FURTHER INVESTIGATION INTO THE RELATIONSHIP BETWEEN PRODUCTIVITY, EARNINGS AND AGE IN THE EARLY YEARS OF A WORKING LIFE

Report Prepared for the Low Pay Commission

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Executive Summary

This report uses data from the Annual Business Inquiry/Survey (ABI/ABS) and the Annual Survey of Hours and Earnings (ASHE) for 2003-2010, to estimate productivity and wage equations at the sector level.

The aim is to extend the report produced for the Low Pay Commission last year[1], to cover the recession years from 2008-2010.

114 sectors were created, mostly at the 3 digit level though some at the 2 digit level to ensure adequate sample sizes, based on the 2007 Standard Industrial Classification.

Productivity at the sector level is measured by gross value added. The explanatory variables indicate characteristics of the workforce in terms of their age, gender, qualifications, sector (private/public) and status (full/part-time). The estimated productivity and wage equations also control for net capital expenditure within each sector. The coefficients on the age variables represent the main coefficients of interest.

The estimated equations are estimated by Fixed Effects, meaning that the impact of each explanatory variable is identified from variation in that variable *within* each sector, therefore controlling for unobserved characteristics of the sector that might affect productivity or wages.

Across the full period 2003-2010, the wage equation results reveal an inverted U-shaped age-earnings profile. All age groups (21-29, 30-49 and 50-59) are associated with higher wages than the youngest age group (16-20 year olds), with the gap being largest for 30-49 year olds.

[1] Dickerson, A. And McIntosh, S. (2011) 'An Investigation into the Relationship Between Productivity, Earnings and Age in the Early Years of a Working Life. LPC Research Report.

The productivity equation reveals no productivity differentials between the age groups, suggesting a flat age-productivity profile.

The sample period was then divided into pre-recession (2003-2007) and post-recession (2008-2010) periods, to determine whether the recession has altered the estimated relationships.

The wage equation results show that, looking within sectors, wage differentials between age groups have narrowed in the post-recession period, relative to pre-recession. The productivity differentials between age groups have however moved the other way. Although no coefficients in the productivity equations are statistically significant, and so the results are not particularly strong, they suggest that the productivity differentials between prime-aged workers and young workers turned from negative pre-recession to positive post-recession.

The finding that the productivity of prime-aged relative to young workers increased in the post-recession period is particularly strong when attention is restricted to low-paying sectors only, where the National Minimum Wage is most relevant.

Taken together, the pre- and post-recession results imply that young workers have become overpaid for their productivity contribution in the post-recession period, relative to prime-aged workers. This result may have implications for the relative level of the youth rate for the National Minimum Wage, though the lack of robustness in the productivity results should again be stressed.

1 Introduction

The recent recession in the UK altered the state of the labour market. Declining demand in the economy feeds through to the labour market. A falling demand for labour will affect wage and employment outcomes. Such effects potentially can vary for different groups in the labour market, for example different age groups. A changing labour market can have implications for the setting of the National Minimum Wage, both in absolute terms and the relative levels of the different rates.

The aim of this project is to investigate the relationships between age, productivity and wages, and how these were affected by the recession. The analysis builds on a study undertaken by us for the Low Pay Commission last year (Dickerson and McIntosh, 2011), which investigated the effect of the introduction of the National Minimum Wage on these relationships. The idea is to estimate productivity and wage equations at the (3 digit) sector level, to determine whether wage and productivity differences between different age groups exist. In a perfectly competitive labour market, any productivity differences between age groups should be reflected in similar wage differences. To the extent that they are not, such discrepancies would be evidence of rigidities in the labour market, and may perhaps be attributable to the floor on wages implied by the National Minimum Wage. The aim of this study is to investigate whether the recent recession has had any impact on the prevalence or extent of the divergences between productivity and wages for workers in different age groups.

The fall in the demand for labour during the recession reduced the average growth in wages. Figure 1 shows the growth in the median wage of different age groups for different time periods. The growth in wages was clearly much lower in the 2007-2010 period, than in either of the other two periods since the introduction of the National Minimum Wage. What is most interesting, however, is the change in the relativities between age groups. During the 1999-2004 and 2004-2007 periods, the growth in median wages was quite similar for each of the age groups (16-17 year olds, 18-20 year olds and those aged 21+) with the youngest age group experiencing slightly higher wage growth. In the recession, however, this has turned around.

Although all groups are experiencing lower wage growth, it is the youngest age groups who are experiencing the lowest. Thus, over the 2007-2010 period, 16-17 year olds and 18-20 year olds experienced wage growth of just 2% and 4% respectively, compared to 9% for adults aged 21 or over.

The aim of this project is to examine these changes in relative wages, and to investigate the extent to which they are related to productivity differences between age groups. The results of such analysis have implications for the setting of the National Minimum Wage. Since its introduction in 1999, the minimum wage rate for each age group has increased by broadly the same amount, thus maintaining the relative minimum wage levels across groups. This has been in line with the broadly similar growth in the average wages of the three groups (as shown in Figure 1). However, if average wages of younger workers are now growing to a lesser extent than the wages of adult workers, does this mean that the minimum wage rate for younger workers should also be raised by a lower amount than for adult workers? If the smaller average wage growth of young workers is due to lower productivity growth, then there would be an argument for raising the youth rate by (proportionately) less than the adult rate.

Why should productivity growth of young workers be less than for adult workers in the recession? One argument is that in a recession when unemployment is high, the lack of available jobs persuades more young people to remain in full-time education.[2] If more able young people are more likely to stay on in post-compulsory education,[3] then as the further education participation rate increases, the average ability of those outside education (and thus in the labour market) will fall.

This report looks for evidence consistent with such effects by examining whether wage differences between age groups are of a similar relative size as productivity

[2] Bell and Blanchflower (2010) provide information on the worsening labour market opportunities for young people in the recession, while Rice (1999) and Clark (2002), amongst others, provide evidence that young people are more likely to participate in post-compulsory education the higher is the local youth unemployment rate.

[3] Again, see Rice (1999) amongst many others, for evidence of a continuous positive relationship between GCSE points scores and the probability of participating in post-compulsory education.

differences. The next section describes the data to be used in this analysis, followed by an outline of the methodology to be used. Section 4 contains the results of the analysis, while a final section offers some conclusions.

2 Data

Productivity of individual workers is extremely difficult to measure, and no large, nationally representative data sets containing measures of individuals' productivity exist. This study is therefore conducted at an aggregate, sectoral level, for which productivity data can be obtained. Specifically, we use data from the Annual Business Inquiry/Annual Business Survey (ABS), which contains information on a large number of firms within the UK.[4] Of use here is a gross value added (GVA) variable, measured as the difference between the income generated by the firm and the value of their intermediate consumption of goods and services used. Dividing GVA by the level of employment produces GVA per capita, which is our productivity measure. Since it is measured in monetary terms, it is expressed in real terms by deflating using the retail price index (RPI), to allow for the effects of inflation over time. In addition, the ABS contains a variable measuring gross capital expenditure per year, which is used as a control variable, due to its potential to affect productivity in particular. It is also measured in financial units, and hence is converted into real terms.

The ABS does not contain any information about the characteristics of workers in the respondent firms. However, it does contain an indicator of the sector in which the firm is found, so that when aggregated to the sector level, data on the worker characteristics at the same level can be matched in from other data sources. We therefore use individual worker data from the Annual Survey of Hours and Earnings (ASHE) and the Labour Force Survey (LFS) from the relevant years to estimate the characteristics of each sector's workforce. Specifically, the ASHE is used to provide estimates of the proportions of workers in each sector falling into each age category (youths aged 16-20, young workers aged 21-29, prime-aged workers aged 30-49 and

[4] The ABS is a census of all large firms, and a sample survey of smaller firms. It was formerly known as the ABI. It covers all sectors and is the primary source used for construction of the Input-Output tables for the National Accounts. The sample size is approximately 62,000 businesses each year.

older workers aged 50-59)[5], the proportion of workers in each sector who are female, the proportion of workers in each sector who work part-time, and the proportion of workers in each sector who are working in the private sector. The LFS was used to provide an estimate of the proportion of workers in each sector who are qualified to each level in the National Qualifications Framework.[6]

The timeframe for the study is 2003-2010. The years of 2008-2010 are designated as recession years, with the starting point of 2003 chosen so as to not be too prior to the start of the recession in 2008. In terms of cross-sectional coverage, almost all sectors of the economy are included in the constructed data set. A few sectors are not included in the ABS and so do not appear in the analysis here. The main areas excluded are financial and insurance activities and public administration and defence.

One issue faced in the construction of the sectoral level dataset is that a new industrial classification, SIC07, was introduced in ABS when it replaced the ABI. In order to have sectors defined on a consistent sectoral basis, 'correspondence tables' were therefore used to map data classified on the earlier SIC, SIC03, to the new classification SIC07.[7] These correspondence tables provide (employment-based) weights to enable mapping between SIC03 sectors at the 2-, 3-, 4- and 5- digit levels to the SIC07 classification at the same levels of disaggregation. Thus the data from ASHE, LFS (prior to 2009) and from the ABI which was classified according to SIC03 were each separately mapped to the SIC07 classification. This then enabled our sectors to be defined according to SIC07 for the whole period under consideration. The majority of sectors were defined at the 3-digit level, though occasionally a sector was defined at the 2-digit level if there were too few observations in ASHE at the 3-

[5] It would have been useful to split the 16-20 year olds into 16-17 year olds and 18-20 year olds, given their different education participation rates, employment opportunities and minimum wage rates. However, there were too few 16-17 year olds in most sectors in the ASHE survey to provide an accurate indicator of their proportion in the sector's workforce.

[6] One limitation with the LFS is that prior to 2009 (i.e. under SIC03), the LFS did not sub-divide some key large sectors to the 3-digit level, namely retail trade, wholesale trade and construction. Therefore for the subsectors of these key large 2 digit sectors that are used in the analysis presented below, we have to assign the same distribution of qualifications to all 3-digit subsectors as in their parent 2-digit sector. This affects 17 of the 114 sectors used here.

[7] See: http://www.statistics.gov.uk/statbase/Product.asp?vlnk=14012.

digit level to accurately estimate the age distribution of the workforce, or at the 4-digit level if there were sufficient observations in ASHE at the 3-digit level to allow further subdivision. The resulting data set contains information on 114 sectors.

3 Methodology

We estimate productivity and wage equations at the sector (industry) level. A similar methodology was employed in a UK context by Dearden *et al*. (2006), who used the technique to estimate the impact of training on productivity and wages. The framework was first developed by Hellerstein *et al*. (1999), and has also been employed by researchers looking at a range of other countries, for example Crepon *et al*. (2002) for France, Ilmakunnas and Maliranta (2005) for Finland, Dostie (2006) for Canada, Gobel and Zwick (2009) for Germany and van Ours and Stoeldraijer (2010) for the Netherlands.[8]

The estimated productivity equation takes the form:

$$\log y_{it} = \gamma_0 + \gamma_1 \log k_{it} + \sum_z \gamma_{2z} a_{zit} + u_{it} \qquad (1)$$

where y is the measure of productivity (GVA/L) and k is capital stock per head (K/L), with L the number of workers. The set of a_z variables are z workforce characteristics, expressed as a proportion of the sector's workforce. Of particular interest is the proportion of each sector's workforce who fall into each age category (here defined as aged 16-20, 21-29, 30-49 50-59), though we also control for the proportion of the sector's workforce who are at each qualification level[9], the proportion who are female, the proportion who work part-time, and the proportion working in the private sector. All of these variables are observed for each sector, i, for each year, t, in our data set. Finally, u_{it} is a random disturbance term.

[8] A review of these papers was provided in the previous report we wrote for the LPC (Dickerson and McIntosh, 2011), and will not be repeated here.

[9] The six qualification levels observed are; 1) degree or equivalent, 2) Higher education below degree level, 3) A levels or equivalent, 4) GCSE grades A-C or equivalent, 5) other qualifications, 6) no qualifications. The final category includes a small number of respondents who reported that they did not know whether or not they held qualifications.

The equivalent wage equation is:

$$\log w_{it} = \delta_0 + \delta_1 \log k_{it} + \sum_z \delta_{2z} a_{zit} + \varepsilon_{it} \quad (2)$$

where *w* is the wage rate in sector *i* in year *t*. Comparison of the γ and δ coefficients reveals whether the workforce characteristics have a larger effect on productivity or wages.

Equations 1 and 2 will be estimated by fixed effects, thus controlling for unobserved characteristics of sectors that remain constant over time, and which may be correlated with both the age structure of the workforce and the dependent variables. Essentially, the estimated coefficients are then identified by variation in the explanatory variables within sectors over time.

4 Results

(i) Descriptive Statistics

Table 1 reports mean values for all of the variables used in the analysis, in total, then separately for the pre-recession and post-recession periods for all sectors, and separately for the pre-recession and post-recession periods for low-paying sectors only. [10] Comparing the means of the variables across the two periods, for all sectors, shows very little difference between the two periods. Average real productivity is very slightly higher in the post-recession period, while average real wage levels are essentially the same in the two periods, showing a lack of real wage growth in the recession period. Most of the explanatory variables also take very similar values in both the pre- and post-recession periods. Table 1 shows a very slight fall in the average proportions of 16-20 year old workers across sectors. There are also very slight increases in the average proportion who are female, part-time and private sector. The largest changes as far as worker characteristics are concerned are in terms of qualification levels, with a 3.6 percentage point increase in the average proportion of graduates across sectors, mostly at the expense of workers with no

[10] The low-paying sectors are those SIC07 sectors identified by the Low Pay Commission as employing significant numbers of low-paying workers in their 2010 report (Low Pay Commission, 2010). These sectors are mostly found in the Retail, Hospitality, Social care, Food processing, Leisure, Cleaning, Agriculture, Security, Childcare, Textiles and Hairdressing groups.

qualifications, whose average proportion falls by 2.3 percentage points. The recession period shows quite a large fall in real net capital expenditure, relative to the pre-recession period.

Comparing the figures for the low-pay sectors only, to the overall figures for all sectors, Table 1 shows that both productivity and wages are lower in the low-pay sectors, as expected. Similarly, expected differences in worker characteristics are also observed, with the low-pay sectors having a higher proportion of younger workers, a lower proportion of highly qualified workers, and a higher proportion of female and part-time workers. Average net capital expenditure per worker is significantly lower in the low-pay sectors than in the economy as a whole. Looking at changes between the pre- and post-recession periods in the low-pay sectors, there is some evidence of a fall in average real wages. The changes in worker characteristics are small, and generally reflect the changes in worker characteristics for the whole economy. The fall in net capital expenditure per worker is of a similar absolute size to the average fall in the whole economy, though is proportionally larger given the smaller starting level in the low-pay sectors.

(ii) Fixed Effects Specifications: All Years

Table 2 reports the results from the Fixed Effects specification, using the full sample of all sectors and all years.[11] Looking first at the wage equation in the middle column, the results display the usual inverted U-shaped age-earnings profile that is often observed, with average earnings rising with age before falling again to a lesser extent after the age of 50. Since all of the estimated coefficients are positive, they show that average wages are estimated to be higher for all age groups relative to the omitted category, who are 16-20 year olds. The coefficients show, for example, that a 1 percentage point increase in the proportion of a sector's workforce aged 30-49, is associated with 0.9% higher average wages in that sector. All estimated wage differences are statistically significant at the 5% level or better, with the exception of

[11] The obtained sample of 879 is slightly less than the 912 that might have been expected (114 sectors x 8 years), since there was missing information for a handful of cases, usually on the productivity (GVA per capita) variable.

that between 21-29 year olds and 16-20 year olds (which is statistically significant at the 10% level).

Turning to the productivity equation, none of the age coefficients are statistically significant, with all coefficients being very small, accompanied by large standard errors in this equation. The age-productivity profile averaged across the whole period is therefore essentially flat. The final column in Table 2 reports the difference between each productivity coefficient and its respective coefficient in the wage equation. Since the productivity differences between age groups are essentially zero, this productivity-wage gaps reflect the wage differences between age groups, with the higher wages of the older workers not reflected in higher productivity.

Briefly considering the other coefficients in Table 2, a higher proportion of women, part-time workers and private sector workers in a sector are all associated with lower average wages (significantly so for females and private sector workers), as might be expected. In the productivity equation, women and part-time workers are associated with higher productivity, albeit not significantly so. There is therefore no productivity justification for their lower wages. Private sector workers are associated with lower productivity, to a greater extent than their negative wage differential relative to public sector workers.[12] The qualification coefficients measure productivity and wage differences relative to the omitted category of workers with degrees. The three qualification categories immediately below degree level reveal lower sectoral productivity when the proportion of workers with these qualifications as their highest increases. Somewhat surprisingly, an increase in the proportion of workers only qualified to the lowest two qualification levels is associated with higher productivity. None of the qualification coefficients are statistically significant in the productivity equation, however. There is a similar lack of statistical significance on the qualification coefficients in the wage equation, and in this case the estimated coefficients are extremely small. The only variable to attract a statistically significant coefficient in the productivity equation is the net capital expenditure variable, which as expected is associated with higher productivity (though not wages).

[12] The results for the private sector variable should not perhaps be given too much focus. The proportion of private sector workers in most sectors is high and stable, and so the fixed effect estimate presented here is based on only a small amount of variation in this proportion within sectors over time.

The results in Table 2 make clear that the Fixed Effects estimation has not produced statistically robust results, particularly for the productivity equation where the standard errors are high and almost all coefficients are statistically insignificant. The estimated coefficients in a Fixed Effects equation are identified by variation in the variables over time, *within* industries. In the time period considered, there have not been very large changes in real gross value added per capita (productivity) or in real wages. There is therefore not much for the explanatory variables to explain over time within sectors, hence the lack of statistical precision. Another way to think about this is that perhaps sectors are employing close to the optimal mix of workers (in terms of age, education etc), and so small changes in these workforce characteristics do not take the sector far from the optimal, and so have little effect on average productivity in the sector.

Table A1 in the appendix shows the results when the productivity and wage equations are estimated by Ordinary Least Squares (OLS) rather than by Fixed Effects. The coefficients in such equations are determined more by the cross-section variation in variables across sectors, rather than the time series variation in variables within sectors. Many more coefficients in Table A1 are statistically significant compared to their equivalents in Table 2. Most of these significant effects are also in line with expectations, for example higher productivity and wages in sectors that employ older workers rather than 16-20 year olds, higher wages the better the qualified the workforce etc. The problem with the OLS results is that it is difficult to put a causal interpretation on the results. For example, is productivity higher in sectors with a larger proportion of older workers than in sectors with a larger proportion of young workers *because of* the age profile of the workforce, or are the productivity and age structure both determined by unobserved characteristics of the sectors? Using Fixed Effects identifies the coefficients only from time series variation within sectors, and so is not affected by differences in unobserved characteristics between sectors. For this reason, the Fixed Effects equations remain our preferred specification and will be used from this point onwards, despite the lack of variation over time producing results that are often not statistically robust.[13]

[13] The OLS results do at least show that the data are consistent with our expectations when variations across sectors are considered, so removing any fear that the Fixed Effects results are not very successful due to some measurement in the data.

Before moving on in the next section to consider the impact of the recession, Table 3 presents the results from estimating equations 1 and 2 for the full period for manufacturing and services sectors separately. The estimated age-earnings profiles are broadly similar for the two sectors, though the size of the coefficients is generally larger in the service sector, and hence the profiles are steeper there than in the manufacturing sector. The age-productivity profiles do differ markedly between manufacturing and services however. The profile in services mirrors that of the whole economy, unsurprisingly given that a majority of sectors are classified as services. The age-productivity profile in manufacturing sectors is different, however, with younger workforces being associated with higher productivity. The age-productivity profile in manufacturing is particularly erratic however, with very large standard errors, with the small sample size compounding the problems with the Fixed Effects estimates discussed above.

(iii) Fixed Effects, Separately for Pre- and Post-Recession Periods

Table 4 investigates the impact of the recession on the productivity and wage relationships. The wage equations show that there is no evidence for the slowdown in wage growth of young workers (that was shown in Figure 1) creating larger wage differentials between the age groups and increasing the slope of the age-earnings profile, at least when measured at the aggregate level with sector average wages. Indeed, the wage differences as measured by the Fixed Effects coefficients within sectors appear to have narrowed in the post-recession period. This would suggest that the aggregate differences in wage growth between age groups observed in Figure 1 are due to differences across sectors, with slower wage growth in youth-dominated sectors, rather than to rising wage differentials between age groups within sectors. Within sectors, changes in the age composition of sectors' workforces have had smaller effects on average sectoral wages in the post-recession period than in the pre-recession period.

Has the relative improvement in young people's wages within sectors been reflected in average productivity improvements? The productivity equation results are not very robust, which is not surprising given that the full period results were not strong. Thus when the sample is divided into two periods producing smaller sample sizes, the results are even weaker. To the extent that the results convey anything, however, the answer to the above question is no. In the pre-recession period, all the age coefficients are negative, suggesting higher productivity when sectors hire a larger proportion of 16-20 year olds, though all are statistically insignificant. This suggests that in the pre-recession period the higher wages that the older groups enjoyed relative to 16-20 year olds were not justified in terms of higher productivity, as reflected by the large negative (though statistically insignificant) productivity-wage gaps in the pre-recession period in the penultimate column. However, in the post-recession period of 2008-10, two of the productivity coefficients, for 21-29 year olds and 30-49 year olds turn positive, with the latter sizeable. They are not statistically significant, but this is due to the large standard errors in this equation, in turn caused by the small sample size of just 329 as a result of having only three years of data in the post-recession period.

Thus, whereas in the pre-recession period, productivity was apparently increased by increasing the proportion of young workers, in the post-recession period the reverse is true. This would suggest that productivity growth of young workers has slowed relative to that of older workers in the post-recession period, consistent with the hypotheses advanced in the Introduction, though this is not reflected in growing wage differences between age groups within sectors.

Finally, Table 5 reports the results from a similar analysis to Table 4, but estimated on the sample of low-paying sectors only. The reason for doing this is that if the impact of the recession has implications for the setting of the National Minimum Wage, it is important to check the impact of the recession where the National Minimum Wage has most bite, i.e. in the low-paying sectors. The results in Table 5 show that the effects discussed for the whole economy in the previous paragraph are even stronger when the sample is restricted to low paying sectors only. Thus, large relative productivity differences between 16-20 year olds on the one hand, and workers in all other age groups on the other hand, open up in the post-recession

period, in favour of the adult workers. With relative wage gaps between age groups if anything narrowing, the productivity-wage gaps in the final columns all change from negative in the pre-recession period to positive in the post-recession period. Two of the gaps are large in size, though statistically insignificant due to small sample sizes and so large standard errors. It therefore appears that the relative productivity slowdown of young workers is particularly pronounced in low paying sectors.

5 Conclusions

The aim of this analysis was to identify the impact of the recession on wages and productivity in the economy, particularly relative wages and productivity between age groups. Any changes in such relativities could have implications for the setting of the different rates by age group of the National Minimum Wage.

The results presented in this report are not statistically strong due to small sample sizes. In addition, the Fixed Effects results presented here suffer from a lack of time series variation within sectors. The results are therefore no more than suggestive only. As they stand, the results do not find any evidence of widening wage gaps between age groups within sectors. If anything, young workers have narrowed the wage gaps on older workers within the same sector in the post-recession period, compared to pre-recession. In terms of productivity, however, there is evidence that young workers aged 16-20 have fallen behind older workers in the same sector in the post-recession period. This is particularly the case in low-paying sectors where the National Minimum Wage has most bite. Combining these results with those in our report last year (Dickerson and McIntosh, 2011), the earlier results showed large productivity differences between adult and youth workers, in favour of older workers, in the pre-minimum wage period. These gaps narrowed following the introduction of the National Minimum Wage, and may even have turned negative in the immediate pre-recession period (Table 4, this report). However, this trend has reversed again in the post-recession period, and the productivity differentials now favour prime-aged workers once again, strongly so in low-paying sectors.

The lower relative productivity of 16-20 year olds could be due to rising education participation rates amongst all but the least able in the recession, because of a

shortage of employment opportunities. This would suggest that young people's relative wage gains within sectors in the post-recession period are not justified in terms of their relative productivity performance. If this evidence is accepted, then it would suggest that the minimum wage setting should also reflect these changing productivity relativities (though note that average relative wages in sectors do not, as yet, reflect these changing productivity differences). It must be stressed again however, that these results are not statistically strong, with few statistically significant differences in wages between age groups, and no statistically significant coefficients at all for the estimated productivity differences between age groups.

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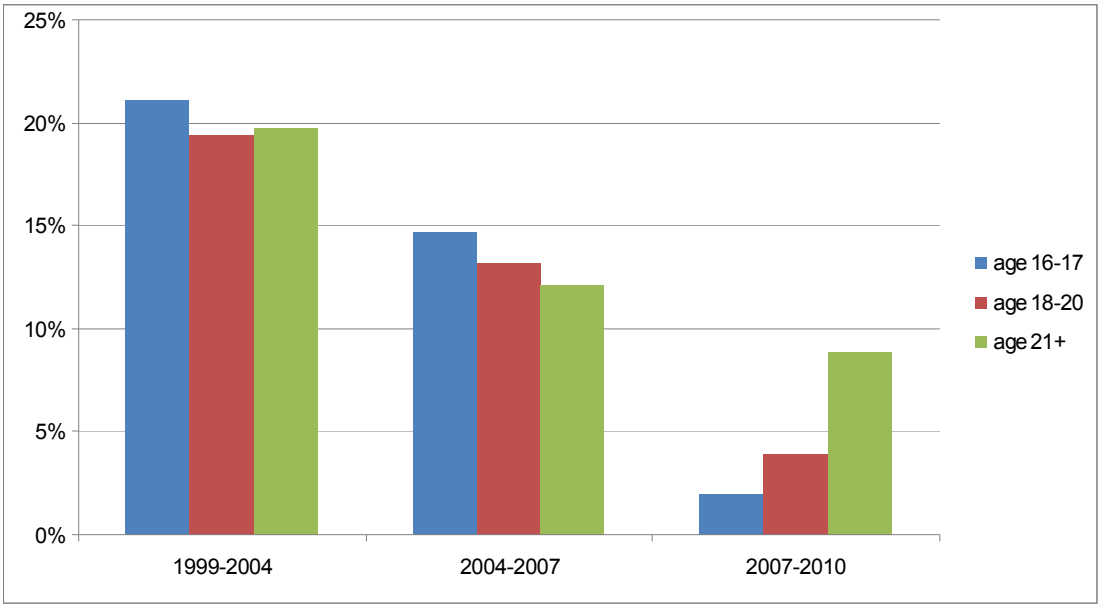
FIGURES

Figure 1: Growth in Median Wage Growth, by Age Group and Time Period



Source: ASHE.

TABLES

Table 1 – Descriptive Statistics

	Total	Pre-recession: 2003-2007 All sectors	Post-recession: 2008-2009 All sectors	Pre-recession: 2003-2007 Low pay sectors	Post-recession: 2008-2009 Low pay sectors
Ln(real GVA per capita)	3.467 (0.910)	3.461 (0.874)	3.477 (0.967)	3.096 (0.450)	3.094 (0.471)
Ln(real wage)	2.432 (0.259)	2.432 (0.256)	2.432 (0.263)	2.196 (0.218)	2.174 (0.208)
Proportion aged 16-20	0.066 (0.067)	0.067 (0.067)	0.064 (0.067)	0.125 (0.085)	0.124 (0.085)
Proportion aged 21-29	0.210 (0.058)	0.207 (0.057)	0.215 (0.059)	0.240 (0.060)	0.251 (0.061)
Proportion aged 30-49	0.526 (0.077)	0.528 (0.077)	0.522 (0.077)	0.460 (0.084)	0.453 (0.086)
Proportion aged 50-59	0.199 (0.051)	0.198 (0.050)	0.199 (0.052)	0.175 (0.054)	0.172 (0.058)
Proportion with degree	0.203 (0.152)	0.190 (0.143)	0.226 (01.63)	0.113 (0.077)	0.134 (0.086)
Proportion with sub-degree	0.081 (0.038)	0.079 (0.038)	0.083 (0.037)	0.066 (0.036)	0.068 (0.033)
Proportion with A-levels	0.240 (0.081)	0.245 (0.079)	0.231 (0.083)	0.249 (0.078)	0.240 (0.085)
Proportion with A-C GCSEs	0.224 (0.064)	0.223 (0.060)	0.227 (0.069)	0.268 (0.052)	0.276 (0.055)
Proportion with other quals	0.122 (0.056)	0.125 (0.052)	0.118 (0.061)	0.138 (0.047)	0.137 (0.064)
Proportion with no quals	0.130 (0.065)	0.138 (0.066)	0.115 (0.061)	0.167 (0.063)	0.145 (0.058)
Proportion female	0.422 (0.202)	0.420 (0.204)	0.426 (0.198)	0.554 (0.180)	0.558 (0.176)
Proportion part-time	0.235 (0.164)	0.232 (0.165)	0.239 (0.163)	0.380 (0.161)	0.390 (0.162)
Proportion private sector	0.869 (0.240)	0.867 (0.246)	0.871 (0.230)	0.881 (0.217)	0.883 (0.210)
Ln real net capital exp/ head	0.916 (1.030)	0.968 (0.954)	0.830 (1.142)	0.640 (0.660)	0.500 (0.811)

Note: standard deviations in parentheses.

Table 2 – Fixed Effects Specification

	Ln real GVA per head	Ln real wage	Productivity-wage gap
Proportion aged 21-29	0.069	0.395	-0.325
	(1.807)	(0.211)	(1.813)
Proportion aged 30-49	0.010	0.892	-0.882
	(1.747)	(0.204)**	(1.753)
Proportion aged 50-59	0.088	0.511	-0.423
	(1.871)	(0.219)*	(1.878)
Proportion with sub-degree	-1.131	-0.017	-1.114
	(0.906)	(0.106)	(0.909)
Proportion with A-levels	-0.066	0.022	-0.088
	(0.513)	(0.060)	(0.515)
Proportion with A-C GCSEs	-0.328	0.058	-0.386
	(0.558)	(0.065)	(0.559)
Proportion with other quals	0.439	0.029	0.410
	(0.629)	(0.074)	(0.631)
Proportion with no qualifications	0.317	0.048	0.269
	(0.647)	(0.076)	(0.650)
Proportion female	0.823	-0.364	1.186
	(1.132)	(0.132)**	(1.136)
Proportion part-time	0.591	-0.176	0.766
	(0.874)	(0.102)	(0.877)
Proportion private	-1.614	-0.280	-1.334
	(0.833)	(0.097)**	(0.836)
Ln real net capital expenditure per head	0.358	0.004	0.354
	(0.040)**	(0.005)	(0.040)**
Constant	4.008	2.184	1.824
	(1.872)*	(0.219)**	(1.878)
Observations	879	879	879
R-squared	0.12	0.10	0.12

Standard errors in parentheses * significant at 5%; ** significant at 1%

Table 3 – Fixed Effects Specification: Manufacturing and Services Separately

	Manufacturing			Services		
	Ln real GVA per head	Ln real wage	Productivity-wage gap	Ln real GVA per head	Ln real wage	Productivity-wage gap
Proportion aged 21-29	0.420	-0.328	0.748	0.128	0.421	-0.292
	(9.675)	(0.515)	(9.711)	(1.635)	(0.247)	(1.635)
Proportion aged 30-49	-4.258	0.426	-4.684	0.695	1.017	-0.322
	(9.936)	(0.529)	(9.973)	(1.591)	(0.240)**	(1.591)
Proportion aged 50-59	-0.229	-0.013	-0.215	0.785	0.233	0.551
	(9.604)	(0.511)	(9.640)	(1.782)	(0.269)	(1.783)
Prop. with sub-degree	-2.747	-0.100	-2.647	-1.136	-0.067	-1.069
	(4.245)	(0.226)	(4.261)	(0.868)	(0.131)	(0.868)
Proportion with A-levels	-1.713	-0.113	-1.600	0.121	0.078	0.043
	(2.628)	(0.140)	(2.637)	(0.505)	(0.076)	(0.505)
Prop. with A-C GCSEs	-1.339	0.008	-1.348	-0.140	-0.006	-0.134
	(2.938)	(0.156)	(2.949)	(0.506)	(0.077)	(0.506)
Prop. with other quals	2.080	-0.101	2.180	0.143	0.027	0.116
	(3.167)	(0.168)	(3.178)	(0.593)	(0.090)	(0.593)
Prop. with no quals	0.854	-0.124	0.978	-0.042	0.087	-0.128
	(3.019)	(0.161)	(3.030)	(0.616)	(0.093)	(0.616)
Proportion female	1.455	-0.322	1.776	0.581	-0.395	0.975
	(6.056)	(0.322)	(6.079)	(1.057)	(0.160)*	(1.057)
Proportion part-time	1.992	0.009	1.983	0.840	-0.325	1.166
	(5.636)	(0.300)	(5.657)	(0.790)	(0.119)**	(0.790)
Proportion private	-0.035	0.336	-0.370	-1.548	-0.301	-1.247
	(5.787)	(0.308)	(5.809)	(0.723)*	(0.109)**	(0.723)
Ln real net cap.exp. / head	0.151	-0.003	0.154	0.392	0.001	0.392
	(0.303)	(0.016)	(0.304)	(0.036)**	(0.005)	(0.036)**
Constant	6.057	2.050	4.007	3.179	2.288	0.891
	(10.924)	(0.581)**	(10.965)	(1.680)	(0.254)**	(1.680)
Observations	173	173	173	623	623	623
R-squared	0.08	0.23	0.08	0.21	0.14	0.21

Standard errors in parentheses. * significant at 5%; ** significant at 1%

Table 4 – Effect of the Recession on Productivity and Wage Equations: Fixed Effects

	Ln real GVA per head		Ln real wage		Productivity- wage gap	
	2003-2007	2008-2010	2003-2007	2008-2010	2003-2007	2008-2010
Proportion aged 21-29	-0.315	0.010	0.926	0.273	-1.241	-0.263
	(2.310)	(2.525)	(0.292)**	(0.375)	(2.335)	(2.517)
Proportion aged 30-49	-0.747	0.916	1.224	0.863	-1.971	0.052
	(2.242)	(2.419)	(0.284)**	(0.360)*	(2.267)	(2.412)
Proportion aged 50-59	-1.055	-0.506	0.711	0.218	-1.765	-0.723
	(2.487)	(2.653)	(0.315)*	(0.394)	(2.514)	(2.645)
Prop. with sub-degree	-0.047	-1.668	0.118	-0.001	-0.165	-1.668
	(1.597)	(0.817)*	(0.202)	(0.121)	(1.614)	(0.814)*
Proportion with A-levels	0.291	-0.361	0.239	-0.113	0.052	-0.248
	(1.263)	(0.436)	(0.160)	(0.065)	(1.277)	(0.434)
Prop. with A-C GCSEs	0.128	-0.659	0.137	0.066	-0.009	-0.725
	(1.152)	(0.538)	(0.146)	(0.080)	(1.164)	(0.536)
Prop. with other quals	1.852	0.104	0.029	-0.013	1.823	0.116
	(1.265)	(0.567)	(0.160)	(0.084)	(1.279)	(0.565)
Prop. with no quals	1.813	0.041	0.274	0.089	1.538	-0.048
	(1.286)	(0.628)	(0.163)	(0.093)	(1.300)	(0.627)
Proportion female	-0.554	1.583	-0.280	-0.588	-0.274	2.172
	(1.607)	(1.510)	(0.203)	(0.225)**	(1.625)	(1.506)
Proportion part-time	0.109	1.982	-0.102	0.591	0.211	1.391
	(1.047)	(1.294)	(0.133)	(0.192)**	(1.059)	(1.290)
Proportion private	-0.529	-3.413	-0.318	0.847	-0.210	-4.261
	(1.083)	(1.668)*	(0.137)*	(0.248)**	(1.095)	(1.664)*
Ln real net	-0.018	0.399	0.019	0.009	-0.036	0.390
cap.exp. / head	(0.103)	(0.040)**	(0.013)	(0.006)	(0.105)	(0.040)**
Constant	4.155	4.888	1.712	1.254	2.443	3.634
	(2.550)	(2.742)	(0.323)**	(0.408)**	(2.577)	(2.734)
Observations	550	329	550	329	550	329
R-squared	0.03	0.37	0.13	0.18	0.03	0.37

Standard errors in parentheses * significant at 5%; ** significant at 1%

Table 5 – Effect of the Recession on Productivity and Wage Equations: Fixed Effects – Low Paying Sectors Only

	Ln real GVA per head		Ln real wage		Productivity- wage gap	
	2003-2007	2008-2010	2003-2007	2008-2010	2003-2007	2008-2010
Proportion aged 21-29	-0.628	1.043	0.718	0.780	-1.346	0.264
	(0.603)	(2.406)	(0.568)	(0.447)	(0.841)	(2.510)
Proportion aged 30-49	-0.691	2.465	1.330	0.488	-2.021	1.977
	(0.600)	(2.198)	(0.566)*	(0.409)	(0.837)*	(2.294)
Proportion aged 50-59	-0.500	3.242	-0.187	0.477	-0.314	2.765
	(0.680)	(2.917)	(0.641)	(0.542)	(0.949)	(3.044)
Prop. with sub-degree	0.551	-2.588	-0.072	0.029	0.622	-2.617
	(0.684)	(1.160)*	(0.644)	(0.216)	(0.954)	(1.210)*
Proportion with A-levels	0.619	0.158	0.565	-0.046	0.054	0.204
	(0.522)	(0.495)	(0.492)	(0.092)	(0.728)	(0.517)
Prop. with A-C GCSEs	0.534	-1.435	0.078	0.151	0.456	-1.586
	(0.415)	(0.728)	(0.391)	(0.135)	(0.579)	(0.760)*
Prop. with other quals	0.552	1.153	0.284	0.208	0.267	0.946
	(0.520)	(0.705)	(0.491)	(0.131)	(0.726)	(0.736)
Prop. with no quals	0.304	0.499	0.426	0.332	-0.122	0.167
	(0.474)	(0.721)	(0.447)	(0.134)*	(0.661)	(0.753)
Proportion female	-0.848	2.427	-0.788	-1.169	-0.060	3.596
	(0.468)	(1.815)	(0.442)	(0.337)**	(0.654)	(1.894)
Proportion part-time	-0.369	3.270	0.016	0.944	-0.385	2.327
	(0.373)	(1.421)*	(0.352)	(0.264)**	(0.521)	(1.482)
Proportion private	-0.659	-5.152	-0.287	0.554	-0.372	-5.706
	(0.334)	(2.392)*	(0.315)	(0.445)	(0.466)	(2.496)*
Ln real net cap.exp. / head	0.081	0.209	0.037	0.011	0.044	0.197
	(0.029)**	(0.061)**	(0.028)	(0.011)	(0.041)	(0.064)**
Constant	4.278	3.232	1.867	1.361	2.412	1.871
	(0.737)**	(2.828)	(0.694)**	(0.526)*	(1.028)*	(2.951)
Observations	185	108	185	108	185	108
R-squared	0.23	0.43	0.19	0.44	0.20	0.42

Standard errors in parentheses * significant at 5%; ** significant at 1%.

Appendix

Table A1 – OLS Specification

	Ln real GVA per head	Ln real wage	Productivity-wage gap
Proportion aged 21-29	2.092	0.838	1.254
	(0.981)*	(0.203)**	(0.974)
Proportion aged 30-49	2.450	1.660	0.790
	(0.692)**	(0.143)**	(0.687)
Proportion aged 50-59	0.945	0.014	0.931
	(0.881)	(0.183)	(0.874)
Proportion with sub-degree	1.151	-0.441	1.592
	(0.690)	(0.143)**	(0.685)*
Proportion with A-levels	0.126	-0.600	0.726
	(0.309)	(0.064)**	(0.307)*
Proportion with A-C GCSEs	0.976	-0.478	1.454
	(0.411)*	(0.085)**	(0.408)**
Proportion with other quals	-0.756	-0.995	0.238
	(0.482)	(0.100)**	(0.479)
Proportion with no qualifications	-0.892	-1.497	0.605
	(0.497)	(0.103)**	(0.493)
Proportion female	0.429	-0.150	0.579
	(0.234)	(0.049)**	(0.233)*
Proportion part-time	-1.398	-0.256	-1.143
	(0.370)**	(0.077)**	(0.367)**
Proportion private	1.878	0.048	1.830
	(0.124)**	(0.026)	(0.123)**
Ln real net capital expenditure per head	0.373	0.014	0.359
	(0.021)**	(0.004)**	(0.021)**
Constant	-0.444	2.092	-2.535
	(0.769)	(0.159)**	(0.764)**
Observations	879	879	879
R-squared	0.63	0.80	0.58

Standard errors in parentheses * significant at 5%; ** significant at 1%.