The route out of the routine: mobility and the changing structure of occupations

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**Abstract**

Over the previous three decades, technological progress has driven a shift in the occupational structure of many countries, including the UK. Some jobs comprise of a number of tasks which could be replaced by ICT capital. As the price of such technology falls, so too does employment in these jobs. These jobs are referred to as routine in the sense that the tasks performed by workers in them tend to follow a series of instructions, which could be replicated by an appropriately programmed machine. This process is often referred to as routinisation (Autor, Levy and Murnane, 2003). Along with the related phenomena of polarisation – which identified routine occupations as mostly middle-wage jobs – much of the related discussion has been on the implications of these changes for wage inequality (Goos and Manning, 2007; Autor, Katz and Kearney, 2006a). However, changes in the occupational structure have potentially important effects on mobility as well, but as yet these effects have not been rigorously analysed. With improving upward mobility often mentioned as an ambition of successive governments, it is important to establish what barriers exists in order to devise policies to overcome them.

One aspect of changes to mobility prospects can be examined by looking at the labour market outcomes of routine job employees displaced by routinisation. A key question is whether these workers are able to move to well-paid non-routine jobs, and if they are, what factors contribute to this upward mobility. Using data from the National Child Development Study (NCDS), this paper presents a mobility analysis of these routine workers between 1981 and 2004. We separate out the effect of routinisation on job moves from other driving factors, such as career advancement or job mismatch. As expected, periods where the employment share of routine jobs fell markedly across the entire economy were periods which witnessed increased the mobility of routine workers towards both high and low wage non-routine jobs. The relationship between routinisation and mobility is mediated through the qualification levels, specific skills and experience of workers. Highly academically qualified displaced workers move to professional occupations, whilst those with high vocational or level 2-3 academic qualifications increasingly move to intermediate occupations. Transitions to managerial occupations for displaced workers are not made more likely by formal qualifications, but are by informal skills proxied by working experience and age. Specific skills acquired through performing routine work dramatically reduce the likelihood of displacement. Finally, there is some evidence to suggest that displaced workers face non human capital barriers to mobility.

**1 Introduction**

Over the previous three decades, technological progress has driven a shift in the occupational structure of many countries, including the UK. Some jobs comprise of a number of tasks which could be replaced by ICT capital. As the price of such technology falls, so too does employment in these jobs. These jobs are referred to as routine in the sense that the tasks performed by workers in them tend to follow a series of instructions, which could be replicated by an appropriately programmed machine. This process is often referred to as routinisation (Autor, Levy and Murnane, 2003). Along with the related phenomena of polarisation – which identified routine occupations as mostly middle-wage jobs – much of the related discussion has been on the implications of these changes for wage inequality (Goos and Manning, 2007; Autor, Katz and Kearney, 2006). However, changes in the occupational structure have potentially important effects on mobility as well, but as yet these effects have not been rigorously analysed. With improving upward mobility often mentioned as an ambition of successive governments, it is important to establish what barriers exists in order to devise policies to overcome them.

There are numerous dimensions to the effect routinisation may have on mobility. Established career paths may be affected by the decline in middle-wage routine occupations, with workers struggling to move up to that level as the number of job opportunities falls. This bottleneck could create a situation where vacancies in well-paid, high skill jobs above the bottleneck are filled by increasingly well-qualified new entrants rather than through the career progression of older workers from less good jobs. A second aspect of this is to consider the mobility (and limits to mobility) of routine job employees displaced by routinisation. As firms' demand for these routine workers declines, it is important to learn how the labour market treats them afterwards. A key question is whether these workers are able to move to well-paid non-routine jobs, and if they are, what factors contribute to this upward mobility. This aspect of mobility is the focus of this paper, which looks at the occupational transitions of these routine workers between 1981 and 2004.

The paper is arranged as follows. The next section discusses the factors which affect occupational mobility, including both changes in the occupational structure and more general career progression. Section 3 describes the empirical strategy used to analyse the destination of displaced workers using a longitudinal dataset, described in section 4. Section 5 presents a series of examples to illustrate the main results.[[2]](#footnote-2) Section 6 concludes.

**2 The determinants of occupational mobility: a theory**

Holmes (2011b) presents a model of the economy where production depends on the input of four types of labour: professional, managerial, routine and service. This model will be briefly summarised in this section, as it motivates the empirical strategy. Routine labour is a perfect substitute for capital in the production process, so, as the this technology becomes cheaper, it drives down routine employment and wages. Employment in professional occupations requires the necessary accreditation or qualifications. Managerial occupations and service occupations have no accreditation requirement, and represent high skill and low skill non-routine occupations respectively. Workers are employed in this labour market for multiple periods, and develop skills and experience through their employment which may allow them to advance to better jobs as they get older.

Workers differ in their levels of education attainment – they may be either university graduates, high school graduates or unqualified. Individuals with higher attainment are able to work in the better jobs, either because these jobs require higher levels of skills developed through more education, or because education acts as a signal in a screening process where the most able invest in more education. University graduates are able to supply their labour to either managerial or professional occupations. High school graduates supply their labour to either managerial or routine occupations. Finally, the unqualified are able to supply their labour to either routine or service occupations. Thus, obtaining higher qualifications can facilitate upward progression.

Within each educational category, workers differ in their productivity in each occupation. This relative productivity can reflect a number of different dimensions. Firstly, it can represent differences in general cognitive abilities. For example, some people may be innately better problem solvers, making them more productive managers, or possess better tool-handling skills, making them better process operatives (a routine occupation). Secondly, individuals develop capabilities through experience which allows for progression to better jobs, leading to the creation of a career. For example, working for a time in a workshop is considered necessary experience for promotion to the position of shop foreman. This type of mobility was introduced in a formal model by Sicherman and Galor (1990). It is included in the model by allowing relative productivity in better occupations to increase as workers get older. Thirdly, individuals develop specific skills from working in a particular occupation, where these skills are only useable within that occupation. This is included in the model by allowing the relative productivity of the job currently being performed to increase as the worker spends more time in it. Wages in each occupation are set per effective unit of labour input, so more productive workers earn more for the same time input. In the absence of routinisation (i.e. with stable relative wage rates) mobility would be in the form of career progression, as individuals becomes relatively more productive in better occupations, and as a result may move occupations as they get older[[3]](#footnote-3).

A change in the relative wages of the different occupations alters supply patterns and generates additional mobility. For example, an exogenous fall in the wage of routine workers (caused, as in the case of routinisation, by a fall in the price of ICT capital for which routine labour is substitutable) would lead some unqualified workers to move to service occupations while some high school graduates would supply their labour to managerial work[[4]](#footnote-4). Assuming the service occupation has a lower wage rate, those who make this move will have the lowest relative productivity in routine work. Moreover, assuming that the managerial occupation attracts a higher wage rate, those that make this move would be those with the highest relative productivity in managerial occupations. Therefore, the model predicts not only that routinisation should increase mobility out of routine occupations, but that these moves are mitigated by a number of factors:

* Mobility from routine to higher skill non-routine occupations should be more likely with higher qualifications. Mobility from routine occupations to service occupations should be less likely with higher qualifications.
* To the extent that older workers (with more labour market experience) become relatively more productive in better occupations over time, then everything else being equal, there will be more mobility towards managerial occupations by older workers, and more mobility towards service occupations by younger workers.
* To the extent that specific skills in routine occupations make workers relatively more productive in those jobs, then everything else being equal, there will be less mobility out of routine occupations by those with more specific skills.

These final two points are connected to the work of Autor and Dorn (2009), who argue that routinisation affects different generations differently. Skill specificity make older workers less likely to move between occupations and more likely to accept falling wages, whilst young workers are less keen to move into those in decline. This has led to routine occupations 'getting old'. The model presented here allows for two separate effects from aging through the development of both occupation-specific skills and career-progressing experience. We certainly might expect older workers to have more specific experience in routine occupations than younger workers on average. However, what this model shows is that, once you control for these specific skills, it will be older (appropriately qualified) workers who are more likely to leave routine occupations following routinisation.

Therefore, there are two forms of occupational moves in the model: career mobility and routinisation-driven mobility. In this paper, we test these different aspects of mobility using a panel data set which follows a cohort of workers in the UK labour market over a substantial period of time.

**3 Methodology**

As identified in our model, individuals may move between occupational categories due to career progression, rather than due to displacement caused by routinisation. Therefore, simply looking at the occupational mobility of routine workers over time may capture both those moving due to career motivations, and those displaced by routinisation. Ideally, we would compare two cohort studies, looking at the probability of moving between different occupational categories for a workforce unaffected by routinisation, and one that entered the labour market just as routine occupations began to decline. However, an appropriate early cohort study does not exist in the UK.

As a result, this paper develops an alternative methodology. Transitions between occupational groups are examined across a number of periods of time. The factors affecting transitions from routine occupations are estimated using a logit model, where the independent variables are education, specific experience and two demographic variables (gender and race), running one regression for each final occupation group. As a final explanatory variable, a measure of routinisation is included for each period of transition. This final addition to the model can, at least to an extent, separate out occupation moves caused by routinisation and those caused by general career progression.

Let *Yi* be a dummy variable which takes value of 1 if the individual *i* is in the given occupational group *Y* at the end of the period. Then, the logit model specifies the functional form of the probability distribution over belonging to a certain occupation at the end of the period *t* as:

Rearranging gives the log odds ratio, z, as a linear function:

(1)

where *Xit*is a vector of educational attainment, specific experience and other personal characteristics of individual *i* (including any interaction terms),in period *t*, the period of transition, and *R* is a measure of routinisation (or the change in the occupational structure) in that period. The time period may enter the equation in a number of forms, but the baseline model includes it as a linear trend and is interpreted as the accumulation of career-progressing experience.

**4 Data**

This model is estimated using the National Child Development Study (NCDS). The members of the NCDS study were all born in a single week in March 1958. Data has been collected on these members in a series of waves. The most useful waves for assessing labour market outcomes over a period where routinisation has taken place are between the fourth and seventh waves, taken in 1981, 1991, 1999-2000 and 2004-5 respectively. The fourth wave is the first one taken after the school leaving age (respondents were aged 23) and records early labour market experience. The seventh wave was completed in 2004-5 (respondents were aged 46-47), and has the most recent data on wages, employment and education. It is possible to construct an entire working life history over this time period using responses from all four waves, including periods of employment, unemployment, self-employment and non-participation for a number of reasons such as sickness or further education. As with all longitudinal studies, there are missing data. The sample size is around 12,000 for the fourth wave, and around 10,000 for the seventh wave. Employment data are available for a subset of these observations. Just under 5000 individuals report employment data in both the fourth and seventh waves, though this sample increases if we look at those who were non-employed or unemployment in one of the waves. The data suggests five periods of transition for this analysis: 1981-1986, 1986-1991, 1991-1995, 1995-1999 and 1999-2004. These periods were chosen so that four of them coincided with the actual survey years of the dataset, and the remainder (1986 and 1995) fell in the mid-point between two surveys.

4.1 Occupational mobility

Occupations of employment are measured using the narrowest available occupational coding. One problem with doing this over a long period of time is that the system of coding occupations has changed three times since 1980. The 1981 wave uses the KOS (Key Occupations for Statistical Purposes) system of job title classification, which categorises occupations within the 18 CODOT (Classification of Occupation and Directory of Occupational Titles) major groups, while the 1991 and 1999 surveys use SOC90 and the 2004 wave uses the most recent SOC2000 classification. The SOC2000 coding system of occupations has a four level classification system, from major group (first digit) to unit group (fourth digit). To make data comparable between 1981 and 2004, a conversion system was derived between KOS and SOC2000 codes, using the descriptions of occupations provided for each group. The conversion is not always perfect (see Holmes, 2010, for a discussion). In some cases a category in SOC2000 could apply to several categories under KOS (and vice versa) and subjective judgements have been made. In some cases, observations have been dropped because it was not possible to place one KOS code into a single SOC2000 code. Total exclusions on this basis account for 12.43% at the minor group (three-digit) level for the 1981 survey.

A similar conversion was created between SOC90 and SOC2000[[5]](#footnote-5). These two classification systems had a much more overlap in terms of the descriptions of each category. A conversion was made from each SOC90 occupation to a 4-digit SOC2000 category, where descriptions were on a similar level of aggregation. These were then reduced into 3-digit categories which are used in the analysis.

Each 3-digit category was assigned to one of the six occupational categories, two more than the four categories discussed in the model. This adds an intermediate occupation category the two high skill non-routine occupations on the basis that such occupations (including associate professionals and technicians) have different entry requirements than professionals and potentially different employment trends than managerial occupations. Moreover, a small category for manual non-routine occupations was added to distinguish this sort of low wage non-routine work from service occupations.

The allocation between different occupational categories were based on the wages (using average values from NCDS data in the 1981 and 2004 waves), description and change in employment share (using Labour Force Survey data). Aside from a few obvious categories (such as those which are clearly professional from the descriptions), any occupation which experienced a decline in employment share is considered to be a routine occupation. Looking at the wages and descriptions is used as a common sense check – all these occupations have middle range wages and their descriptions suggest the work involves administrative or manual processes which could be replaced by computer technology. The occupational categories are shown in Table 6.

4.2 Educational attainment

Across the four waves of the NCDS used in this paper, there are numerous systems for recording educational achievement, including detailed data on a wide range of vocational courses which have declined in importance in recent years. As a way to bring all of this data together, the highest NVQ equivalent level across time is recorded[[6]](#footnote-6). Each individual has two educational variables – a highest NVQ level in academic courses and a highest NVQ level in vocational courses, with both ranging from 0-5. The data are cleaned so that NVQ levels do not decline over time.

4.3 Experience and specific skills

General experience is captured by age, or period of transition, which ranged from 1 to 5. Specific experience within a routine occupation is included below using a scale measure from 0 to 4, which counts all the previous periods where a worker was in a routine occupation at both the beginning and end of it. This is likely to be a conservative measure of experience in specific routine occupations. However, it is significantly simpler than checking over all employment histories and counting the total number of years in routine occupations.

Specific experience and the time period are positively correlated, as would be expected, with a correlation coefficient of 0.672. Within each period of transition, there is sufficient variety in existing routine experience that issues relating to multicollinearity would not be an immediate concern – around 55% of the total variance of specific experience is not accounted for by age.

4.4 Routinisation

The measure of routinisation comes from data from the Labour Force Survey (LFS). Data on employment have been collected by the LFS since 1973, on a yearly basis until 1992, then on a quarterly basis. Wage data have been available from the LFS since 1993. The sample is much larger than any UK cohort study, as it looks at around 60,000 households, leading to approximately 120,000-130,000 individual observations.

Using these data, the measure of routinisation in each of these time periods is the changes in employment of routine occupations across the whole labour market. shows the change in the different occupation groups over each period.

Routinisation had its largest effects in the late 1980 and the early 2000s, and had much less of an effect in the 1990s. The process of routinisation is assumed to directly affect the employment share of routine workers and is exogenous. It seems sensible to look at decline rates rather than absolute declines – a 2% fall in employment share will have a much larger effect on occupational mobility if the initial employment share was 4% than if it were 20%. Thus, the routinisation variable takes the following values:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Year** | **1981-86** | **1986-91** | **1991-95** | **1995-99** | **1999-2004** |
| Period of transition, *t* | 1 | 2 | 3 | 4 | 5 |
| Change in employment share | -4.30% | -15.29% | -3.27% | -1.90% | -6.27% |
| Rate of decline | -6.55% | -24.91% | -7.09% | -4.44% | -15.32% |
| Routinisation | 0.0655 | 0.2491 | 0.0709 | 0.0444 | 0.1532 |

Source: LFS, own calculations

Period of transition and routinisation are barely correlated – they have a correlation coefficient of -0.05 – which means we can be confident that the routinisation index will not capture any effects of career progression when both are included in the model. Thus, this method allows for the mobility effects of routinisation to be distinguished from those that would already occur over the working life.

**5 Results**

5.1 Estimation

The following baseline model, based on equation (1), is estimated using these data and maximum likelihood:

(2)

Periods are stacked, so *i* denotes a individual-time period pair. The qualification variables are dummies for each NVQ level, and dummies for gender and race are included.

Two alternative specifications are used to test the effect of different variables when conditioned on routinisation. Multiplicative interaction terms are regularly used in statistical analyses where context may alter the effect of an independent variable, leading to conditional hypotheses. These terms are introduced here to see whether certain types of individuals do better or worse out of the loss of routine occupations. The first set of regressions, look to see whether certain qualifications enabled individuals to move upwards to better jobs as routine jobs were lost. The number of qualification variables is reduced to three dummies: vocational at level 4 and above, academic at level 4 and above and academic at level 2 or 3. This is based on the results of the baseline model, where vocational qualifications below level 3 did not have significant explanatory power on mobility relative to those at level 3, in almost all cases. Moreover, level 2 academic qualifications did not have significant explanatory power on mobility relative to level 3 academic qualifications. Reducing the number of qualification dummy variables is convenient to limit the number of interaction terms The second set of regressions look to see whether general and occupation specific experience makes individuals less likely to move from routine occupations as the process of routinisation takes place, in the manner discussed by Autor and Dorn (2009).

The results of these estimations are shown in the appendix. Before illustrating these estimated models with examples, a number of points need to be made. Firstly, in the baseline model, estimated coefficients give significance and direction of the marginal effects on transition probabilities, but they do not give magnitude. Secondly, the interaction models estimated include all relevant terms, including the constitutive terms alone as well as all two-way, three-way and higher interactions. This is considered good practice, even if the interaction term has no predicted effect in theory (Brambor, Clark and Golder, 2006). As with the baseline model, estimated coefficients in these interaction models are not marginal effects. Moreover, in terms of the interaction effects of interest, the earlier approach (which focused on identifying significant effects, rather than discussing magnitude) is further complicated. Ai and Norton (2003) demonstrate that in a logit model with interactions, the sign on the interacted term coefficient is not always the same as the direction of the interaction effect. Moreover, a zero coefficient on the interaction term is not the same thing as a zero interaction effect. Finally, the standard error of the interaction effect is not the same as the standard error found on the interaction term coefficients. Hence, simply looking at the sign and significance of estimated coefficients is not enough to describe the effect of each independent variable fully. Holmes (2011) follows their suggested methodology for deriving marginal and interaction effects via differentition of the estimated probability functions, and for computing the standard error of this estimated effect using the delta method. These results are not presented here, but is implicitly included in the remainder of this section.

5.1 Intermediate level qualifications

The first comparison is made between those with no qualifications and those with level 2-3 academic qualifications, using the interaction model with qualifications. Everything else is held constant – the predicted probabilities are for the transitions of a white male between the ages of 33 and 38, who has worked in a routine occupation for one prior period. These are shown in Table 1, which gives an idea of the size of the effects discussed in the previous section.

The first thing the table shows is that in any five year period, the overwhelming majority of individuals do not leave routine occupations. In the absence of routinsation, around 6.5% of low skilled and 8.5% of middle skilled workers leave these occupations. Many of these moves appear to be some form of career progression (i.e. towards intermediate and managerial occupations), with higher qualifications significantly increasing the likelihood of this (as shown in the column labelled 'marginal effect'). The second thing it shows is the effect of a 10% decline in routine occupations on mobility. This causes additional mobility across all qualification levels (shown by the decline in the probability of staying in a routine occupations for both levels). Just over 1% more low qualification routine workers and around 2.5% level 2-3 workers leave following this decline in occupations – far less than the total decline in jobs. For the more qualified workers, the larger decrease in the probability of remaining in a routine occupation and larger increase in the probability of moving to an intermediate occupation following routinisation (showed by the 'interaction effect' column), suggests this is the main destination for those displaced.

Table 1: Predicted probabilities of transition – intermediate level qualifications

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | 0 % routinisation | | | 10% routinisation | | |  |
| Occupation | No quals | Level 2-3 | Marginal effect | No quals | Level 2-3 | Marginal effect | Interaction effect |
| Professional | 0.6% | 0.5% | -0.1% | 0.6% | 0.9% | 0.3% | 0.4% |
| Managerial | 1.3% | 3.0% | 1.7%\* | 1.5% | 3.7% | 2.2%\* | 0.5% |
| Intermediate | 1.3% | 2.3% | 1.0%\* | 1.1% | 2.8% | 1.7%\* | 0.7%\* |
| Routine | 93.5% | 91.5% | -2.0%\* | 92.2% | 89.0% | -3.2%\* | -1.2%\* |
| Service | 1.1% | 1.2% | 0.1% | 1.5% | 1.5% | 0.0% | -0.1% |

Note: \* indicates the effect is significant

5.2 Higher education

shows the changes in the predicted probabilities of transition for the same benchmark individual if they moved from level 2-3 academic qualifications to level 4-5 qualifications, such as a university degree.

Table 2: Predicted probabilities of transition – higher academic qualifications

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | 0 % routinisation | | | 10% routinisation | | |  |
| Occupation | Level 2-3 | Level 4-5 | Marginal effect | Level 2-3 | Level 4-5 | Marginal effect | Interaction effect |
| Professional | 0.5% | 3.5% | 3.0%\* | 0.9% | 7.6% | 6.7%\* | 3.7%\* |
| Managerial | 3.0% | 9.4% | 6.4%\* | 3.7% | 6.5% | 2.8%\* | -3.6% |
| Intermediate | 2.3% | 5.6% | 3.3%\* | 2.8% | 6.1% | 3.3%\* | 0.0% |
| Routine | 91.5% | 85.7% | -5.8%\* | 89.0% | 78.4% | -11.6%\* | -5.8%\* |
| Service | 1.2% | 0.5% | -0.7% | 1.5% | 0.9% | -0.6% | 0.1% |

Note: \* indicates the effect is significant

In the absence of routinisation, around 15% of level 4 and 5 qualified routine workers move to new occupations, which is significantly more than those at level 2 and 3. Almost all of this appears to be upward career progression to professional, managerial and intermediate occupations.

With a 10% reduction in the number of routine jobs, this changes to around 22%, and much larger increase than for less qualified. This implies that the most qualified are best placed to progress to better jobs after being displaced, as would be expected. There is a significant increase in the estimated number of transitions to professional occupations as a result of routinisation (from 3% to nearly 7%), suggesting this as the main destination for displaced degree educated routine workers.

In both cases of academic qualifications, progression to managerial occupations is not more likely as a result of routinisation. It is not immediately clear why more educated displaced routine workers are not able to move managerial occupations when displaced from their jobs, although it suggests non-human capital barriers to this form of mobility.

5.3 Higher vocational qualifications

Although it's possible to talk about the marginal effects of vocational qualifications, few individuals have very high vocational qualifications and no academic qualifications, so the comparison shown in is for workers with level 2 and 3 academic qualifications and either with or without level 4-5 vocational qualifications.

A similar story to higher academic qualifications can be seen – earning level 4 and 5 vocational qualifications increases upward mobility – 12% of such workers leave routine occupations each period, generally to progress to one of the higher occupations. However, this is less than those with similarly graded academic qualifications.

Table 3: Predicted probabilities of transition – higher vocational qualifications

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | 0 % routinisation | | | 10% routinisation | | |  |
| Occupation | Level 2-3 academic | Level 2-3 academic +  Level 4-5 vocational | Marginal effect | Level 2-3 academic | Level 2-3 academic +  Level 4-5 vocational | Marginal effect | Interaction effect |
| Professional | 0.5% | 3.1% | 2.6%\* | 0.9% | 3.8% | 2.9%\* | 0.3% |
| Managerial | 3.0% | 6.8% | 3.8%\* | 3.7% | 7.6% | 3.9%\* | 0.1% |
| Intermediate | 2.3% | 2.5% | 0.2% | 2.8% | 4.4% | 1.6%\* | 1.4%\* |
| Routine | 91.5% | 88.1% | -3.4%\* | 89.0% | 83.2% | -5.8%\* | -2.4%\* |
| Service | 1.2% | 1.0% | -0.2% | 1.5% | 1.1% | -0.4% | -0.2% |

Note: \* indicates the effect is significant

Following a 10% decrease in routine occupations, this figure increases to around 17%. Interestingly, the only transition which becomes increasingly likely for such workers are intermediate occupations. Therefore, there is a different destination for displaced workers with level 4-5 academic and level 4-5 vocational qualifications. Again, routinisation appears to have no effect on the likelihood of moving to managerial occupations.

6.4 Specific skills

Table 4 shows the estimated probabilities of transition for a white male with both level 3 academic and vocational training between the ages of 28 and 33.

Table 4: Predicted probabilities of transition – specific experience and skills

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | 0 % routinisation | | | 10% routinisation | | |  |
| Occupation | No specific experience | 5 years specific experience | Marginal effect | No specific experience | 5 years specific experience | Marginal effect | Interaction effect |
| Managerial | 4.7% | 2.1% | -2.6%\* | 5.4% | 2.8% | -2.6%\* | 0.0% |
| Intermediate | 4.1% | 3.4% | -0.7%\* | 4.8% | 3.5% | -1.3%\* | -0.6% |
| Routine | 89.4% | 91.9% | 2.5%\* | 84.0% | 91.0% | 7.0%\* | 4.5%\* |
| Service | 0.8% | 0.8% | 0.0% | 1.3% | 0.8% | -0.5%\* | -0.5%\* |

Note: \* indicates the effect is significant

It shows that an extra period of experience in routine occupations – the proxy for specific skill acquisition – reduces the probability of leaving a routine occupation by 2.5%. Moreover, the additional experience is even more important following a 10% decline in routine jobs. Those with this experience are barely more mobile following this change, whereas an additional 6% of those with less specific skills are estimated to leave routine occupations. The only occupation with a significant interaction effect are service occupations, suggesting that those with little specific experience are more likely to move downwards following routinisation. The percentages are not large however, even if they are significant. This indicates that while specific experience may decrease mobility following routinisation, it is other factors which are explaining destinations of those that are displaced.

6.5 Working experience

Table 5 shows the estimated probabilities of transition for a white male with both level 3 academic and vocational training and no specific experience.

It shows that, absent of routinisation, younger workers are more mobile. Around 11% of younger workers (aged 28-33) leave routine occupations each period, compared to just over 7% of workers five years older. Most leave for intermediate and managerial occupations, which is likely to be career progression. Decreasing the number of routine jobs available by 10% increases mobility from routine occupations, but more so for older workers – 5% of younger workers move on following routinisation, whereas an additional 7% of older workers move on. The significance of the interaction effect on managerial and intermediate occupations suggests that many routine workers with more general labour market experience and skills move towards these occupations after displacement. It appears to be non-formally accredited skills and experience, rather than formal qualifications, which lead to transitions to managerial occupations following routinisation. There is also an increase in mobility towards service occupations, but not a significant difference across the two groups.

Table 5: Predicted probabilities of transition – work experience and age

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | 0 % routinisation | | | 10% routinisation | | |  |
| Occupation | Aged 28-33 | Aged 33-38 | Marginal effect | Aged 28-33 | Aged 33-38 | Marginal effect | Interaction effect |
| Managerial | 4.7% | 3.2% | -1.5%\* | 5.4% | 5.1% | -0.3%\* | 1.2%\* |
| Intermediate | 4.1% | 2.6% | -1.5%\* | 4.8% | 4.1% | -0.7%\* | 0.8%\* |
| Routine | 89.4% | 92.8% | 3.4%\* | 84.0% | 86.0% | 2.0%\* | -1.4%\* |
| Service | 0.8% | 0.6% | -0.2% | 1.3% | 1.2% | -0.1% | 0.1% |

Note: \* indicates the effect is significant

6.6 Transition to service occupations

One final point to note is that across all the interaction model estimates, there is no evidence that either higher qualifications reduce the probability of moving to lower wage service occupations. In all cases, the marginal effect of routinisation is to increase the likelihood of making such a transition regardless of level of education. This suggests the presence of some non human capital barriers to mobility, which mean that some well trained or well qualified workers are forced into less good occupations while others similar to them do make upward transitions.

**7 Conclusion**

Routinisation, the process where routine task based occupations are replaced by increasingly cheap ICT capital has altered the occupational structure of many labour markets. Some authors have commented that this has lead to a polarisation of job markets with more individuals being employed in high wage and low wage non-routine occupations, at the expense of middling wage routine occupations. So far, very little attention has been paid to the effects on mobility resulting from this change in the occupational structure – far more attention is paid to the effects on wage inequality. This paper has analysed the fortunes of workers displaced from routine occupations.

Using the National Child Development Survey, it looks at occupational transitions between 1981 and 2004. One difficulty simple mobility analysis would face is that it could not easily distinguish between, on the one hand, career progression and job mismatch explanations of mobility and, on the other hand, the effects of routinisation. This paper has presented a new methodology which focuses on transitions within four- or five-year periods and exploits the fact that the degree of routinisation in each period is sufficiently varied and uncorrelated with time that it can be used as a separate explanatory variable.

The main result of this analysis is that our measure of general labour market routinisation is an important driver of mobility from routine occupations, both upward to higher skill occupations and downwards to low-skill non-routine occupations. This relationship is mediated through several individual-level variables. Qualifications, experience and specific skills all had important roles. Illustrative examples were used to give a sense of the magnitude of these effects. In these examples, upward career mobility leads to between 7% and 15% of routine workers moving to new jobs each period. Up to 8% additional mobility was created for routine workers for a 10% decline in routine occupations, depending on the characteristics of the workers. In most cases, this additional mobility fell between 3% and 7%. For those with higher qualifications or more work experience, the majority of this additional mobility is upward. Workers with more routine experience, on the other hand, are no more mobile following this change in occupation structure, indicating specific skill acquisition prevents displacements. However, regardless of skills or qualifications, mobility towards lower skill work also increases as a result of routinisation.

A number of other conclusions can be drawn. Firstly, not all qualifications have been able to aid displaced routine workers in their future careers. Managerial occupations, in particular, are no more likely an outcome following displacement for a routine worker who holds a degree than a worker who left school at the earliest age. Moreover, higher qualifications do not offer much protection against downward moves – following routinisation, individuals of all educational level are more likely to find themselves in such a job. Moreover, there is also evidence that vocational qualifications are relatively poor as enablers of upward mobility, and that (for this cohort at least) the attainment of level 3 qualifications of either kind did not significantly increased upward progression prospects compared to level 2.

Secondly, career experience has important and sometimes conflicting effects on mobility. Firstly, specific skills developed through working in routine occupations decrease mobility. When routine jobs are being lost, it is the most experienced routine workers who remain. Secondly, in the absence of routinisation, individuals are less likely to move from routine occupations to higher wage non-routine occupations as they get older. That said, older workers are more likely to move to managerial and intermediate occupations as a result of routinisation. This offers a more complex view on the Autor and Dorn notion that routine occupations are "getting older". Skill specificity acts to make it less appealing for individuals to leave certain occupations after they have worked in them for a lengthy period of time. However, in some cases, routinisation may act as an impetus for older workers to move on to better jobs. This suggests that the role of the two forms of experience identified in the theoretical model may be heterogeneous. In some cases, the specific skill effect may dominate, making changing occupation very costly even in the face of declining prospects in the existing occupation. In other cases, general work experience (and the informal training and on-the-job learning it might entail) may lead to significant opportunities for career advancement (for example, into a managerial role) which the decline in routine occupations may act as the trigger for pursuing.

Finally, this analysis has suggested that, as well as qualifications, skills and experience, there may be some non human capital barriers to mobility acting. A government that cares about increasing upward mobility needs to care about helping individuals overcome the barriers that prevent them from moving from their current job to better ones, and so identifying such barriers is necessary.

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Table 6: Occupational groups using SOC 3-digit categories

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **MANAGER** | **PROFESSIONAL** | **INTERMEDIATE** | **ROUTINE** | **NON-ROUTINE MANUAL** | **SERVICE** |
| Functional managers,  Production managers,  Protective service officers,  Corporate managers and senior officials,  Financial institution and office managers,  Managers in distribution, storage and retailing. | Business and statistical professionals.  Health professionals,  Legal professionals,  Information and communication technology professionals,  Public service professionals,  Architects, town planners, surveyors,  Science professionals,  Engineering professionals,  Teaching professionals,  Librarians and related professionals,  Therapists. | Transport associate professionals,  Protective service occupations,  Artistic and literary occupations,  Business and finance associate professionals,  Sales and related associate professionals,  Public service and other associate professionals,  Social welfare associate professionals,  Science and engineering technicians,  Sports and fitness occupations,  Health associate professionals,  Administrative occupations: government and related organizations. | Managers and proprietors in hospitality and leisure services,  Managers and proprietors in other service industries,  Draughtspersons and building inspectors,  Administrative occupations: records,  Administrative occupations: communications,  Secretarial and related occupations,  Electrical trades,  Printing trades,  Metal machining, fitting and instrument making trades,  Metal forming, welding and related trades,  Textiles and garments trades,  Vehicle trades,  Skilled trades nec,  Food preparation trades,  Construction operatives,  Mobile machine drivers and operatives,  Plant and machine operatives,  Process operatives,  Transport drivers and operatives,  Assemblers and routine operatives,  Elementary administration occupations,  Elementary process plant occupations,  Elementary construction occupations,  Elementary goods storage occupations,  Elementary cleaning occupations,  Elementary personal services occupations,  Elementary agricultural occupations. | Construction trades,  Building trades,  Agricultural trades. | Design associate professionals,  Media associate professionals,  Administrative occupations: finance,  Leisure and travel service occupations,  Sales related occupations,  Healthcare and related personal services,  Childcare and related personal services,  Housekeeping occupations,  Sales assistants and retail cashiers,  Hairdressers and related occupations,  Personal services occupations nec,  Customer service occupations,  Elementary security occupations,  Elementary sales occupations. |

**Table 7: Change in employment shares by occupational group, 1981-2004**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **1981-86** | **1986-91** | **1991-95** | **1995-99** | **1999-2004** | **1981-2004** |
| Professional | 1.71% | 0.83% | 0.85% | 1.14% | -0.29% | 4.24% |
| Managerial | 0.15% | 2.15% | 1.72% | 0.00% | 2.43% | 6.45% |
| Intermediate | 0.65% | 4.40% | 0.24% | 0.25% | 1.95% | 7.49% |
| Routine | -4.30% | -15.29% | -3.27% | -1.90% | -6.27% | -31.04% |
| Service | 1.68% | 6.27% | 1.38% | 0.74% | 1.59% | 11.66% |
| Non Routine Manual | 0.12% | 1.64% | -0.92% | -0.23% | 0.59% | 1.20% |
| TOTAL | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |

Source: LFS, own calculations

Table 8: Results of baseline logit regressions for routine occupation transitions

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | PROFESSIONAL | | MANAGERIAL | | | INTERMEDIATE | | | ROUTINE | | | SERVICE | | | MANUAL NON-ROUTINE | | |
|  |  |  | |  |  | |  |  | |  |  | |  |  | |  |  |
| GENDER | -0.020 |  | | -0.555 | \*\*\* | | 0.340 | \*\*\* | | -0.532 | \*\*\* | | 1.948 | \*\*\* | | -2.079 | \*\*\* |
|  | -(0.13) |  | | -(4.27) |  | | (3.00) |  | | -(9.21) |  | | (17.01) |  | | -(7.00) |  |
| NON-WHITE | 0.292 |  | | -0.336 |  | | 0.305 |  | | 0.178 |  | | -0.633 | \*\* | | -0.069 |  |
|  | (0.81) |  | | -(0.92) |  | | (1.18) |  | | (1.14) |  | | -(2.02) |  | | -(0.16) |  |
|  |  |  | |  |  | |  |  | |  |  | |  |  | |  |  |
| PERIOD | -0.204 | \*\*\* | | -0.035 |  | | -0.126 | \*\* | | 0.051 | \* | | 0.011 |  | | 0.204 | \*\*\* |
|  | -(2.66) |  | | -(0.61) |  | | -(2.34) |  | | (1.92) |  | | (0.28) |  | | (2.62) |  |
| ROUTINE EXP | -0.236 | \*\* | | -0.328 | \*\*\* | | -0.324 | \*\*\* | | 0.361 | \*\*\* | | -0.296 | \*\*\* | | -0.485 | \*\*\* |
|  | -(2.44) |  | | -(4.58) |  | | -(4.52) |  | | (10.64) |  | | -(5.65) |  | | -(5.15) |  |
|  |  |  | |  |  | |  |  | |  |  | |  |  | |  |  |
| ROUTINISATION | 4.052 | \*\*\* | | 1.184 |  | | 1.583 | \*\* | | -2.691 | \*\*\* | | 2.867 | \*\*\* | | 2.144 | \*\* |
|  | (4.67) |  | | (1.65) |  | | (2.39) |  | | -(7.85) |  | | (5.22) |  | | (2.00) |  |
|  |  |  | |  |  | |  |  | |  |  | |  |  | |  |  |
| VNVQ LVL0 | -0.412 | \* | | -0.209 |  | | 0.006 |  | | 0.005 |  | | 0.333 | \*\* | | -0.115 |  |
|  | -(1.80) |  | | -(1.29) |  | | (0.04) |  | | (0.06) |  | | (2.32) |  | | -(0.50) |  |
| ANVQ LVL0 | -1.040 | \*\*\* | | -0.909 | \*\*\* | | -1.088 | \*\*\* | | 0.333 | \*\*\* | | 0.268 |  | | 0.650 |  |
|  | -(3.10) |  | | -(3.49) |  | | -(4.65) |  | | (2.86) |  | | (1.34) |  | | (1.63) |  |
| VNVQ LVL1 | 0.435 |  | | 0.112 |  | | -0.006 |  | | -0.137 |  | | 0.228 |  | | 0.130 |  |
|  | (1.34) |  | | (0.42) |  | | -(0.02) |  | | -(1.09) |  | | (1.17) |  | | (0.32) |  |
| ANVQ LVL1 | -0.871 | \*\*\* | | -0.667 | \*\*\* | | -0.991 | \*\*\* | | 0.313 | \*\*\* | | 0.265 |  | | 0.445 |  |
|  | -(2.90) |  | | -(2.77) |  | | -(4.40) |  | | (2.75) |  | | (1.33) |  | | (1.12) |  |
| VNVQ LVL2 | -0.012 |  | | -0.528 | \*\* | | -0.041 |  | | 0.069 |  | | 0.210 |  | | 0.006 |  |
|  | -(0.04) |  | | -(2.18) |  | | -(0.20) |  | | (0.65) |  | | (1.19) |  | | (0.02) |  |
| ANVQ LVL2 | -0.638 | \*\*\* | | 0.073 |  | | -0.144 |  | | -0.028 |  | | 0.328 | \* | | 0.023 |  |
|  | -(2.64) |  | | (0.37) |  | | -(0.85) |  | | -(0.28) |  | | (1.81) |  | | (0.06) |  |
| VNVQ LVL4 | 0.745 | \*\*\* | | 0.533 | \*\*\* | | 0.513 | \*\* | | -0.383 | \*\*\* | | -0.042 |  | | -1.645 | \*\* |
|  | (2.77) |  | | (2.59) |  | | (2.40) |  | | -(3.20) |  | | -(0.16) |  | | -(2.24) |  |
| ANVQ LVL4 | 1.632 | \*\*\* | | 0.687 | \*\*\* | | 0.456 | \*\* | | -0.881 | \*\*\* | | -0.119 |  | | -0.549 |  |
|  | (6.47) |  | | (2.77) |  | | (2.01) |  | | -(6.61) |  | | -(0.42) |  | | -(0.79) |  |
| VNVQ LVL5 | 0.914 | \*\*\* | | 0.790 | \*\*\* | | 0.737 | \*\*\* | | -0.832 | \*\*\* | | 0.073 |  | | -0.342 |  |
|  | (3.33) |  | | (3.35) |  | | (3.10) |  | | -(5.97) |  | | (0.24) |  | | -(0.55) |  |
| ANVQ LVL5 | 1.991 | \*\*\* | | 0.320 |  | | 0.874 | \* | | -1.129 | \*\*\* | | 0.297 |  | | - |  |
|  | (4.36) |  | | (0.51) |  | | (1.87) |  | | -(3.68) |  | | (0.46) |  | | - |  |
|  |  |  | |  |  | |  |  | |  |  | |  |  | |  |  |
| CONSTANT | -3.545 | \*\*\* | | -2.875 | \*\*\* | | -2.889 | \*\*\* | | 1.897 | \*\*\* | | -4.730 | \*\*\* | | -4.424 | \*\*\* |
|  | -(11.54) |  | | -(11.68) |  | | -(12.78) |  | | (15.01) |  | | -(19.68) |  | | -(10.06) |  |

Notes: \*\*\* = 1% significance; \*\* = 5% significance; \* = 10% significance. t-statistics given in brackets. Level 5 academic qualifications omitted from non- routine manual regression as it perfectly predicted failure – 56 observations dropped from regression.

Table 9: Results of extended logit regressions for routine occupation transitions with experience interactions

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | PROFESSIONAL | | MANAGERIAL | | INTERMEDIATE | | ROUTINE | | SERVICE | | MANUAL NON-ROUTINE | |
|  |  |  |  |  |  |  |  |  |  |  |  |  |
| GENDER | -0.016 |  | -0.548 | \*\*\* | 0.350 | \*\*\* | -0.545 | \*\*\* | 1.953 | \*\*\* | -2.067 | \*\*\* |
|  | -(0.10) |  | -(4.22) |  | (3.09) |  | -(9.38) |  | (17.05) |  | -(6.97) |  |
| NON-WHITE | 0.287 |  | -0.324 |  | 0.311 |  | 0.180 |  | -0.656 | \*\* | -0.050 |  |
|  | (0.79) |  | -(0.89) |  | (1.20) |  | (1.15) |  | -(2.09) |  | -(0.12) |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |
| PERIOD | -0.439 | \*\* | -0.396 | \*\*\* | -0.474 | \*\*\* | 0.415 | \*\*\* | -0.315 | \*\*\* | -0.031 |  |
|  | -(2.14) |  | -(2.76) |  | -(3.46) |  | (6.14) |  | -(3.09) |  | -(0.16) |  |
| ROUTINE EXP | 1.201 |  | -1.774 | \*\* | 0.023 |  | 0.476 |  | 0.046 |  | -1.976 |  |
|  | (1.28) |  | -(2.35) |  | (0.03) |  | (1.36) |  | (0.08) |  | -(1.53) |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |
| ROUTINISATION | 3.395 |  | -4.859 | \* | -4.644 | \* | 0.395 |  | 1.285 |  | -1.329 |  |
|  | (0.91) |  | -(1.64) |  | -(1.66) |  | (0.28) |  | (0.62) |  | -(0.30) |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |
| PERIOD\*ROUTINE EXP | -0.334 |  | 0.464 | \*\* | -0.105 |  | -0.089 |  | -0.035 |  | 0.330 |  |
|  | -(1.24) |  | (2.29) |  | -(0.50) |  | -(0.91) |  | -(0.22) |  | (0.93) |  |
| PERIOD\*ROUTINISATION | 1.426 |  | 3.213 | \*\* | 3.093 | \*\* | -2.579 | \*\*\* | 1.989 | \*\* | 1.455 |  |
|  | (0.80) |  | (2.52) |  | (2.52) |  | -(4.25) |  | (2.23) |  | (0.83) |  |
| ROUTINE EXP \* ROUTINISATION | -11.513 | \*\* | 6.461 |  | -3.282 |  | 4.715 | \*\* | -8.824 | \*\*\* | 3.357 |  |
|  | -(2.25) |  | (1.55) |  | -(0.80) |  | (2.37) |  | -(2.72) |  | (0.48) |  |
| ROUTINE EXP \*PERIOD\* ROUTINISATION | 2.712 | \* | -2.527 | \*\* | 0.970 |  | -0.611 |  | 1.697 | \* | -0.652 |  |
|  | (1.69) |  | -(2.11) |  | (0.77) |  | -(1.05) |  | (1.78) |  | -(0.32) |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |
| VNVQ LVL0 | -0.430 | \* | -0.194 |  | 0.026 |  | -0.011 |  | 0.341 | \*\* | -0.076 |  |
|  | -(1.87) |  | -(1.20) |  | (0.16) |  | -(0.13) |  | (2.36) |  | -(0.33) |  |
| ANVQ LVL0 | -1.047 | \*\*\* | -0.896 | \*\*\* | -1.091 | \*\*\* | 0.333 | \*\*\* | 0.269 |  | 0.659 | \* |
|  | -(3.13) |  | -(3.44) |  | -(4.66) |  | (2.84) |  | (1.34) |  | (1.65) |  |
| VNVQ LVL1 | 0.376 |  | 0.063 |  | -0.082 |  | -0.053 |  | 0.175 |  | -0.066 |  |
|  | (1.16) |  | (0.23) |  | -(0.31) |  | -(0.42) |  | (0.89) |  | -(0.16) |  |
| ANVQ LVL1 | -0.876 | \*\*\* | -0.651 | \*\*\* | -0.986 | \*\*\* | 0.307 | \*\*\* | 0.265 |  | 0.473 |  |
|  | -(2.91) |  | -(2.70) |  | -(4.38) |  | (2.67) |  | (1.32) |  | (1.19) |  |
| VNVQ LVL2 | -0.020 |  | -0.520 | \*\* | -0.037 |  | 0.068 |  | 0.205 |  | 0.021 |  |
|  | -(0.07) |  | -(2.15) |  | -(0.18) |  | (0.64) |  | (1.16) |  | (0.07) |  |
| ANVQ LVL2 | -0.645 | \*\*\* | 0.087 |  | -0.140 |  | -0.036 |  | 0.332 | \* | 0.043 |  |
|  | -(2.67) |  | (0.45) |  | -(0.82) |  | -(0.35) |  | (1.83) |  | (0.11) |  |
| VNVQ LVL4 | 0.720 | \*\*\* | 0.538 | \*\* | 0.508 | \*\*\* | -0.373 | \*\*\* | -0.078 |  | -1.635 | \*\* |
|  | (2.68) |  | (2.61) |  | (2.37) |  | -(3.09) |  | -(0.30) |  | -(2.23) |  |
| ANVQ LVL4 | 1.565 | \*\*\* | 0.678 | \*\*\* | 0.431 | \* | -0.833 | \*\*\* | -0.214 |  | -0.564 |  |
|  | (6.17) |  | (2.72) |  | (1.90) |  | -(6.17) |  | -(0.75) |  | -(0.81) |  |
| VNVQ LVL5 | 0.883 | \*\*\* | 0.806 | \*\*\* | 0.756 | \*\*\* | -0.853 | \*\*\* | 0.052 |  | -0.308 |  |
|  | (3.19) |  | (3.40) |  | (3.17) |  | -(6.03) |  | (0.17) |  | -(0.49) |  |
| ANVQ LVL5 | 1.895 | \*\*\* | 0.306 |  | 0.863 | \* | -1.063 | \*\*\* | 0.132 |  | - |  |
|  | (4.11) |  | (0.48) |  | (1.83) |  | -(3.38) |  | (0.20) |  | - |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |
| CONSTANT | -3.232 | \*\*\* | -2.221 | \*\*\* | -2.197 | \*\*\* | 1.306 | \*\*\* | -4.206 | \*\*\* | -3.814 | \*\*\* |
|  | -(7.12) |  | -(6.36) |  | -(6.83) |  | (7.53) |  | -(14.11) |  | -(6.70) |  |

Notes: \*\*\* = 1% significance; \*\* = 5% significance; \* = 10% significance. t-statistics given in brackets. Level 5 academic qualifications omitted from non- routine manual regression as it perfectly predicted failure – 56 observations dropped from regression.

Table 10: Results of extended logit regressions for routine occupation transitions with qualification interactions

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | PROFESSIONAL | | MANAGERIAL | | INTERMEDIATE | | ROUTINE | | SERVICE | | MANUAL NON-ROUTINE | |
|  |  |  |  |  |  |  |  |  |  |  |  |  |
| GENDER | -0.011 |  | -0.560 | \*\*\* | 0.324 | \*\*\* | -0.527 | \*\*\* | 1.961 | \*\*\* | -2.075 | \*\*\* |
|  | -(0.07) |  | -(4.37) |  | (2.88) |  | -(9.20) |  | (17.19) |  | -(7.02) |  |
| NON-WHITE | 0.274 |  | -0.318 |  | 0.335 |  | 0.179 |  | -0.684 | \*\* | -0.047 |  |
|  | (0.75) |  | -(0.87) |  | (1.30) |  | (1.14) |  | -(2.19) |  | -(0.11) |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |
| PERIOD | -0.178 | \*\* | -0.039 |  | -0.137 | \*\* | 0.053 | \*\* | 0.012 |  | 0.226 | \*\*\* |
|  | -(2.35) |  | -(0.70) |  | -(2.56) |  | (2.02) |  | (0.30) |  | (2.97) |  |
| ROUTINE EXP | -0.238 | \*\* | -0.330 | \*\*\* | -0.328 | \*\*\* | 0.360 | \*\*\* | -0.299 | \*\*\* | -0.489 | \*\*\* |
|  | -(2.48) |  | -(4.60) |  | -(4.57) |  | (10.63) |  | -(5.72) |  | -(5.18) |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |
| ROUTINISATION | 0.678 |  | 1.617 |  | -1.761 |  | -1.871 | \*\*\* | 3.379 | \*\*\* | 1.878 |  |
|  | (0.32) |  | (1.08) |  | -(1.04) |  | -(3.21) |  | (4.06) |  | (1.39) |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |
| ACADEMIC LVL 2-3 | -0.059 |  | 0.877 | \*\*\* | 0.606 | \*\* | -0.287 | \*\* | 0.118 |  | -0.573 | \* |
|  | -(0.15) |  | (3.31) |  | (2.45) |  | -(2.57) |  | (0.70) |  | -(1.67) |  |
| ACADEMIC LVL 4-5 | 1.837 | \*\*\* | 2.089 | \*\*\* | 1.505 | \*\*\* | -0.868 | \*\*\* | -0.778 |  | 0.774 |  |
|  | (4.09) |  | (4.85) |  | (3.94) |  | -(3.94) |  | -(1.50) |  | (0.38) |  |
| VOC LVL 4-5 | 0.641 |  | 3.300 | \* | 1.582 | \*\* | -0.865 | \*\* | 0.677 |  | -1.454 |  |
|  | (0.64) |  | (1.77) |  | (2.11) |  | -(2.15) |  | (0.79) |  | -(1.00) |  |
| ROUTINISATION \* ACADEMIC LVL 2-3 | 4.142 |  | 0.433 |  | 3.717 | \* | -0.991 |  | -1.036 |  | 1.254 |  |
|  | (1.57) |  | (0.24) |  | (1.94) |  | -(1.29) |  | -(0.91) |  | (0.56) |  |
| ROUTINISATION \* ACADEMIC LVL 4-5 | 7.590 | \*\*\* | -5.658 |  | 2.646 |  | -3.140 | \*\* | 2.540 |  | -27.226 |  |
|  | (2.68) |  | -(1.60) |  | (0.96) |  | -(2.09) |  | (0.85) |  | -(0.82) |  |
| ROUTINISATION \* VOC LVL 4-5 | 4.009 |  | -38.478 |  | -5.622 |  | 5.394 |  | -8.404 |  | 4.869 |  |
|  | (0.63) |  | -(1.23) |  | -(0.71) |  | (1.50) |  | -(0.95) |  | (0.56) |  |
| ACADEMIC LVL 2-3 \* VOC LVL 4-5 | 1.121 |  | -2.449 |  | -1.516 | \* | 0.493 |  | -0.851 |  | 0.797 |  |
|  | (1.03) |  | -(1.30) |  | -(1.85) |  | (1.11) |  | -(0.90) |  | (0.41) |  |
| ACADEMIC LVL 4-5 \* VOC LVL 4-5 | 0.526 |  | -3.089 |  | -1.840 | \* | 0.230 |  | -0.179 |  | 1.019 |  |
|  | (0.47) |  | -(1.59) |  | -(1.89) |  | (0.42) |  | -(0.14) |  | (0.31) |  |
| ROUTINISATION \* ACADEMIC LVL 2-3 \* VOC LVL 4-5 | -6.558 |  | 37.771 |  | 9.554 |  | -6.542 | \* | 6.832 |  | -11.504 |  |
|  | -(0.95) |  | (1.20) |  | (1.17) |  | -(1.73) |  | (0.74) |  | -(0.84) |  |
| ROUTINISATION \* ACADEMIC LVL 4-5 \* VOC LVL 4-5 | -8.512 |  | 44.568 |  | 8.828 |  | -5.775 |  | 4.848 |  | 2.670 |  |
|  | -(1.20) |  | (1.41) |  | (1.00) |  | -(1.32) |  | (0.45) |  | (0.06) |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |
| CONSTANT | -4.389 | \*\*\* | -3.906 | \*\*\* | -3.593 | \*\*\* | 2.141 | \*\*\* | -4.265 | \*\*\* | -4.008 | \*\*\* |
|  | -(13.15) |  | -(15.73) |  | -(15.18) |  | (20.54) |  | -(23.74) |  | -(14.79) |  |

Notes: \*\*\* = 1% significance; \*\* = 5% significance; \* = 10% significance. t-statistics given in brackets.

1. Correspondence email: craig.holmes@education.ox.ac.uk [↑](#footnote-ref-1)
2. See Holmes (2011a) for a full discussion of the econometric results and the estimation of marginal and interaction effects. This more technical discussion has been omitted from this paper. [↑](#footnote-ref-2)
3. Assuming that this effect outweighs the routine occupation specific skill effect. [↑](#footnote-ref-3)
4. This is the sort of occupational mobility that a part of the literature tends to focus on, which starts with the assumption that changes in employer or job arise when there is a shift in an individual's information set or preferences, or the external labour market environment, such that an alternative occupation yields a higher expected lifetime utility. [↑](#footnote-ref-4)
5. Both conversions are available upon request. [↑](#footnote-ref-5)
6. The full table of NVQ equivalent qualifications can be found here: http://www.gos.gov.uk/497745/docs/379399/428699/469541/qualificationsguidance [↑](#footnote-ref-6)