) estimates significant and positive earnings returns for the untreated group for both English / literacy courses (12%) and numeracy / basic mathematics courses (30%).

However returns for people that have previously participated (the average treatment on the treated) are low indicating that those that benefit the most from attending a basic skills course are the people that currently do not participate. There is evidence to suggest that this group is largely made up of those with no or few qualifications.

6 The impact of adult literacy and numeracy on employment outcomes

6.1 Introduction

This section attempts to demonstrate and quantify the association between the level of an individual's basic skills and their labour market status. The Skills for Life survey shows a clear associative relationship between economic activity and low levels of basic skills. Here we aim to investigate whether this relationship still holds when taking account of other factors that influence labour market participation. The implicit hypothesis is that individuals with low basic skills levels will be more likely to be unemployed or inactive than similar individuals with higher basic skills.

This section will proceed with a short review of previous research on this topic, followed by some basic descriptive statistics related to labour market status. The methodology used is then detailed and the results presented.

6.2 Previous research

McIntosh and Vignoles (2000)[19] use National Child Development Survey and International Adult Literacy Survey (IALS) data to assess employment effects associated with proxied Level 1 literacy and numeracy skills. The dependent variable used is ILO employed vs non-employed[20] excluding fulltime students. They find a 3-4% higher probability of being in employment for those with Level 1 literacy or numeracy rather than Entry level skills. However the majority of their results are insignificant at the 95% level, with only the large IALS literacy results being statistically significant - these are for Level 1 literacy where the IALS dataset returns a 10% higher employment probability[21].

Machin *et al* (2001) follow a similar line to McIntosh and Vignoles but focus on the NCDS including 'soft skill' variables in their analysis. Their findings suggest a 4-5% higher probability of employment (relative to unemployment or inactivity) for men with Level 1 literacy or numeracy, with no further effect for Level 2+ skills. For women the effect is smaller at 3% for Level 1 numeracy and a further 1% for Level 2+ numeracy, literacy appears to have little effect. None of their results are significant at the 95% level, reflecting the small NCDS sample size. When further controls are included (controlling for soft skills and qualifications in addition to age 16 ability) the effect is approximately zero for both men and women.

Bynner *et al* (2001) analyse both the NCDS and the Birth Cohort Study (BCS70) to examine the employment effects of basic skills. Importantly though they compare those with Entry level skills to those with skills at Level 1 *or above*, rather than just those at Level 1 ergo McIntosh and Vignoles (2000) and Machin *et al* (2001). The effects they estimate are slightly larger than in previous studies, possibly reflecting the inclusion of Level 2 skills. The BCS70 literacy results appear particularly large at 6%, and the 4% NCDS numeracy coefficient fits uneasily with

[19] Reproduced in Dearden *et al* 2000

[20] International Labour Organisation definition, where non-employed includes both those unemployed and seeking work together with those classified as inactive, but excluding full-time students

[21] In Annex 6-A we attempt to replicate this research using the Skills for Life data

the cumulative 2% employment effect Machin *et al* find from their NCDS analysis.

It is important to note that the analysis based upon the two cohort studies (NCDS and BCS70) only report the effect at fixed ages (age 37 for NCDS and age 26 for BCS). At these ages most men are in the labour market (and hence the effects shown are compared against unemployment rather than inactivity) and for women the decision to participate in the labour market is largely dependent on child rearing commitments. Hence the results from the NCDS and BCS may not give a representative picture for adults of all ages.

Given this multitude of studies, datasets and specifications it is difficult to draw a definite conclusion as to whether there is any relationship between literacy and numeracy and an adult's likelihood of being in employment. Such factors as the age specific samples in the cohort studies, the different controls introduced (ability test scores at 7 and 16, education level, 'soft skills' etc.) and different basic skills variables (Entry level against Level 1 or Entry level against Level 1 and above, with basic skills levels being measured with different tests in the different datasets) must surely contribute to the variability of the results. All we can be safe in saying is that the analysis to date suggests a small positive effect of better literacy and numeracy skills on an individual's probability of being employed.

Looking internationally Charette and Meng (1998) add further weight to this conclusion. They examine the relationship between literacy, numeracy and labour market outcomes for native born Canadians. They define labour market outcomes as whether the respondent had participated in the labour market in the past 12 months. They conclude that numeracy is "generally a statistically significant determinant of labour market status, whilst literacy is most often not statistically significant." They also find significant differences in the basic skills and employment outcomes relationship between males and females. The different measure of basic skills used[22] does not allow us to compare their results to the existing UK focused research.

6.3 Employment data in the Skills for Life survey

The Skills for Life survey data includes a great deal of background information on interviewees labour market status. Questions asked include:

- Whether employed, self employed, on a government training scheme or a student
- Whether respondent had worked in the last 7 days
- Whether working full or part time, or were away from their business
- Ever had a paid job
- Whether searching for work and / or available to start work
- Reasons for not seeking work (student, looking after family, temporarily / permanently sick or disabled, retired, other, refused)

[22] Charette and Meng use Canada's Survey of Literacy Skills Used in Daily Activities (LSUDA) which reports literacy and numeracy on a 500 point scale.

Additionally other useful background information is available that may affect labour market outcomes:

- Age, qualifications, ethnicity
- Any children under 4 / children aged 5-16 in household
- Whether English is spoken as a first language
- Self assessment of personal health
- Level of parental education
- Government office region

Figure 6.1 - Economically active: [base: 5,615 (75%)] Economically inactive: [base: 1,901 (25%)]

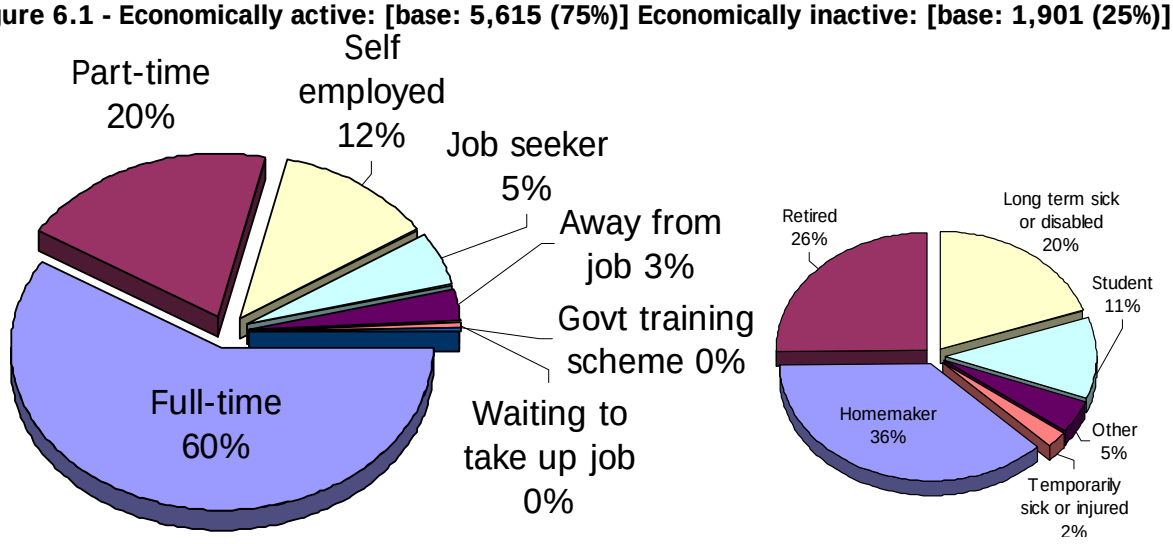


Figure 6.1 shows the composition of the active and inactive groups. Full-time employees make up 60% of the economically active, and 20% fall into categories other than full and part time. Of the inactive, homemakers and early retired form the bulk, though sick, injured and disabled make up 20% of the total.

Just looking at the raw proportions of economically active and inactive at each basic skills level shows a very strong correlation between higher basic skills and greater labour market participation. Figure 6.2 and Figure 6.3 split the sample by gender and highlight this relationship. It is interesting to note that the slope of the lines are approximately the same, with activity rates increasing 40% between EL1 and L2 suggesting changes in literacy and numeracy have similar effects on economic activity for both men and women, but the numeracy line is *above* the literacy line for men, but below for women. This would suggest that it is literacy that matters for women, but numeracy for men, though may reflect that men and women may select into different types of jobs that require different types of skill.

Figure 6.2

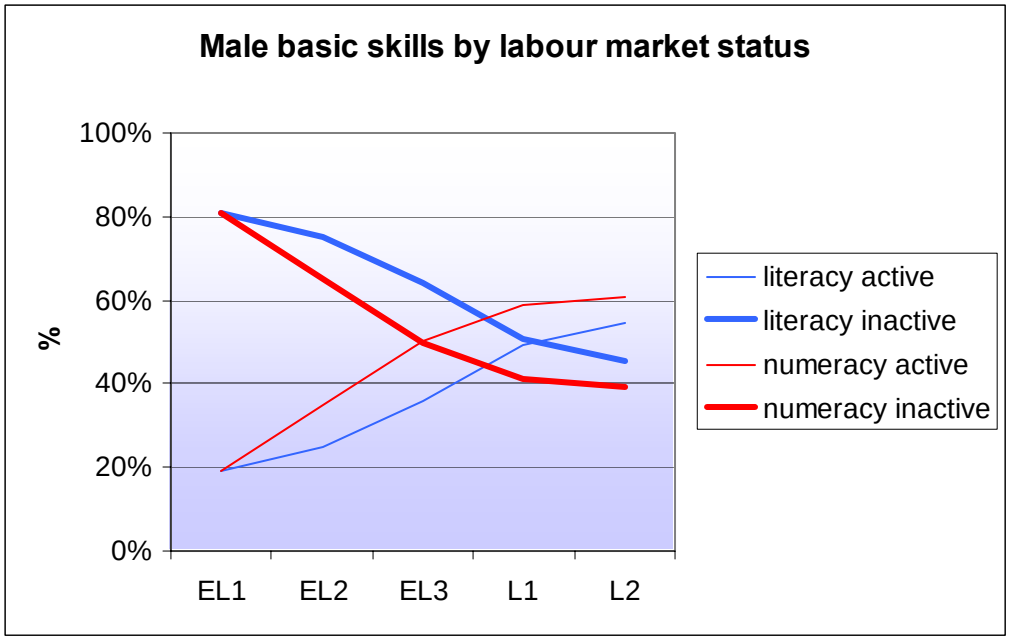


Figure 6.3

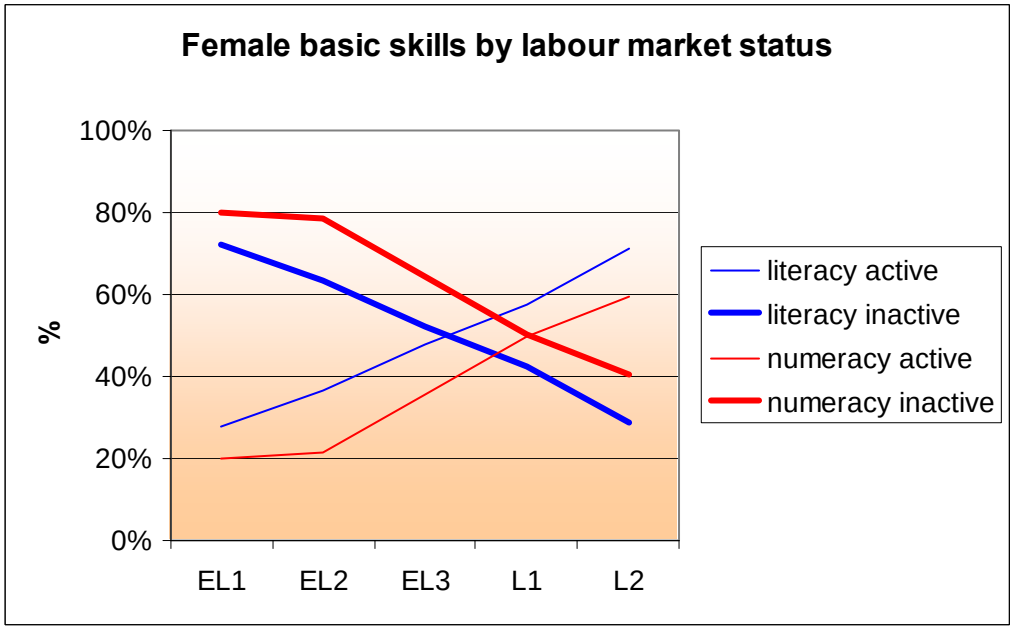
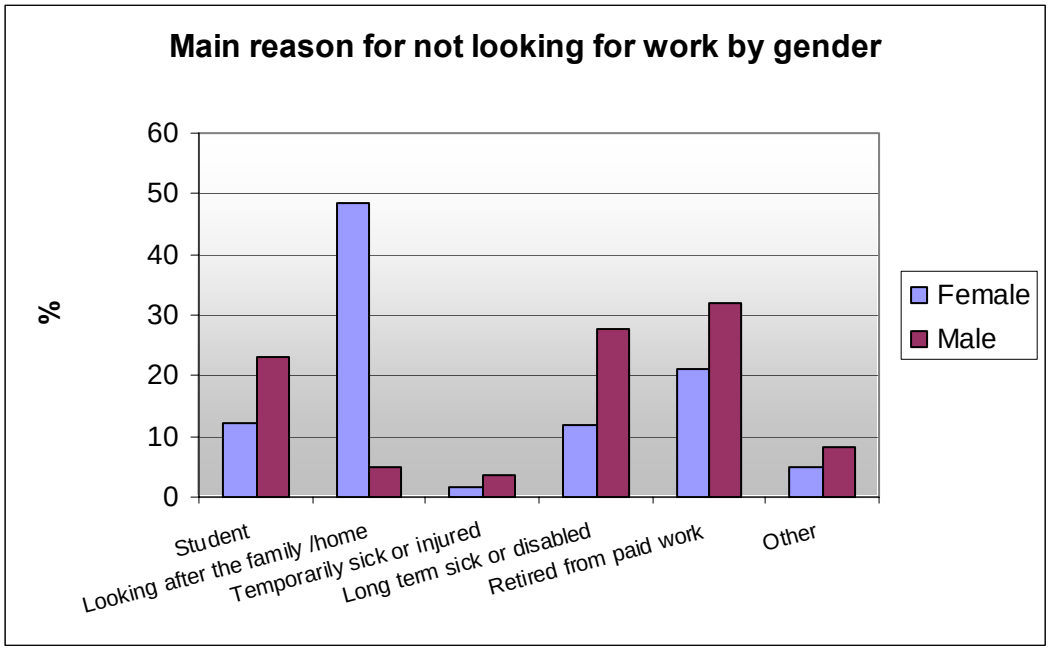


Figure 6.4 below shows the clear and expected gender differences for reasons given why respondents are not actively seeking work. Women are 10 times more likely to withdraw from the labour market to raise children than men, whilst men are over twice as likely to be long-term sick or disabled.

Figure 6.4



Base: Economically inactive: 2,397

6.4 Definitions of inactivity and unemployment

Two primary definitions of unemployment are widely used in the UK; ILO unemployment and the claimant count. The former is used in the Labour Force Survey (LFS) in accordance with the definition used by the International Labour Organisation (ILO). The ILO unemployed include those without a job who were able to start work in the two weeks following their LFS interview and had either looked for work in the four weeks prior to interview or were waiting to start a job they had already obtained.

The definition of ILO employed applies to anyone (aged 16 or over) who has done at least one hour's paid work in the week prior to interview, or has a job they are temporarily away from (e.g. on maternity leave). Also included are people who do unpaid work in a family business and people on Government-supported employment training schemes.

Claimant count unemployed refers to the term 'claimants' in the claimant count defined as those who claim Jobseekers Allowance and National Insurance credits. The figures include the severely disabled unemployed, but exclude students seeking vacation work and those who have temporarily stopped work.

Economically inactive refers to those neither ILO employed nor ILO unemployed, which equates to those not in work, nor looking for work. The analysis follows these ILO definitions of employment and unemployment. Students are also dropped from the analysis, in line with McIntosh and Vignoles. This leaves a base size for the inactive group of 2,080.

Our analysis also examines job seekers. Using the available fields in the SfL survey we classify a respondent as a jobseeker if they report looking for work and / or claiming Job Seekers Allowance and / or available to start work. Using this definition there are a total of 393 jobseekers in the sample.

6.5 The model

A standard probit model is used to quantify the marginal effects of the explanatory variables on the probability of individuals falling into various labour market groups. Again, as in section 4, we are not measuring the effect of *improving* adult basic skills on employment outcomes, merely the observable association between basic skills and labour market status.

The following models defines the relationship assumed between person *i*'s propensity to participate in the labour force (LFP_i – economically active), person *i*'s propensity to be employed (EMP_i – ILO employed), and individual characteristics of person *i* that are believed to affect the labour force participation decision (X_{1i}) and the employment outcome (X_{2i}):

$$LFP_i = \alpha_1 + \beta_1 X_{1i} + \lambda_1 Lit_{1i} + \eta_1 Num_{1i} + \varepsilon_{1i}$$

$$EMP_i = \alpha_2 + \beta_2 X_{2i} + \lambda_2 Lit_{2i} + \eta_2 Num_{2i} + \varepsilon_{2i}$$

For the 'employed' specification, we test the probability of employment against both all the non-employed, and against only job seekers, hence in total we use three specifications. In all the specifications tested we exclude the tertiary educated, those with English not as a first language and students. Furthermore we restrict the sample to those that straddle the basic skills threshold under investigation.

The coefficients of interest are λ (lambda) and η (eta) – the effects respectively of literacy and numeracy on employment outcomes. α is the constant term, X_{1i} and X_{2i} are core explanatory variables we use in all specifications[23] and ε the error term. As in section 4 we test literacy on a 4-point scale and numeracy on a 5-point scale. When testing literacy we control for numeracy and vica versa.

6.5.1 Possible sources of bias

As we found in section 3, employment is correlated with better literacy and numeracy skills. Of course this relationship is likely to run in two directions; you are more likely to find employment if you have better skills, and you are more likely to gain or keep existing skills if you are in employment. Given the characteristics of the SfL data it is impossible to disentangle these two effects, and this should be borne in mind when interpreting the results.

6.6 Results[24]

6.6.1 Literacy

Probability of employment

The results show a clear relationship between an individual's literacy level and their probability of being in employment. As one may expect the effect is generally greater for women than for men, with the male results being statistically insignificant.

[23] age, age squared, ethnicity, highest qualification and government office region dummies, parental education dummies, child under 4 in household, child aged 4-16 in household, whether a lone parent, any learning difficulties

[24] full results are presented in Annex 6-B

Though we find no effect between Entry level 2 and Entry level 3 skills we see an average 6% higher employment probability for individuals with Level 1 literacy over those at Entry level 3. However there is a large gender difference, with women returning a very large 8% higher probability, whilst for men the effect is smaller and statistically insignificant.

Level 2 and above literacy skills appear to have a negligible effect on employment, returning statistically insignificant zero or negative coefficients.

	Employed vs non-employed	Both sexes	Male	Female
Literacy	Entry level 2 or below			
	↓ Entry level 3	0%	-2%	4%
	↓ Level 1	6%***	4%	8%**
	↓ Level 2 and above	-1%	0%	-2%

*** significant at 10%; ** significant at 5%; *** significant at 1%**

Probability of economic activity

Here we see a contrasting picture compared to the probability of employment. Entry level 3 literacy returns a large 12% effect for men driving an average 8% effect for both sexes. For women the largest effect is found at Level 1 with women at this level nearly 7% more likely to be in employment than women with Entry level 3 skills. Again Level 2 and above has no apparent effect on economic activity.

	Economically active vs inactive	Both sexes	Male	Female
Literacy	Entry level 2 or below			
	↓ Entry level 3	8%*	12%**	4%
	↓ Level 1	3%	-2%	7%*
	↓ Level 2 and above	-1%	0%	-2%

*** significant at 10%; ** significant at 5%; *** significant at 1%**

Probability of employment vs being a jobseeker

The data is stretched when looking at job seekers and comparing them to those in employment. There are only 293 non-graduate, non-student, non-ENFL job seekers in the dataset, and 3,747 employed. Consequently we do not disaggregate the Entry levels. The analysis reports coefficients that are effectively zero for most combinations of gender and level. However we find men with literacy skills at Level 1 are 4% more likely to be employed than those with Entry level skills. Again we see Level 2+ literacy having a zero effect.

	Employed vs jobseekers	Both sexes	Male	Female
Literacy	Entry level			
	↓	3%**	4%**	0%
	Level 1			
	↓	1%	0%	1%
	Level 2 and above			

*** significant at 10%; ** significant at 5%; *** significant at 1%**

6.6.2 Numeracy

Probability of employment

For numeracy the gender difference at Entry level 3 is the reverse of that for literacy with men seeing the larger effect. As with literacy the effect appears greatest at the lower skills levels, with movement to Entry level 3 yielding the highest probability of employment, averaging 6% for men and women, and nearly 9% for men alone. Level 1 returns a further 4% higher probability of being in employment.

	Employed vs non-employed	Both sexes	Male	Female
Numeracy	Entry level 2 or below			
	↓	6%***	9%**	4%
	Entry level 3			
	↓	4%*	4%	3%
	Level 1			
	↓	2%	1%	3%
	Level 2			
	↓	2%	2%	7%
	above Level 2			

* significant at 10%; ** significant at 5%; *** significant at 1%

Probability of economic activity

Here we find similar results to those for the probability of being in employment. Entry level 3 numeracy gives an 8% effect for men, with 6% overall effect for both sexes. Level 1 numeracy returns a 3% effect that is just significant at the 10% level. Numeracy at levels above Level 1 appear to only have a weak correlation with economic activity.

	Economically active vs inactive	Both sexes	Male	Female
Numeracy	Entry level 2 or below			
	↓	6%***	8%***	4%
	Entry level 3			
	↓	3%	3%*	2%
	Level 1			
	↓	1%	-1%	5%
	Level 2			
	↓	1%	2%	4%
	above Level 2			

* significant at 10%; ** significant at 5%; *** significant at 1%

Probability of employment vs being a jobseeker

Again, we are stretching the data when comparing the small numbers of job seekers in the sample to those in employment. Unlike our results for literacy we find significant results at the top end of the numeracy scale. Those with Level 2 numeracy are 2% more likely to be employed, and similarly those with above Level 2 skills have an additional 2% higher likelihood of being in employment. As with literacy Level 1 skills appear important for men, though this effect only reaches statistical significance when including both men and women in the regression, where we see a 2% effect.

	Employed vs jobseekers	Both sexes	Male	Female
Numeracy	Entry level ↓ Level 1	2%**	2%	0%
	Level 1 ↓ Level 2	2%	2%*	5%
	Level 2 ↓ above Level 2	2%	2%*	5%

* significant at 10%; ** significant at 5%; *** significant at 1%

Overall we see higher literacy skills being correlated with higher labour market participation and employment for both men and women, with the largest effects being found at Entry level 3 and Level 1. People with literacy skills above this level do not appear to more likely to be economically active or employed.

For numeracy we only see a significant effect for men. Those with Entry level 1 or 2 numeracy skills are over 8% more likely to be unemployed or outside the labour market. Furthermore men with Level 2 or above numeracy skills are less likely to be searching for work. However we find no statistically significant relationship between numeracy and female labour market outcomes.

6.7 Conclusions

The results we present show a clear association between literacy and numeracy levels and labour market outcomes, even when controlling for a person's qualification level.

From just looking at the raw correlation between literacy, numeracy and labour market participation we see a clear association between poor skills and economic inactivity. For example whilst less than 50% of respondents with Entry level 1 literacy are economically active, over 80% with Level 2+ literacy are in the labour market.

When controlling for other factors that influence labour market participation decisions we still find a clear relationship between basic skills and labour market status.

For women literacy appears to have the greatest effect on labour market participation and finding work, and this effect is largest at Level 1. Women at this level are around 7% more likely to be in the workforce and be employed than women with Entry level 3 literacy. Numeracy skills appear to have an additional positive effect, though the results are not statistically significant.

For men literacy is also important, particularly on labour market participation. Men with Entry level 1 or 2 skills are 12% more likely to be outside the labour market than men with EL3 literacy. The correlation with Level 1 and 2 skills appears negligible. Numeracy is also important with men at Entry level 3 being 8% more likely to be economically active than men with lower numeracy skills. Level 1 numeracy skills increase this likelihood a further 3%.

When focusing on job seekers we find a small effect of both literacy and numeracy. People with Level 1 literacy are just under 3% more likely to be employed rather than be a job seeker than those with Entry level skills. For Level 1 numeracy the effect is smaller but still positive at 2%.

7 Final conclusions

The Skills for Life survey provides a new and important tool for analysing the relationship between basic skills and labour market outcomes. This paper examines first the determinants of an adult's literacy and numeracy, and continues to analyse how these skills affect both earnings and the probability of being in employment. The survey also allows, for the first time, analysis of the impact of participating in post-school English and mathematics training.

We find the correlations between literacy, numeracy and labour market outcomes to be strikingly strong. Even after controlling for background characteristics and qualifications held, which is at the core of our analysis, the relationships between literacy, numeracy, earnings and labour market status are often robust and statistically significant. Differences by gender frequently exist and are large, suggesting that literacy and numeracy skills are of differing importance to men and women.

Of particular interest is the analysis examining impact on earnings of participating in post-school English or basic mathematics training. Though we find small or sometimes negative 'returns' to people that have taken such a course, our matching estimates indicate that the returns for those that don't typically engage in adult English or maths training (chiefly those who hold no qualifications) do earn substantial returns three or more years after taking part on the course.

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Annex 4-A

Comparisons with previous research

As discussed previously, McIntosh and Vignoles (2000) analysed the private returns to literacy and numeracy using the International Adult Literacy Survey (IALS) and a subset of the National Child Development Study (NCDS). With certain caveats it is possible to replicate this analysis using Skills for Life data and compare the results. The analysis here differs from that in the main text in that the restrictions we place on the sample are removed.

To recap IALS contained 1,533 observations in the wage equations and the NCDS 854 observations. The NCDS comprises only of 37 year olds, and therefore we present additional results from the SfL survey calculated on a subset including respondents five years above and below the age of 37 (i.e. 32-42 year olds) to attempt to aid comparisons.

The NCDS and IALS analysis presents the returns to Level 1 literacy and numeracy compared to Entry level skills, in other words combining Entry levels 1, 2 and 3 into one group. As discussed in Chapter 10 of the Skills for Life survey report, the levels used in the IALS and NCDS tests do not map directly to the levels in the Skills for Life survey, though approximate comparisons can drawn, as shown in Table 7.1 (reproduced from McIntosh and Vignoles).

Table 7.1
Literacy and numeracy skills in the SfL Survey, IALS and the NCDS

Basic Skills Agency Standard	SfL Survey		IALS levels -	IALS levels -	NCDS -	NCDS -
	Literacy	Numeracy	Literacy	Numeracy	Literacy	Numeracy
Entry levels 1-2	6%	23%	Level 1 (22%)	Level 1 (23%)	V low (6%)	V low (23%)
Entry level 3	11%	26%		Level 2 (28%)	Low (13%)	Low (25%)
Level 1	**40%**	**27%**	**Level 2 (30%)**	**Level 3 (30%)**	**Average (38%)**	**Average (24%)**
Level 2	43%	24%	Level 3+ (48%)	Level 4+ (19%)	Good (43%)	Good (27%)

Differences exist in the variables contained in each of the three datasets, which in turn alters the exact specification tested for each one. For example NCDS uses log hourly earnings as the dependent variable, whilst both IALS and SfL use banded annual earnings. The most noticeable gaps in the Skills for Life and IALS surveys are the ability scores at ages 7 and 16, and thus we cannot compare SfL and IALS results when these controls are included, hence we only replicate specifications (a), (b) and (e) from McIntosh and Vignoles. For specification (f) we proxy age 16 ability with three binary variables indicating A*-C GCSE / O-level English and maths passes and 5 A*-C GCSE / O-level passes.

Furthermore it should be noted that in specifications (b) and (e) both the IALS and NCDS estimates control for family background, and NCDS further controls for parental social class, whether the family experienced financial difficulties when the child was aged 7 and child's school type (grammar, comprehensive etc.) and parental interest in the child's education, as determined by the child's teacher. The Skills for Life survey only has parental educational background and hence the NCDS and SfL specifications do differ quite significantly over and above the NCDS age range.

Table 7.2
Wage effects associated with Level 1 numeracy and literacy skills

	(a)	(b)	(c)	(d)	(e)	(f)
Numeracy Level 1						
Skills for Life Survey	0.315	0.184			0.133	0.129
	*(0.035)***	*(0.030)***			*(0.028)***	*(0.030)***
IALS Estimates	0.187	0.114			0.066	
	*(0.050)***	*(0.044)***			*(0.043)*	
NCDS Estimates	0.147	0.108	0.089	0.077	0.069	0.057
	*(0.041)***	*(0.038)***	*(0.038)**	*(0.039**	*(0.036)*	*(0.037)*
Skills for Life Survey 32-42 year olds	0.355	0.193			0.114	0.098
	*(0.058)***	*(0.047)***			*(0.047)**	*(0.047)**
Literacy Level 1						
Skills for Life Survey	0.168	0.161			0.110	0.107
	*(0.050)**	*(0.046)***			*(0.045)***	*(0.045)***
IALS Estimates	0.152	0.176			0.114	
	*(0.061)***	*(0.056)***			*(0.054)**	
NCDS Estimates	0.148	0.085	0.071	0.047	0.026	0.013
	*(0.044)***	*(0.040)**	*(0.041)*	*(0.042)*	*(0.039)*	*(0.041)*
Skills for Life Survey 32-42 year olds	0.154	0.171			0.113	0.115
	*(0.085)**	*(0.081)***			*(0.081)*	*(0.082)*
Controls						
Family background		X	X	X	X	X
Age 7 ability			X	X		X~
Age 16 ability				X		X
Education level					X	X

Note: Results are for men and women combined. Dependent variable is log earnings. ~ age 7 ability controls for NCDS only. Standard errors are given in parenthesis * significant at 5%; ** significant at 1%

The Skills for Life survey estimates are closer to those estimated from the IALS dataset rather than the NCDS dataset. For most specifications the coefficients are larger using SfL data.

For numeracy SfL estimates are consistently larger than both those from IALS and NCDS data, particularly when demographic controls are included [specifications (b) and (e)] where we see coefficients around twice as large as those from IALS and NCDS data.

The specification of most interest (e) shows a 13% earnings effect to numeracy compared to the 7% return calculated from both IALS and NCDS data. This comparatively high figure compares closely to the other SfL results examining progression from Entry levels 1 & 2 to Entry level 3 (13%).

For literacy the raw SfL survey results are smaller than for IALS and NCDS estimates. When demographic controls are included SfL and IALS estimates are quite close (0.161 vs 0.176 [literacy] & 0.184 vs 0.114 [numeracy]) though the distance from NCDS estimates are large. As for numeracy the results here are close to those detailed earlier when just looking at movements from Entry level 3 to Level 1 (12%).

Reassuringly the 32-42 year old SfL estimates are similar to those calculated using the full age range. This is to be expected as the coefficients for literacy and

numeracy are reported at the mean age (around 41) for IALS and SfL which is close to the age of the NCDS respondents (37).

Comparing the results presented in this paper with those from Machin *et al* (2001) which again uses NCDS data but includes both age 7 and age 16 ability and 'soft skill' variables we find broad equivalency for numeracy, but interesting differences for literacy.

Adult skills:	**Machin *et al* NCDS (2001)**		**Skills for Life Survey**	
Numeracy skills-average (Level 1)				
men	0.086	(0.055)	0.103	(0.036)**
women	0.040	(0.065)	0.117	(0.045)**
Numeracy skills-good (Level 2+)				
men	0.048	(0.055)	0.081	(0.032)*
women	0.017	(0.071)	0.062	(0.046)
Literacy skills-average (Level 1)				
men	-0.002	(0.065)	0.118	(0.052)*
women	0.039	(0.069)	0.162	(0.065)*
Literacy skills-good (Level 2+)				
men	0.065	(0.071)	0.009	(0.029)
women	0.090	(0.075)	0.034	(0.034)
Controls	Personal characteristics Family background Region Age 16 ability Soft skills / attitudes Age 7 ability Highest qualification		Personal characteristics Parental education Region GCSE performance Highest qualification	

* significant at 5% level; ** significant at 1% level

For literacy Machin *et al* find a 0-3% return to Level 1 and 7-9% for Level 2+. We find a 0-3% return to Level 2+ and a 12-16% return to Level 1

So what may explain these differences? The absence of some demographic controls, particularly those included in the NCDS may explain some of the gap, and the additional data the NCDS estimates include may further lower the coefficients for literacy and numeracy.

A further explanation, as detailed by McIntosh and Vignoles (2000), is that the NCDS literacy measure is subject to measurement error, with considerable right censoring (43% record the highest possible 'good' literacy score). However, this is also the case for SfL data, with an unweighted 43% scoring Level 2+ literacy. For IALS this is not the case as both literacy and numeracy are measured up to IALS Level 5.

Unobserved early ability may also contribute. NCDS estimates are reduced from 0.069 to 0.057 for numeracy and 0.026 to 0.013 for literacy (17% and 50% reductions respectively). We may conclude that the absence of early ability measures for SfL and IALS estimates biases the coefficients upward, particularly for literacy. However, including GCSE English and maths performance as further controls (as the best available proxies for early ability) makes little difference to the SfL estimates.

However, as has been discussed above, gender differences can be significant, with the coefficients often larger for women. When repeating the analysis split by men

and women[25] we see the earnings effects slightly higher for females, though only by a few percentage points. The gender differences in the IALS and NCDS datasets are equally small.

Additionally of the four datasets that have been analysed by different researchers (NCDS, BCS70, IALS and Skills for Life survey) the NCDS reports returns to lowest returns to literacy, whether Level 1 or Level 1 *and above*. If, as the Skills for Life survey results suggest, there is a zero effect for Level 2+ literacy then the BCS70, SfL and IALS estimates are 6%, 11% and 12% respectively, which further undermines the 1% effect of Level 1 literacy estimated from the NCDS sample.

To conclude this section, the SfL survey fails to fully resolve the large differences between the IALS and NCDS estimates for the returns to level 1 literacy. However, the SfL survey results place the low NCDS estimates in greater doubt. Previously many saw the 12% literacy earnings premium IALS produced as implausibly large given the NCDS estimate of 2.6%. However, analysis using the SfL survey supports the higher IALS coefficient, and the perhaps surprising finding that the returns to literacy (at lower levels) are greater than the returns to numeracy.

[25] Regression results available from the author on request

Annex 4-B: estimation results

	Estimation results: by level, specification and sample restriction Dependent variable; log earnings. Both sexes.	unrestricted Specification A Raw relationship	unrestricted Specification B Demographic controls	unrestricted Specification C Full controls	restricted to observations that straddle the basic skills level under investigation Specification A Raw relationship	restricted to observations that straddle the basic skills level under investigation Specification B Demographic controls	restricted to observations that straddle the basic skills level under investigation Specification C Full controls
Literacy	**Entry Level 1 & 2 to Entry Level 3**	0.071	0.059	0.047	0.042	0.065	0.045
		-0.087	-0.080	-0.079	-0.090	-0.083	-0.080
	Excluding degree holders	0.078	0.074	0.047	0.059	0.106	0.066
		-0.090	-0.081	-0.081	-0.094	-0.084	-0.085
	Excluding degree & other HE holders	0.066	0.071	0.058	0.056	0.111	0.094
		-0.092	-0.082	-0.083	-0.092	-0.097	-
	Entry Level 3 to Level 1	0.094	0.153	0.114	0.097	0.156	0.106
		(0.044)*	-	-	(0.045)*	(0.043)**	(0.042)*
	Excluding degree holders	0.091	0.153	0.119	0.089	0.150	0.113
		(0.045)*	-	-	-0.046	(0.043)**	(0.043)**
	Excluding degree & other HE holders	0.075	0.140	0.115	0.076	0.138	0.111
		-0.048	-	(0.045)*	-0.049	(0.046)**	(0.046)*
	Level 1 to Level 2 and above	0.097	0.083	0.033	0.098	0.082	0.033
		(0.023)**	(0.021)**	-0.020	(0.023)**	(0.021)**	-0.020
	Excluding degree holders	0.030	0.036	0.018	0.031	0.034	0.016
		-0.025	-0.023	-0.022	-0.025	-0.023	-0.022
	Excluding degree & other HE holders	0.023	0.040	0.027	0.023	0.037	0.024
		-0.029	-0.025	-0.025	-0.029	-0.025	-0.025
Numeracy	**Entry Level 1 & 2 to Entry Level 3**	0.159	0.124	0.097	0.161	0.124	0.094
		(0.041)**	(0.039)**	(0.038)**	(0.041)**	(0.039)**	(0.038)*
	Excluding degree holders	0.147	0.114	0.098	0.152	0.116	0.099
		(0.041)**	(0.039)**	(0.038)*	(0.042)**	(0.039)**	(0.039)*
	Excluding degree & other HE holders	0.165	0.136	0.118	0.170	0.139	0.121
		(0.045)**	(0.042)**	(0.042)**	(0.045)**	(0.042)**	(0.043)**
	Entry Level 3 to Level 1	0.166	0.134	0.082	0.169	0.134	0.081
		(0.029)**	(0.026)**	(0.025)**	(0.030)**	(0.027)**	(0.026)*
	Excluding degree holders	0.131	0.104	0.073	0.136	0.105	0.075
		(0.030)**	(0.027)**	(0.027)**	(0.030)**	-	(0.027)*
	Excluding degree & other HE holders	0.118	0.080	0.060	0.120	0.079	0.061
		(0.033)**	(0.029)**	(0.029)*	(0.034)**	(0.029)**	(0.029)*
	Level 1 to Level 2	0.189	0.136	0.070	0.186	0.136	0.070
		(0.028)**	(0.026)**	(0.025)**	(0.028)**	(0.026)**	(0.025)**
	Excluding degree holders	0.142	0.093	0.067	0.139	0.096	0.067
		(0.033)**	(0.030)**	(0.029)*	(0.033)**	(0.030)**	(0.029)*
	Excluding degree & other HE holders	0.133	0.071	0.045	0.129	0.071	0.039
		(0.038)**	(0.035)*	-0.034	(0.038)**	(0.035)*	-0.034
	Level 2 to Level 3 and above	0.192	0.137	0.121	0.203	0.154	0.135
		(0.041)**	(0.038)**	(0.036)**	(0.041)**	(0.038)**	(0.036)**
	Excluding degree holders	0.162	0.108	0.100	0.182	0.138	0.133
		(0.056)**	(0.051)*	(0.050)*	(0.055)**	(0.050)**	(0.049)**
	Excluding degree & other HE holders	0.194	0.132	0.127	0.239	0.196	0.193
		(0.067)**	(0.061)*	(0.060)*	(0.077)**	(0.059)**	(0.074)**

Robust standard errors in parentheses; * significant at 5%; ** significant at 1%; - standard error not reported

Estimation results; by gender, level and specification

Dependent variable; (banded) log earnings

Sample restricted to observations that straddle the basic skills level under investigation

Excluding degree & other HE qualification holders

Numeracy		Entry Level 1 & 2 to Entry Level 3	Entry Level 3 to Level 1	Level 1 to Level 2	Level 2 to Level 3+	Literacy	Entry Level 1 & 2 to Entry Level 3	Entry Level 3 to Level 1	Level 1 to Level 2+
Raw		0.17	0.12	0.129	0.239		0.056	0.076	0.023
		*(0.045)***	*(0.034)***	*(0.038)***	*(0.077)***		*-0.092*	*-0.049*	*-0.029*
	Male	0.156	0.07	0.075	0.206	*Male*	0.096	0.112	0.042
		*(0.057)***	*-0.042*	*-0.044*	-0.254		*-0.094*	*(0.056)**	*-0.035*
	Female	0.085	0.13	0.094	0.192	*Female*	0.258	0.208	0.071
		-0.065	*(0.048)***	*-0.065*	-0.148		*-0.201*	*(0.086)**	*-0.042*
Demographic controls		0.139	0.079	0.071	0.196		0.065	0.156	0.082
		*(0.042)***	*(0.029)***	*(0.035)**	*(0.059)***		*-0.083*	*(0.043)***	*(0.021)***
	Male	0.041	0.138	0.051	0.168	*Male*	0.156	0.065	0.082
		*(0.056)**	*(0.056)**	*-0.039*	(0.064)**		*-0.083*	*-0.083*	*-0.039*
	Female	0.082	0.125	0.104	0.154	*Female*	0.112	0.23	0.104
		-0.065	*(0.046)***	*-0.067*	-0.143		*-0.181*	*(0.076)***	*-0.067*
Demographic controls & qualification controls		0.121	0.061	0.039	0.193		0.045	0.106	0.033
		*(0.043)***	-	*-0.034*	*(0.074)***		*-0.08*	*(0.042)**	*-0.02*
	Male	0.125	0.019	0.027	0.153	*Male*	0.1	0.099	0.015
		*(0.056)**	-	*-0.039*	(0.063)*		*-0.086*	*-0.051*	*-0.025*
	Female	0.073	0.094	0.074	0.225	*Female*	0.112	0.188	0.059
		-0.068	*(0.046)**	*-0.068*	-0.143		*-0.185*	*(0.073)**	*-0.033*

Robust standard errors in parentheses

* significant at 5%; ** significant at 1%; - standard error not reported

Example of full interval regression analysis

The estimation results above only report the coefficients on the literacy and numeracy variables using various samples and different controls.

The results reported below show the coefficients on *all* the variables used in the regression analysis and are intended to give the reader an idea of the coefficients returned on the non-literacy and numeracy variables used in the analysis.

Our exemplar regression tests specification C *without* restricting the sample (hence the results do not correspond exactly with those in section 4.4).

Dependent variable log earnings (banded) Non-tertiary educated only	Earnings, both sexes	Earnings, male	Earnings, female
Literacy level (base; Entry level 1 or 2)			
Literacy Entry level 3	0.058	0.03	0.257
	-0.083	-0.089	-0.191
Literacy level 1	0.177	0.137	0.46
	(0.081)*	-0.09	(0.186)*
Literacy level 2+	0.202	0.147	0.516
	(0.083)*	-0.094	(0.188)**
Numeracy level (base; Entry level 1 or 2)			
Numeracy Entry level 3	0.118	0.12	0.087
	(0.042)**	(0.055)*	-0.066
Numeracy level 1	0.18	0.153	0.169
	(0.044)**	(0.058)**	(0.069)*
Numeracy level 2	0.223	0.186	0.238
	(0.049)**	(0.062)**	(0.083)**
Numeracy level 3	0.39	0.348	0.411
	(0.068)**	(0.079)**	(0.137)**
Part time interactions (base part time x Entry level 1 or 2)			
Part time x literacy EL3	0.028	-0.33	-0.011
	-0.177	-0.291	-0.294
Part time x literacy L1	0.015	-0.339	-0.082
	-0.163	-0.204	-0.281
Part time x literacy L2	0.011	-0.438	-0.093
	-0.17	-0.264	-0.285
Part time x numeracy EL3	-0.136	-0.439	-0.083
	-0.083	(0.175)*	-0.103
Part time x numeracy L1	-0.02	0.131	-0.025
	-0.091	-0.194	-0.111
Part time x numeracy L2	-0.212	0.194	-0.261
	-0.114	-0.249	-0.14
Part time x numeracy L3	-0.273	0.358	-0.397
	-0.215	-0.802	-0.225
Child under 4	0.147	0.188	0.059
	(0.042)**	(0.049)**	-0.072

Child age 5-16	-0.005	0.07	-0.109
	-0.028	(0.036)*	(0.046)*
Self employed	0.076	0.111	-0.028
	-0.046	(0.044)*	-0.114
Work part time	-0.673	-0.533	-0.5
	(0.153)**	(0.178)**	-0.271
Age cohort dummies (base aged 16-30)			
Aged between 31-45	-0.022	-0.05	-0.004
	-0.062	-0.092	-0.085
Aged between 46-65	-0.143	-0.242	-0.07
	-0.09	-0.127	-0.129
Qualifications (base; no qualifications)			
GCSE / O-level below 5 A*-C	0.037	0.019	0.061
	-0.035	-0.043	-0.054
GCSE / O-level 5 A*-C	0.017	0.064	-0.01
	-0.03	-0.039	-0.045
GCSE / O level English A*-C	0.022	0.048	-0.024
	-0.032	-0.039	-0.051
GCSE / O level Maths A*-C	0.047	-0.003	0.085
	-0.033	-0.04	-0.048
Level 3 vocational	0.129	0.134	0.079
	(0.028)**	(0.034)**	-0.047
Level 2 or below vocational	0.01	-0.104	0.102
	-0.027	(0.035)**	(0.038)**
A levels	0.119	0.096	0.111
	(0.039)**	-0.055	(0.052)*
Other qualifications, level unknown	0.026	-0.015	0.06
	-0.035	-0.039	-0.063
Male	0.372		
	(0.026)**		
Age	0.063	0.069	0.055
	(0.012)**	(0.019)**	(0.016)**
Age squared	-0.001	-0.001	-0.001
	0.000	(0.000)**	0.000
Ethnicity (base; white)			
Black	0.000	-0.293	0.18
	-0.103	-0.239	-0.111
Asian	-0.313	-0.301	-0.242
	-0.166	-0.189	-0.282
East Asian	0.685	-	0.553
	(0.126)**	-	(0.105)**
Other ethnicity	-0.146	-0.052	-0.138
	-0.15	-0.171	-0.324
Any learning difficulties (inc. dyslexia)	-0.051	-0.075	0.075
	-0.062	-0.065	-0.124

Parental education (base; neither parent educated beyond primary school)			
Neither parent completed secondary school	0.056	0.113	-0.071
	-0.099	-0.121	-0.158
Most educated parent completed secondary school	0.048	0.133	-0.105
	-0.095	-0.116	-0.153
Most educated parent attended 6th form	0.02	0.149	-0.155
	-0.107	-0.131	-0.169
At least one parent attended university	0.148	0.253	-0.038
	-0.104	(0.127)*	-0.167
Missing parental education	-0.021	0.048	-0.157
	-0.099	-0.119	-0.16
Self reported poor health	-0.202	-0.368	-0.078
	(0.091)*	(0.163)*	-0.097
Government Office Region (base; London)			
North East	-0.288	-0.414	-0.153
	(0.057)**	(0.068)**	-0.092
Yorkshire and Humberside	-0.233	-0.303	-0.176
	(0.055)**	(0.064)**	-0.092
East Midlands	-0.232	-0.338	-0.143
	(0.056)**	(0.068)**	-0.09
West Midlands	-0.264	-0.34	-0.197
	(0.058)**	(0.071)**	(0.091)*
South West	-0.227	-0.282	-0.201
	(0.054)**	(0.063)**	(0.090)*
East of England	-0.155	-0.208	-0.108
	(0.056)**	(0.067)**	-0.09
South East	0.123	-0.109	0.14
	(0.044)**	-0.065	(0.066)*
North West	-0.185	-0.315	-0.057
	(0.055)**	(0.066)**	-0.087
Constant	7.538	7.979	7.648
	(0.244)**	(0.375)**	(0.354)**
Observations	2,794	1,404	1,390
Robust standard errors in parentheses			
*** significant at 5%; ** significant at 1%**			

Annex 6-A

Comparisons with previous findings

Table 7.3 summarises the findings of the two papers in this area: McIntosh and Vignoles (2000) who examine both the NCDS and IALS datasets, and Machin *et al* (2001) who use the NCDS but additionally control for 'soft skills'.

In both these papers, the key results compare all Entry level skills to Level 1. Additionally Level 2+ results are also presented. The results presented are for the specifications that include the most controls, including age 7 and age 16 ability for the NCDS estimates. In contrast to the analysis presented in the main text fewer restrictions are placed on the sample, so degree holders are included together with respondents with English as a second language, and the analysis isn't restricted to people that straddle the basic skills level in question. Students are still excluded.

Table 7.3

Employed vs non-employed			**Males**		**Females**	
Literacy	**IALS**	**Entry level→ Level 1**	0.090	*(0.038)**	0.135	*(0.042)***
		Entry level→ Level 2+	0.162	*(0.058)*	0.085	*(0.055)*
		Level 1→ Level 2+	0.072		-0.050	
	NCDS	**Entry level→ Level 1**	0.038	*(0.019)**	-0.037	*(0.047)*
		Entry level→ Level 2+	0.046	*(0.027)*	-0.030	*(0.053)*
		Level 1→ Level 2+	0.008		0.007	
	NCDS w. soft skills	**Entry level→ Level 1**	0.013	*(0.125)*	-0.050	*(0.423)*
		Entry level→ Level 2+	0.006	*(0.071)*	-0.036	*(0.312)*
		Level 1→ Level 2+	-0.007		0.014	
	Skills for life survey	**Entry level→ Level 1**	0.041	*(0.020)**	0.099	*(0.024)***
		Entry level→ Level 2+	0.047	*(0.022)**	0.085	*(0.027)***
		Level 1→ Level 2+	0.007	*(0.017)*	-0.014	*(0.019)*

* significant at 5%; ** significant at 1%

Employed vs non-employed			Males		Females	
Numeracy	IALS	Entry level→ Level 1	-0.046	*(0.043)*	0.090	*(0.040)**
		Entry level→ Level 2+	0.033	*(0.047)*	0.123	*(0.049)***
		Level 1→ Level 2+	0.079	-	0.033	-
	NCDS	Entry level→ Level 1	0.038	*(0.019)*	-0.037	*(0.047)*
		Entry level→ Level 2+	0.046	*(0.027)*	-0.030	*(0.053)*
		Level 1→ Level 2+	0.008	-	0.007	-
	NCDS w. soft skills	Entry level→ Level 1	0.010	*(0.547)*	0.013	*(0.125)*
		Entry level→ Level 2+	0.008	*(0.458)*	0.006	*(0.071)*
		Level 1→ Level 2+	-0.002	-	-0.007	-
	Skills for life survey	Entry level→ Level 1	0.046	*(0.017)**	0.045	*(0.020)**
		Entry level→ Level 2+	0.049	*(0.019)**	0.076	*(0.025)***
		Level 1→ Level 2+	0.003	*(0.019)*	0.032	*(0.026)*

* significant at 5%; ** significant at 1%

Table 7.3 shows the range of results different datasets and specifications can produce. The IALS and NCDS soft skills results are subject to sizeable standard errors, though some IALS results show statistically significant coefficients. However there is little consistency between datasets which makes it difficult to draw firm conclusions. For example both IALS and the SfL results show large positive effects on employment for women at Level 1 literacy, however the NCDS analysis return negative results. This may be due to a variety of factors; the fixed age of the NCDS sample, different measures of Level 1 skills, and the inclusion of childhood ability controls.

Annex 6-B

Estimation results

The estimation results presented below show the difference in probability of being employed or economically active over having literacy or numeracy one level lower. For example in the first table we see L1 literacy returning a co-efficient of 0.063. This indicates that people with L1 literacy have a 6.3% higher probability of being employed than people with EL3 literacy, controlling for the background characteristics listed in footnote 23 on page 52.

The results are cumulative, so people with L3+ numeracy have a (0.061 + 0.037 + 0.024 + 0.021 = 0.136) 13.6% higher probability of being employed than people with EL2 or below numeracy.

These results correspond with those in section 6.6 above.

Employed vs non-employed			
	All	**Men**	**Women**
EL3 literacy	0.003	-0.017	0.035
	-0.043	-0.067	-0.056
L1 literacy	0.063	0.039	0.077
	(0.024)***	-0.032	(0.035)**
L2+ literacy	-0.007	0.001	-0.016
	-0.016	-0.019	-0.023
EL3 numeracy	0.061	0.085	0.037
	(0.023)***	(0.036)**	-0.03
L1 numeracy	0.037	0.037	0.029
	(0.019)*	-0.024	-0.027
L2 numeracy	0.024	0.013	0.031
	-0.02	-0.021	-0.035
L3+ numeracy	0.021	0.019	0.065
	-0.031	-0.026	-0.061

active vs inactive			
	All	**Men**	**Women**
EL3 literacy	0.079	0.12	0.043
	(0.043)*	(0.055)**	-0.058
L1 literacy	0.03	-0.02	0.066
	-0.022	-0.021	(0.034)*
L2+ literacy	-0.014	-0.002	-0.022
	-0.014	-0.014	-0.023
EL3 numeracy	0.06	0.081	0.037
	(0.022)***	(0.029)***	-0.029
L1 numeracy	0.025	0.026	0.015
	-0.017	(0.016)*	-0.026
L2 numeracy	0.014	-0.01	0.048
	-0.017	-0.013	-0.033
L3+ numeracy	0.014	0.021	0.04
	-0.023	-0.02	-0.057

Employed vs jobseekers	All	Men	Women
EL3 literacy	-0.038	-0.077	-0.002
	-0.025	(0.036)**	-0.037
L1 literacy	0.032	0.052	0.007
	(0.014)**	(0.022)**	-0.015
L2+ literacy	0.007	0.004	0.008
	-0.007	-0.011	-0.007
EL3 numeracy	0.012	0.005	0.011
	-0.012	-0.02	-0.012
L1 numeracy	0.012	0.013	0.005
	-0.008	-0.013	-0.007
L2 numeracy	0.004	0.02	-0.008
	-0.009	(0.011)*	-0.009
L3+ numeracy	0.015	0.021	0.045
	-0.011	(0.011)*	-0.085

Robust standard errors in parenthesis; * significant at 10%; ** significant at 5%; *** significant at 1%

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