Qualifications, Employment and the Value of Human Capital, 1986-2001

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Abstract

This paper summarises the changing nature of qualifications across the working age population in New Zealand over the period from 1986 to 2001, and investigates the relationships between the changing qualification distribution and employment and income. First, the results confirm that there was a general upskilling of the population, as measured by formal educational qualifications. Second, we examine patterns of qualification change and employment growth measured in job groups, and find that the upskilling of the population occurred across a wide range of job-groups. Also, although the results show the employment growth was strongest in job-groups with high initial levels of skilled workers, employment growth is only weakly related to upskilling. Third, we decompose the change in the value of human capital into contributions due to changes in the qualification mix, changes in the (economic) returns to qualifications, and the interaction between these two factors. The value of human capital increased by 20% over the period: about 75% of this increase can be attributed to increasing incomes holding constant the mix of qualifications, 15-20% to an increasing skill mix, and the residual to interaction effects.

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1   Introduction

There has been much recent discussion in New Zealand about the role of education in promoting growth, reducing inequality, and improving societal functioning.[1] The changing patterns of qualifications across employment should provide an insight into the economic and labour market forces associated with the observed qualification changes. For example, if university-qualified employment is driven by an increase in demand for goods and services produced in university-qualification intensive industries, we would expect employment growth to be concentrated in these industries. Alternatively, if there is a widespread increase in the returns to skills, as has been documented in the international literature,[2] we would expect the employment and relative wages of university qualified workers to increase, both within and between labour market groups based on industry, occupation, and demographic characteristics.

Our objective in this paper is to describe the changes in the qualifications structure of the working age population, and analyse changes in the relationship between qualifications and employment growth and incomes over the period 1986-2001.[3] The analysis addresses three key sets of questions. First, how has the qualification composition of New Zealand's working age population changed? Second, how are workers with different qualifications allocated across jobs and how has the allocation changed? Third, how has the value of human capital changed, and how is this related to the changing mix of qualifications and economic returns to qualifications? More specifically, using census data we examine the relationships between education-based measures of human capital, industry and occupation level employment, and incomes, and the role of human capital in spurring employment growth and generating higher incomes over the period.[4]

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[1] See, for example, The Treasury (2001), Maani (1999), Acemoglu (2001), David and Lopez (assisting) (2001).

[2] See, for instance, Katz and Autor (1999) for a summary.

[3] Related summaries are also available in other publications, including Statistics New Zealand (1997), The Treasury (2001), and Maani (2000). In order to reduce the influence of differential tertiary education and/or training enrolments, and also that of older workers most likely affected by changes in the age of eligibility for superannuation over the period, the analysis focuses on the population aged 20-59. Although we focus largely on the whole population, we also consider corresponding analyses for the sub-populations of employed workers, and the labour force.

[4] This represents only a subset of the possible ways that human capital may affect growth and wellbeing. For instance, we abstract from its role as a component of social capital (see Spellerberg 2001 for a recent New Zealand review), and/or as a form of consumption.

We begin our analysis in the next section by first describing the structure of the Census data used in the analysis, and then presenting a brief summary of the aggregate changes in qualifications, together with shifts in the population across different labour force states and changes in average incomes for each over the period. In Section 3, the analysis focuses on the changes in the distribution of qualifications over the period, and compares New Zealand's qualifications composition with that of other OECD countries. We also introduce an economic summary measure of skill intensity, which weights the average incomes earned by different qualification groups by their respective population shares. Using this summary measure, we show that skill levels increased broadly across a wide range of population subgroups, defined according to age, gender, region, labour force status, and industries and occupations for those employed.

Section 4 of the paper examines the nature of changes in the distribution of employment over the period. We focus on employment in "jobs", as defined by 2-digit industry and occupation cells. The analysis first describes the raw employment distribution across such jobs at each census date. We then use regression-based analysis to examine how the changes in employment were related to the changing distribution of qualifications versus effects attributable to general industry and/or occupation changes. The results show that roughly one-third of the variation in employment growth was associated with qualification factors and, although employment growth was strongest in jobs with high levels of skilled workers, the employment growth appears to be only weakly related to subsequent upskilling.

Although the composition of qualifications is often used as an indicator of a country's human capital,[5] one weakness of such an approach is that it does not take into account the (economic) value associated with different qualifications. In Section 5, we turn our attention to the value of human capital, as measured by the average annual income across the working age population, and examine the factors associated with its changes over the period.[6] The analysis decomposes the change in the value of human capital over time into components attributable to changes in the skill composition of the population, as measured by the skill intensity index described above, and changes in economic returns to skills, as measured by average incomes of different qualification groups. The value of human capital increased 20% between 1986 and 2001. About 75% of this increase can be attributed to an increase in incomes of qualification groups holding constant the qualifications' mix in the population, 15-20% to increasing qualifications holding constant qualification incomes, and the residual 5-10% to the interaction of these effects.

2 Data

The data used for this project come from New Zealand's 1986, 1991, 1996 and 2001 censuses of population and dwellings. The data were provided by Statistics New Zealand (SNZ) in cell-format, where the population cells are stratified by individuals' highest educational qualification, gender, age, regional location, labour force status, and industry and occupation for those employed. The data obtained are in the form of cross-

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[5] OECD (2001) uses such an indicator (Indicator A2), and states that it "estimates the existing stock of human knowledge and skills, sometimes referred to as human capital. A common method of estimating educational attainment in a population is highest level of education completed by members of the adult population. This is the most easily measurable proxy for the overall qualifications of the workforce, and is a factor which plays an important role in shaping economic outcomes and the quality of life".

[6] This measure can be viewed as a measure of the current "flow" value of human capital, based on the current returns to the existing stock of qualifications. An alternative approach, used by Le, Gibson and Oxley (2003), is to measure the net present value of the current and future income stream arising from the stock of qualifications.

tabulations of these variables, and include cell sizes and annual income characteristics of the tabulated cells. In order to protect the confidentiality of individual responses, all cell counts have been randomly rounded to base-3.

The measure of qualifications used is a categorical measure of the highest qualification attained. Although there have been changes in the form of the census qualifications questions over the period of our study, it is possible to derive more or less consistent measures. In this paper we group the highest qualification reported into nine categories: higher degree, bachelor's degree, other (non-University) post-school qualifications, higher-school qualification, sixth-form qualification, school-certificate, other-school qualifications, no qualification, and highest qualification not specified.[7] Employment in industry and occupation cells is measured as a count of all persons gainfully employed, irrespective of full-time or part-time status. The income data are collected in categorical form in each census.

The raw data extract includes the numbers of individuals in each of the cells, the numbers in each categorical income band and those not specifying an income band, together with summary statistics on the income distribution within the cell (mean, mean log(income), and the 10th, 25th, 50th, 75th and 90th percentiles of the distribution). In order to derive the summary statistics pertaining to the income distribution for each cell, SNZ assigned to each cell the corresponding average income estimated from the Household Economic Survey (HES), where income is recorded as a continuous variable.

The analyses of changes in qualifications, employment outcomes and incomes that follow are based on a variety of populations. In the next section we provide descriptive analyses of qualification changes for employed workers, the labour force, and the whole population; together with various subgroups of each of these populations. The following section focuses on employment changes across industry and occupation groups for the employed population. We supplement this analysis by adding in, first, the unemployed and then also those not in the labour force to consider the broader labour force and whole working-age populations. Our analysis of the qualifications-based changes human capital in Section 5 is conducted separately for the employed, labour force, and whole populations. In addition, our analyses of income concentrate on the mean income data. Finally, analyses requiring income data use the number of individuals, including those that did not specify an income, as the relevant cell size.

3 Changing educational qualifications and skills

3.1 The changing distribution of qualifications

Table 1 summarises New Zealand's changing distribution of qualifications over the four censuses from 1986 to 2001 for the population aged 20-59, and various subpopulations according to their labour force status. Panel A pertains to the employed workforce, panel

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[7] We also suspect that the recording of the highest qualification as "other post-school" versus one of the secondary school qualifications ("higher school", "6th form", and "school certificate") was not applied using the same criteria in 1991 as in the other years. For example, table 1 shows that there was a marked increase in the fraction of the population reporting other post-school as their highest qualification from 1986 to 1991, which was subsequently reversed in 1996 and 2001; while the fractions in the school groups (especially 6th form and school certificate) show the opposite trend.

B to those unemployed, panel C to those not in the labour force, and panel D pertains to the full population of interest.

Although the skill mix differs across these populations,[8] similar patterns of upskilling are evident in all four panels. In particular, there is a common pattern of rising shares of people with university-level and school-level qualifications and declining shares with other post-school qualifications and no qualifications. For example, the fraction of the population with university qualifications rose from 6.7% in 1986 to 13.0% in 2001, the fraction with school qualifications rose from 22.5% to 34.5%, while the fractions with other post-school qualifications and no qualifications fell from 29.1% to 20.9% and from 35.9% to 20.5% respectively. Also a much larger fraction of the population did not specify their highest qualification in 2001 (11%) than in the other years (around 5%).[9] Similar changes are apparent for the labour force status subpopulations.

Appendix Table A2 presents a detailed breakdown of the qualifications composition of the population aged 20-59 grouped according to gender, age, region, industry and occupation. This table shows the pattern of upskilling described above is remarkably consistent across a wide range of population subgroups. This pattern of upskilling is similar to that found for the US (eg, see Pryor and Schaffer, 1999).

The Treasury (2001) compares New Zealand's qualification composition and changes with those of other OECD countries, and Australia in particular. The comparisons draw on summaries prepared by the OECD (2000a and 2000b). New Zealand's increasing educational attainment has been somewhat slower than that of other OECD countries. Despite the fact that New Zealand's average years of education increased between 1971 and 1998 from 10.3 years to 11.8 years, it dropped in ranking from 5th to 9th out of the 21 countries considered in Maré (2000).

Table 2 provides a comparison of New Zealand's education performance with that of other selected OECD countries. The figures are for 1998 or 1999, and relate therefore to near the end of our study period. The first column shows the measure just mentioned – average years of education for the working age population, where New Zealand ranks lowest among the 6 countries shown. The three pairs of columns to the right show the variation in attainment composition that lies behind the differences in average years of education. For instance, Germany has the highest average years of education, the lowest level of tertiary educational attainment, but the highest "higher secondary & post-school" proportion. New Zealand has a relatively high proportion of its working age population with, at best, lower secondary attainment. Only Australia has a higher proportion.

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[8] Broadly speaking, employed workers tend to be more highly qualified than unemployed workers who, in turn, tend to be more highly qualified than non labour force participants.

[9] In the 1986 and 1991 censuses respondents were asked to identify their post-school qualification(s) from a list of set answers. In the 1996 and 2001 censuses respondents were asked if they had a post-school qualification and then to write down the name(s) of their post-school qualification(s). The introduction of a written response to the post-school qualification question between 1991 and 1996 probably (according to SNZ) contributed to an increase in the number of people with an unidentified post-school qualification (this group also includes individuals that did not specify or state their post-school qualification). The unidentified school and post-school qualification groups were allocated to the not-specified qualification group in 1986, 1991 and 2001 and to the other school/post-school group in 1996, which probably suppressed the not-specified population in 1996 compared with 2001. There are two further potentially related and important changes in the data over the period of this study, apparent in Table 1. First, although the fraction of the overall population with not-specified qualifications is similar in 1986, 1991 and 1996, there were large falls in the fraction between 1991 and 1996 for those with specified labour force statuses. Second, in 1986 and 1991 there were no "not-specified" labour force status reports, whereas in 1996 and 2001 about 3% of the population are reported to have not-specified labour force status. We suspect these changes may be due to changes in the census questionnaires and/or the way SNZ has coded the data over the period.

These measures reflect past as well as current educational patterns. The rightmost columns in Table 2 show each country's expected years of schooling,[10] which provides a better reflection of current education patterns. The expected years of tertiary education for New Zealanders is second only to that of the United States. The overall expected years of schooling is below the OECD average, but above the OECD average for part-time and for the sum of full-time and part-time.

Table 3 presents changes in the field of study for individuals with a degree qualification between 1996 and 2001.[11] Field of study information is also available for individuals with a non-degree post-school qualification and is included in Table A3. Unfortunately, changes between 1996 and 2001 in the way that respondents with "other post-school" qualifications were selected and classified make analysis of information on field of study for non-degree post-school qualifications problematic (see footnote 9). We will therefore concentrate on degree qualifications – further analysis examining relationships between field of study groups and employment and income growth has not been undertaken.

The proportion of people with a degree level qualification in the fields of Engineering, Architecture and Building, Agriculture and Environment, Society and Culture and Personal Services declined between 1996 and 2001 as shown in Table 3, however, only the field of Agriculture experienced an absolute decline in the number of individuals with a degree. The growth in degree qualifications was particularly strong within the Information Technology, Health,[12] Education and Creative Arts fields (61-67%).

3.2   A summary measure of skill-intensity

As is evident from Appendix Table A2, it is possible to generate a large number of tabular breakdowns of qualification composition. While this provides an unrestricted account of changes in the distribution of qualifications over time, it is difficult to construct a clear and concise understanding of overall patterns. To this end, we aggregate the qualification distribution into a single index of skill intensity. There are many different ways of calculating such an index – see Laroche and Mérette (2000) for a discussion of different approaches.

In this paper, we use an economics-based approach to measure the skill intensity of a subgroup of the population. This approach entails, first, calculating the average income of each qualification group across the whole population in 1986 and treating this as the "price" of that qualification and, second, weighting each qualification's price by its subgroup share.[13] Specifically, we calculate the skill-intensity for group-i in year-t as

$$SI_{it} = \sum_q s_{qit} y_{q86} \tag{1}$$

where y_{q86} is the average annual income for all people with (highest) qualification-q in 1986, and s_{qit} is the qualification-q share of the group-i population in year-t – ie, $s_{qit} =$

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[10] The OECD derives these figures "under current conditions in public and private institutions, excluding education for children under five years of age".

[11] The field of study question was not available prior to the 1996 census.

[12] Health degrees increased by 10,584 (141.4%), whereas the number of health related other post-school qualifications decreased by 11,319. Although there was considerable change in the qualification mix of the health field between 1996 and 2001 the number of people with a health related qualification only changed by 624 individuals.

[13] Using 2001 instead of 1986 incomes (prices) produces larger absolute changes, but similar relative changes in skill intensity. We will examine a similar income-based human capital measure in Section 5, where we decompose the changes in the value of human capital over time.

N_{qit}/N_{it}, where N_{qit} is the number of people in group-i in year-t with qualification-q, and N_{it} is the total number of people in group-i in year-t.

This index of skill intensity holds constant the "prices" of different qualification (ie, skill) levels across population subgroups and over time, and normalises the size of the population. Thus, changes in group-level skill intensity are due entirely to changes in the qualifications distribution within the group, and do not reflect either changing employment levels or incomes. The use of average annual income as the "price" of skill tends to confound the unit price (ie, hourly wage) effect with employment intensity (ie, hours of work), which may vary systematically across qualification groups, over time, and/or across population subgroups. A final point to note about this analysis (and also the human capital analysis later in the paper) is that the construction of the skill-intensity index uses qualification-group average incomes based on only those who report incomes but the full qualification-cell population shares (ie, including those who do not report incomes). Implicitly, this assumes that the income distribution (or, at least, the relevant moments) within qualification groups is the same for the non-specified income group as for the group with specified incomes.[14]

The aggregate skill intensity index for 1986 ($SI_{\bullet 86}$) is simply the population average income in 1986. In general, however, the measure differs from actual income for two reasons. First, qualification average incomes are measured in 1986, so that any changes in qualification-specific incomes over time will not factor into the skill intensity index. Second, qualification average incomes are measured at their national level, so that the average income of any group that pays a wage premium will exceed the skill intensity measure for that group. We return to this issue shortly.

We can examine the extent of changes in relative skill-intensity of the population as a whole, as well as the skill intensity of various sub-groups of the population, over time using this index. Tables 4a, 4b, and 4c summarise the results of such an analysis for each of the employed workers, labour force, and whole populations aged 20-59. In each table, the first two columns show the 1986 and 2001 measures of skill intensity, the third column presents the change in skill intensity for each group between 1986 and 2001, and columns four to six present the change in skill intensity over each of the three intercensal periods of our study: 1986-91, 1991-96 and 1996-2001. The skill intensity in the first row pertains to the full population, and is expressed relative to the 1986 measure. The skill intensity in subsequent rows pertain to different population subgroups, and each is expressed relative to the overall skill intensity in that year.

Consider first the skill intensity for subgroups of the employed population, reported in Table 4a. The first row shows that the overall skill intensity of workers increased by 4% between 1986 and 2001: 2.6% between 1986 and 1991, 0.3% between 1991 and 1996, and 0.6% between 1996 and 2001. At least some of the increase in the skill intensity of workers between 1986 and 1991 may be due to relatively high unemployment among lower-skilled workers in 1991, which had the effect of raising the average skill level of the employed workforce. For example, Table 1 shows that unemployment is more concentrated in low-skills, and also was higher in 1991 than other years.

The second and third rows of Table 4a pertain to skill intensity levels of male and female workers. In 1986 male skill intensity was 1% higher than average, while female skill intensity was 2% lower. However, growth in female skill intensity between 1986 and 2001

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[14] The mean income (Y_{qt}) measure was calculated using only the population that specified an income. The population (S_{qit}) measure includes all individuals irrespective of whether they specified an income.

was 5.7%, compared to only 2.1% for males. This relatively faster growth resulted in no apparent gender difference in the skill intensity in 2001.

The next set of rows describes the skill intensity of different age groups of employed workers. This shows that younger workers (aged under 40) are relatively more skilled than older workers, with the peak skill-group aged 25-29. In addition, the skill intensity of younger workers also tended to increase more than older workers, from 5.7% for 20-24 year olds to 2.3% for 50-59 year olds, reflecting the rapidly increasing levels of education being acquired during this period.

The third dimension along which we describe skill intensity of workers, is their region of residence. In 1986, the regional differences in skill ranged from a high of 4% above the average in Wellington to a low of 3% below the average in Gisborne, Southland and areas outside regional councils.[15] Although all regions experienced an increase in skill levels between 1986 and 2001, the changes in skill intensity over the period tended to favour the urban and more skilled regions, thus increasing regional disparities. By 2001 the skill levels ranged from 5% above average in Wellington to 7% below average in the "Area Outside", and 5% below average in the West Coast and Southland.

We next consider the skill levels of different industries and occupations. The skill levels of industries in 1986 range from 18% above average in Education and 10% above average in Business Services to 8% below average in Clothing and 7% below average in Agricultural Services. There was substantial variation in the changes in the skill intensity across industries between 1986 and 2001, ranging from an increase of 7.1% in the Electricity, Gas and Water, and 6.2% in Finance and Insurance, industries to a decrease of –1.9% in Construction Services and –0.2% in the Primary Goods industries.

Perhaps not surprisingly, the most marked differences in skill intensity occur between occupations. For example, Science Professionals had a skill-intensity 26% above the average in 1986, while the skill levels of Labourers and Drivers was 10% below the average. Also, and in contrast to changes in skill along other dimensions, the skill intensity of several occupations declined between 1986 and 2001. The changes in skill levels ranged from increases of 5.2% for Managers and 4.5% for Sales workers to decreases of 3.9% for Science Professionals and 3.0% for Administrators, Building Trades and Services workers.

The skill changes for particular subgroups across the three intercensal periods tend to reflect the average skill changes of employed workers in the first row. That is, most of the growth in measured skills tended to occur between 1986 and 1991, during which time average skill increased 2.6%, compared to 0.3% and 0.6% in the subsequent intercensal periods (between 1991 and 1996, and between 1996 and 2001 respectively). In fact, the measured skill intensity of many subgroups, especially defined by industry and occupation, declined in the latter two intercensal periods. For example, the skill intensity of Science Professionals declined by 1%, 2% and 1% respectively in the three subperiods, and the skill intensity of administrators dropped 6% between 1996 and 2001.

As mentioned earlier, some of the fluctuations in intercensal skill changes may be attributable to cyclical factors, which affect the skill-based composition of employment. In order to control for such effects, we repeat the analysis of skill intensity using the broader target populations pertaining to, first, the labour force and, second, the full population aged 20-59. The results are summarised in Tables 4b and 4c. The results are broadly in

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[15] The "Area Outside" consists of Ross Dependency, the New Zealand Economic Zone, Oceanic-Bounty Islands, Bounty Islands, Oceanic-Snares Islands, Snares Island, Oceanic-Antipodes Islands, and the Antipodes Islands.

line with those for employed workers in Table 4a and confirm that, in 1986, employed workers were more skilled than unemployed workers who, in turn, were more skilled than those out of the labour force.

3.3 The relationship between income and skill intensity of jobs

How good a measure of economic skill is the qualifications-based skill intensity index constructed above? To consider this issue we examine the relationship between the average income and the measure of skill intensity, measured across industry and occupation specific cells (described here and in the next section as "jobs"). For this purpose we use the population of employed workers. If the skill intensity index accurately measures the level of economic skill, as measured by average annual income, we would expect to see that average incomes closely track skill intensity.

Figure 1 graphs the relationship between the ratio of average income to skill intensity against the index of skill intensity for each industry-occupation cell in 1986, together with the least-squares fitted regression line. The size of the plotting symbols indicates the relative size of the industry-occupation cells. Figure 1 shows there is a wide dispersion in the relationship between average income and skill intensity (regression R^2=0.11), although the fitted line is positively sloped. For example, the slope coefficient is 0.003, which implies that a \$1,000 increase in skill-intensity is associated with a 3 percentage point increase in the income to skill ratio. Starting from a typical job with income equal to skill intensity (ie, the point in Figure 1 where the predicted ratio is equal to 100: SI=\$29,429), a \$1,000 increase in skill intensity (to \$30,429) would be associated with an increase in income above this level (to \$31,291). This suggests that highly-qualified individuals are over-represented in industries and occupations where incomes are higher for everyone. One interpretation for this finding is that there are spillover or peer-effects operating in jobs dominated by high skills that tend to raise incomes of all workers above the average given their qualifications (see Dillingham 2002). An alternative interpretation for the differences between the average income of a group and its skill intensity is that they reflect the effects of non-qualification based components of skill (eg, experience), which are not priced in the skill intensity measure used here.

4 Employment growth and the role of qualifications

One of the main purposes of this paper is to examine the way in which the upskilling documented in the previous section has interacted with labour market changes. The summaries of skill intensity patterns by industry and occupation have already provided some indication of changes. In this section, we examine in more detail the changes that have occurred between groups of workers defined by industry and occupation. We begin by describing how employment has been distributed across industry-occupation cells, and changes that have occurred in the distribution during the period. We then incorporate qualifications, and evaluate the relative importance of qualification, industry and occupation specific effects in understanding employment change over the period. Loosely speaking, we consider qualification effects to reflect labour supply side factors, occupation effects to reflect production side factors, and industry effects to reflect product market factors.

Our focus of analysis is on the allocation of qualifications in the labour market across "jobs", which we define according to the interaction of the 28 industry and 24 occupation groups described above: thus generating 672 possible cells.

4.1   The changing distribution of employment

Figures 2a to 2d describe the distribution of employment across the industry and occupation cells for each of the four census years.[16]   The vertical axis on each figure lists the 24 occupation groups, ordered according to each occupation's 1986 relative skill intensity, and shows the fraction of total employment in that occupation group (and the year-specific skill intensity in parentheses).   Likewise, the horizontal axis lists the 28 industry groups, ordered by each industry's 1986 relative skill intensity, and shows the fraction of total employment in that industry (with year-specific skill intensity in parentheses).   Each cell in a figure then corresponds to an industry-occupation specific *job*, and is shaded according to the fraction of total employment in that job: the darker cells represent the jobs with relatively large employment.

It is both evident and unsurprising that employment is not evenly distributed across the cells.   This is partly due to industries and occupations having different sizes, and partly due to the distribution of occupational employment within an industry varying across industries.   For example, in 1986 the largest single job cell, agricultural workers employed in the primary production industry group, accounted for 6.0% of total employment in 1986, and this share had fallen to 3.6% in 2001.   The second largest cell, teaching professionals in education, had 4.1% of employment in 1986, and this increased to 4.3% in 2001. Furthermore, 29 of the 672 job cells account for half of employment in 1986, and 33 job cells account for half of employment in 2001.

Although purely anecdotal, it is illustrative to compare the changes over the period in the employment, together with the changes in the qualification distributions, of the two largest job cells just mentioned.   First, agricultural workers have predominantly low qualification levels: in 1986 the largest fractions of workers had no qualifications (42%), other post-school qualifications (23%), or school certificate (16%).   While employment in this job cell fell by nearly one-third between 1986 and 2001 (from 77,856 to 52,950), the skill levels increased markedly: the fraction of workers with no qualifications fell by one-third to 28%, and there was a general increase in the fractions of other qualifications over this period. On the other hand, teaching professionals are generally highly qualified: the largest three qualification groups were other post-school (57%), bachelor degrees (20%) and higher degrees (17%).   Total employment of these workers increased by 2%   (from 52,785 to 63,369), and this also coincided with an increase in qualifications: the employment shares with bachelor and higher degrees increased to 33% and 20% respectively, and the other post-school share dropped to 38%.   Comparing the changes of these two job cells suggests that both a shift to skilled employment across job cells and also an increase in skills within job cells occurred.

The first dimension along which we explore the growth in employment over the period is by the initial (1986) size of the job cell.   Figure 3 graphs the change in log employment between 1986 and 2001 against the log of 1986 employment for each industry-occupation cell, together with the least-squares fitted regression line.   Two features of the relationship are apparent.   First, the relationship is negative (the slope of the fitted regression line is –

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[16] See the Appendix Table A1 for detailed descriptions of the industry and occupation categories over the sample period.

0.26, standard error = 0.02), implying some convergence in size and/or reversion to the mean occurred.

Second, there is clearly a great deal of variation, both in employment size and growth rates. For example, 409 job cells, employing 492,000 workers (29%) in 1986 either grew or declined by over 50 log points in the following 15 years.[17] Furthermore, in a regression of the change in log employment between 1986 and 2001, only 22% of the variation is explained by 1986 log employment. It is this variation in growth rates that we will analyse to identify a relationship between employment growth and qualifications.

4.2 Upskilling and employment change

We now turn to the relationship between upskilling and changes in employment over the period. Upskilling may occur either within types of jobs (ie, as a result of a shift from lower to higher qualifications of workers in particular jobs), or between different types of jobs (ie, as a result of a shift in employment from lower to higher skilled jobs). Examining the pattern of qualification changes across different job types will help us to identify the factors behind qualification upgrading, and also the relative importance of different patterns of upskilling. For example, upskilling may be due to changes in production technology, biased towards higher skills, and reflected in increased demand for more qualified workers. Such an explanation is often referred to in the literature as "skill-biased technological change" although, as Card and DiNardo (2002) note, without any explicit consideration of technology measures this labelling is tautological. Alternatively, upskilling may be the result of changes in product market demand biased towards industries with higher skill levels, and/or work organisational changes biased towards occupations with higher skill levels.

Furthermore, many different patterns of upskilling could generate an equivalent increase in measured skill intensity. For instance, improvements may occur at the lower end of the qualifications spectrum (eg, a shift in workers with no qualifications to school qualifications), or at the higher end (eg, a shift in workers with post-school qualifications to university qualifications). As is evident from the tables already presented, the reality is a more complex configuration of changes reflecting a general increase in qualifications across the population over the period.

This section examines patterns of employment growth over the period, and the relative importance of industry, occupation, and qualification-related factors in shaping employment growth. It should be borne in mind that this analysis is descriptive, and cannot identify what the specific growth factors are; only whether they operated more strongly on workers in particular industries, occupations, or with particular types of qualification. Three analyses are presented: first, a regression analysis of employment growth, which focuses on the proportion of the variation in employment growth accounted for by industry, occupation, and qualification factors; second, an analysis of the covariation of employment growth between different qualification groups; and third, a graphical summary of the relationship between employment growth, initial skill intensity, and changes in skill intensity.

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[17] Figure 3 shows log changes rather than percentage changes. These measures are linked by percentage change=exp(log change) – 1: a 50 log point decline corresponds to a 39% decrease; a 50 log point rise corresponds to a 65% increase. These 409 jobs include 16 jobs with zero employment in 1986 that grew to between 6 and 489 workers in 2001.

4.2.1 Regression analysis of job-cell employment changes

We first focus on the extent to which the change in *job* cell employment is associated with upskilling (qualification effects), changes in product markets (industry effects) and/or work organisation (occupation effects). Specifically, we examine regression models of the form:

$$dEmp_{ioq} = \alpha_{ioq} + \varepsilon_{ioq} \tag{2}$$

where $dEmp_{ioq}$ is a measure of the change in employment of workers in industry-i, occupation-o, with qualification-q, between 1986 and 2001; α_{ioq} is the "explained" component of employment growth, which may vary by industry, occupation, and/or qualification; and ε_{ioq} is the regression residual representing the unexplained component of growth. The measure of employment growth that we use is:

$$dEmp_{ioq} = \frac{Emp_{ioqt} - Emp_{ioqt-1}}{0.5(Emp_{ioqt} + Emp_{ioqt-1})}, \tag{3}$$

where the time subscript "t-1" denotes the initial year (eg, 1986), and "t" denotes the final year (eg, 2001). This employment growth measure differs from the commonly used employment growth rate in that the change in employment is divided by average employment rather than by initial employment. This employment growth index has the properties that it is bounded between –2 and 2, is monotonically related to the usual measure of growth, and treats employment increases and decreases symmetrically.

Table 5 presents results for various specifications of equation (2), which differ in the specification of the intercepts. All regressions are weighted by the initial 1986 employment level (Emp_{ioqt-1}). For each regression, we report the coefficients on the qualification variables (when included), an indication of whether industry, occupation or their interaction effects have been included, and the regression R-squared and marginal R-squared associated with the various sets of controls.[18] The results in column (1) pertain to a regression that includes just indicator variables for each of the qualification groups. That each of the qualification coefficients are positive and statistically significant indicates there was employment growth for all groups relative to the (omitted) "no qualifications" group. The R-squared from this regression is 0.33, implying that over one-third of the variation in employment growth across cells defined by industry, occupation, and qualification is associated with qualification differences in growth.

The regressions reported in columns (2) and (3) include, respectively, just industry and occupation dummy variables. The R^2 from these regressions is 0.37 and 0.24 respectively. When we include both industry and occupation dummy variables additively (column (4)), the R^2 rises to 0.46. This implies industry and occupation marginal R^2s of 0.26 and 0.09, which are substantially lower than the R^2s reported in columns (2) and (3), and imply the industry and occupation effects on employment changes are quite strongly correlated. Column (5) includes the full set of industry and occupation interactions, and the R^2 rises to 0.68.

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[18] Each marginal R-squared is calculated as the difference between the R-squared from the specification that includes the set of controls and the R-squared from the corresponding regression that excludes those controls. For example, in column (4) which includes both industry and occupation controls, the marginal industry R-squared is the difference between the R-squared in column (4) and that in column (3), which includes occupation but not industry controls; while the occupation marginal R-squared is the difference between the R-squared in column (4) and that in column (2), which includes industry but not occupation controls.

Columns (6) to (9) in Table 5 repeat the specifications in columns (2) to (5) with the addition of the set of qualification dummy variables. The qualification coefficients in these columns are remarkably stable and are very close to the coefficients in column (1), with the exception of the coefficients on "Higher degree" and "Bachelor's degree" which fall by 10-15% from column (1), and the coefficients on "Higher school" which falls by about 5%. Furthermore, the qualification marginal R^2s from these regressions range from 0.23 to 0.25. Compared to the (full) R^2 for qualifications of 0.33 in column (1), these results suggest that the sizeable contribution of qualification effects to employment changes across jobs is largely unrelated to industry and/or occupation factors. This implies that the relatively high growth in employment for workers with high qualifications is quite broad and not merely a reflection of their being in fast growing industries and occupations.

The stability of the marginal R^2 for qualifications is in contrast to those of industry and occupation, where the proportion accounted for by each of these factors reduces markedly if the other factor is controlled for. There is clearly a strong relationship between industry and occupation effects.

The patterns of stable coefficients on qualification effects and marginal R^2s also holds over the three intercensal sub-periods as well (we report the results in Appendix Tables A4a to A4c). The primary difference across the three periods is that qualifications are much less important in understanding the changes between 1986 and 1991, associated with only about 13% of the variation in employment changes, than in the subsequent two periods where qualification effects account for about 40% of the variation in employment change in each period. Thus, while a large fraction of the variation in employment change over the 1986-91 period appears to be related to job-cell specific effects (industry-occupation interactions account for over three quarters of the variation in this period), qualifications play a much greater role in the subsequent two periods.

The key inference to be drawn from the regression analyses presented here is that, except possibly during the first intercensal period, factors operating at the industry and occupation level cannot account for the more rapid growth in employment experienced by more highly qualified workers. It would appear that upskilling reflects changes in factor markets rather than in product markets or in occupational mix alone. Furthermore, the same positive relationship between qualifications and employment growth is apparent both within and between job groups. That is, upskilling has occurred both as a result of a shift in employment to higher skilled jobs, and as a result of an increase in skill levels of workers in particular jobs.

4.2.2 Patterns of upskilling – correlation/covariance analysis

We now turn attention to the correlation in job-cell employment growth between the different qualification groups. This analysis shows how the employment changes of different qualification groups are related, and helps to shed light on the skill substitutability and/or complementarity of different qualifications.

Table 6 presents the results from this analysis. The table is organised in block format, with each block pertaining to a pair of qualifications, and contains 4 entries. The first entry in each block is based on the raw employment change numbers; the second entry is based on the employment change controlling for industry effects (ie, the residuals from the regression in Table 5, column (2)); the third is based on employment change controlling for industry and occupation effects (ie, the residuals from the regression in Table 5, column (4)); and the fourth entry is based on employment change controlling for industry and occupation interaction effects (ie, the residuals from the regression in Table 5, column

(5)). The entries in bold, listed down the diagonal of the table, are the variances of within qualification group employment change for each case, while the entries below the diagonal are the correlations of job-cell employment change between qualification groups.

To illustrate the use of the table, consider the correlation between employment growth for workers with higher degrees and those with higher school qualifications. The first entry shows that the correlation between raw employment changes for these groups is 0.67. Some of this positive relationship is due to industry effects: employment of all qualification groups grew in high-growth industries. Controlling for these effects, the correlation between employment changes of higher degree and higher school qualification workers drops to 0.46. Controlling also for occupation related effects, the correlation drops further to 0.42 and, finally, allowing for a separate growth rate for each industry-occupation combination reduces the correlation further to 0.17.[19]

As might be expected, the employment growth of the two university level qualifications groups are highly correlated, even after controlling for job-specific employment growth levels. For example, the correlations between raw employment changes are 0.84, and after controlling for job-specific effects, the correlation is 0.66. Similarly, we find the employment growth of school level qualification groups are strongly correlated, even controlling for industry and occupation effects. This is particularly true of the higher school and sixth form groups, and the sixth form and school certificate groups, whose correlations range from 0.92 to 0.94 between raw changes to 0.73 to 0.74 between changes controlling for job-specific effects. On the other hand the correlations between university and school level qualifications' raw employment changes are reasonably strong (ranging from 0.50 to 0.74), but these correlations die away when controls for industry and/or occupation effects are included (ranging from –0.17 to 0.41), reflecting the common industry and occupation specific effects across the qualification employment changes.

Table 6 also sheds some light on whether the non-university post-school qualifications are more similar to university qualifications or school qualifications. In terms of the raw employment changes for these groups, the correlations between the changes of other post-school and university qualifications are about 0.75, and between other post-school and school qualifications are about 0.8. However, in terms of employment change conditional on industry and occupation controls, the correlations die away, especially for school qualifications (ranging from –0.17 to 0.04, compared to 0.14 to 0.22 for university qualifications). Furthermore, the relative strength of the correlations with either university or school qualifications groups is greater than between those two groups. These results suggest that the post-school qualifications group is quite distinct in terms of its employment changes vis-à-vis other groups, and that most of the raw correlations are due to common industry and occupation specific factors.

The tables in Appendix Tables A5a to A5c present comparable results for the three subperiods. The results are qualitatively similar to those discussed for the whole period, although the correlations tend to be somewhat stronger in the first period, 1986-91, than the latter two periods. This pattern is consistent with the findings, shown in Appendix Tables A4a to A4c, that qualifications were more strongly associated with employment changes in the 1991-96 and 1996-2001 periods than in 1986-91. That is, industry and occupation related factors account for a larger proportion of the variances and

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[19] Note that once job-type specific growth rates have been allowed for, at least one of the correlations between qualification groups must be negative unless all correlations are zero.

covariances in the earlier period, resulting in stronger between qualification correlations in employment changes.

As in the earlier regression analysis, industry and occupation factors are clearly evident in the pattern of covariation between employment growth for different qualification groups. Once we control for these factors, we find that there is not a single pattern of upskilling that was sustained throughout the 1986-2001 period. For the period as a whole, increases in graduate employment occurred together with increases in post-school and senior-school employment (which were negatively correlated with each other). Between 1986 and 1991, when employment was contracting, university and other post-school qualified workers together gained employment share at the expense of other groups. In contrast, during the subsequent expansion between 1991 and 2001, university and school qualified employment both grew, but not in the same job groups.

4.2.3 Links between skill Intensity, upskilling, and employment growth

The results so far have shown that there is a clear positive relationship between qualification levels and employment growth, and that this relationship is not merely a reflection of changes in industry or occupation employment. In order to investigate whether upskilling is a driver of employment growth, or merely a necessary concomitant of growth, we now examine the relationship between skill intensity, upskilling and employment growth.

The measure of skill intensity used for this analysis is the index introduced in Equation 1, while the measure of employment growth is that introduced in Equation (3) and used in the regression analysis. Figure 4 describes the relevant relationships over the 1986-2001 period in three graphs, using industry-occupation job cells as the unit of analysis while the size of plotting symbol reflects the number of people employed in each cell in 1986. The top left graph in this figure graphs employment growth over the 1986-2001 period against the 1986 skill intensity of different jobs, together with the least-squares regression line. This graph shows a mildly positive relationship between employment growth and skill intensity (slope coefficient = 0.00006, t-statistic = 8.0, regression R^2 = 0.09),[20] consistent with the previous analysis that was based on qualification groups rather than on single measure of skill intensity.

The bottom left graph in Figure 4 shows the relationship between the percentage change in skill intensity from 1986 to 2001 against the 1986 skill intensity of jobs. At the industry-occupation job cell level, the observed changes in skill intensity cover a wide range. Although the majority of job cells and most employment experienced increasing skill intensity, 299 job cells (with 25% of employment in 1986) experienced declining skill intensity. The regression line shows there was a weakly negative relationship between the initial skill intensity and its change over the period (coefficient = -0.00008, t-statistic = -1.6, regression R^2 = 0.004),[21] suggesting that the greatest upskilling occurred in cells where the skill intensity was initially low.

Combining insights from these two graphs implies that upskilling was strongest in jobs where employment growth was relatively weak. This relationship is illustrated in the final (bottom right) graph in Figure 4. The relationship between the change in skill intensity and

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[20] This implies that a $1,000 increase in initial skill intensity is predicted to increase employment growth by 0.06 between 1986 and 2001.

[21] That is, a $1,000 increase in initial skill intensity is associated with, on average, a 0.08% drop skill intensity over the period.

employment growth, although positive and statistically significant (coefficient = 1.4, t-statistic = 6.0, regression R^2 = 0.05), is relatively weak and brings into question the role of upskilling as a primary engine of growth. For example, a 1% increase in employment growth (roughly 0.1 on the employment growth index) was associated with about a 0.15% increase in skill intensity over the period.

The analysis in this section has documented the changing nature of skills and employment in New Zealand's working age population over the 1986-2001 period. This analysis showed that there has been a general upskilling of the population and that employment has tended to increase more for workers with higher qualifications. The relative increase in skilled employment has occurred both across jobs, via a shift in employment to higher skilled jobs, and within jobs, via an increase in the skill mix associated with job cells.

5   Changes in the value of human capital, 1986–2001

In this section we consider more explicitly the income generating value of qualifications, which we refer to as the "value" of human capital, and how this has changed over the period. We focus on changes in the population-shares and relative incomes associated with the different qualification groups. In particular, given there has been an increase in the proportion of skilled workers in the population (as measured by the index of skill intensity discussed above), we are interested in the contribution of such a change in population shares to the value of human capital. A key factor for this question is whether there was a change in relative incomes across qualifications, and how this reinforced or counteracted the increase in the skilled population share.

A positive relative income contribution would occur if average incomes increased most for groups that expanded their employment share. If the change in employment shares reflected solely an increase in supply for highly qualified workers, we would expect that average incomes would decline for them, as marginal productivity is reduced, and that average incomes would rise for other workers, as their reduced share induces a rise in marginal productivity. In this case there would be a negative contribution from relative income changes. Conversely, if there is an increase in demand only for highly qualified workers, this would lead to an increase in their relative income, and a positive relative income effect. The greater the supply response in the form of an increasing share of workers having high qualifications, the smaller would be the relative income effect.

The analysis in this section takes the form of a simple decomposition of the change in the value of human capital.[22] The measure of the value of human capital used here is the average annual income across the relevant population (alternatively employed workers, labour force, or the full population).[23] This measure of human capital is closely related to

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[22] We do not attempt to control for the costs of obtaining higher qualifications. Given that it is costly to increase the qualifications, both in terms of direct education costs and foregone earnings, there will be some optimal level, and mix, of qualifications, determined by where the marginal value of an additional qualification equals it cost. In addition, we only consider the "economic" value of human capital to individuals, and ignore any value associated with its role in social capital and/or as a form of consumption.

[23] A potentially important caveat to this analysis is that it considers only the qualifications-dimension of human capital. For example, bearing in mind that the increase in qualifications over the period was relatively stronger for younger workers (see Table 3), while younger workers have lower experience-based human capital, suggests that the measured change in qualification-group incomes will be biased downwards relative to the true effect of qualification upskilling.

the index of skill intensity used previously, and the two measures coincide in the base year 1986.

Specifically, we express the value of human capital in year-t ($\bar{Y}_t$) as the qualification-share weighted sum of qualification average incomes:

$$\bar{Y}_t = \sum_q s_{qt} \cdot y_{qt} \tag{4}$$

where s_{qt} denotes the share of the population with qualification-q in year-t, and y_{qt} is the average income of qualification-q in year-t. Given expression (4), we can then express the change in the value of human capital from year-0 (eg, 1986) to year-1 (eg, 2001) in terms of changes in the qualification shares in the population and changes in economic returns to qualifications (measured by average incomes) as follows:

$$\bar{Y}_1 - \bar{Y}_0 = \sum_q \left\{ (s_{q1} - s_{q0}) \cdot y_{q0} + s_{q0} \cdot (y_{q1} - y_{q0}) + (s_{q1} - s_{q0}) \cdot (y_{q1} - y_{q0}) \right\}. \tag{5}$$

The first term in this decomposition, $\sum_q \left\{ (s_{q1} - s_{q0}) \cdot y_{q0} \right\}$, measures the contribution of changes in the qualification skill-mix in the population, holding qualification average incomes constant at their initial level. This is simply the change in the skill intensity measure described above. The second term, $\sum_q \left\{ s_{q0} \cdot (y_{q1} - y_{q0}) \right\}$, measures the contribution of changes in the average incomes *returns* to different qualification groups, holding constant the qualification shares at their initial level. Finally, the third term in expression (5), $\sum_q \left\{ (s_{q1} - s_{q0}) \cdot (y_{q1} - y_{q0}) \right\}$, measures the contribution of the interaction of the changes in both qualification shares and incomes. For example, if relative incomes increased for qualifications whose share of the population also grew, this interaction effect will be positive.

Table 7 presents the results of this decomposition for employed workers, the labour force, and the full population aged 20-59. Panel A of the table pertains to the full period, while the subsequent panels present results for the three intercensal subperiods. We discuss the full period changes here first, and return to the subperiod effects subsequently. The first row of panel A shows that, between 1986 and 2001, the value of the human capital of the employed New Zealand workforce and the population both rose by 20%, while the value of human capital of the labour force increased 18%. The skill-intensity changes described previously imply that the change in the skill-mix over the period has favoured those qualifications that were more highly rewarded in 1986, and thus contributes positively to the observed increase in the annual incomes. Row 2 documents that this upskilling in the population accounts for between 13% (for the full population) and 18% (for employed workers) of the increase in annual incomes over the period.

The third row of Table 7 presents the contribution to the overall change in annual income that is due to changes in qualification-specific average incomes at constant qualification shares. This component accounts for most of the increase, ranging from 72% for the employed population to 78% for the full population. This factor confounds two effects: a change in average incomes shared by all qualifications, and a change in relative incomes that may cause the incomes of some qualification groups to rise more rapidly than others. For example, a broad increase in productivity across qualifications is likely to result in an increase in the incomes of all qualification groups and, hence, increase the value of

human capital. On the other hand, a change in the relative productivity of different skill groups with no broad increase in productivity (eg, via a skill-biased technological change) would likely result in a change in relative incomes of different qualification and, depending on the qualification shares, may increase or decrease the value of human capital. We will return to this issue shortly.

The final row of Table 7 presents the contributions of the interaction effects between changing qualification shares and incomes. For each population group this interaction effects accounts for about 9% of the observed increase in annual incomes. These positive combined contributions of income and relative employment effects confirms that there were some income gains associated with the upskilling, although these may reflect average income gains common across skill groups rather than skill-specific relative income gains.

The complexity of the relative employment and income effects is not evident from the summary measures generated from the decomposition in Table 7. In order to understand more of what drives these aggregate changes, we next delve into the changes that occurred at the qualification level. First, we examine the qualification specific contributions to the component factors of the changes in human capital and, second, we examine the relationship between changes in qualification-specific relative incomes and shares over the period.

Table 8 presents the qualification specific contributions to the decompositions described in Table 7 of the changes in human capital between 1986 and 2001. The first column in the table (for each of the population groups) presents the qualification-contributions to qualification share component of the decomposition in Table 7, the final row sums these into the overall contribution of this component (from Table 7). Obviously the sign of a qualification's share change determines whether that qualification contributes positively or negatively, while the magnitudes of the share change and the average income affect the magnitude of its contribution. With these points in mind, it is apparent that the shares associated with the "post-school" and "no qualifications" groups fell and this made large negative contributions to the overall share effect on human capital change. On the other hand, all the other qualification groups increased their shares over the period, with the "bachelor's degree" group making a particularly large contribution to the overall qualification-share effect. The results are very similar across the employed, labour force, and full populations.

The second column in Table 8 shows the corresponding results for the component due to the changes in qualification specific average incomes over the period. In this case, the sign of the change in a qualification's average income determines the sign of its contribution, while the magnitude is determined by the size of the income change and the qualification share. That each of the qualification contributions is positive implies that the average incomes of all qualification groups increased over this period: that is, there was a general increase in incomes across qualifications. Furthermore, the "post-school" and "no qualifications" groups made the largest contribution here. As we will see soon, this is largely due to these groups having by far the largest shares of the population – each approximately one-third of the various populations. However, the relative contribution of the "no qualifications" group (18-21%, depending on population) is substantially smaller than its initial share (33-36%: see Table 1) implies that the increase in incomes for this group was relatively less than the average increase across qualifications. On the other hand, the relative contributions of the University-level and "post-school" groups exceed their initial population shares, implying their relative incomes increased.

The third column shows the qualification contributions to the interaction effects. Given that average incomes increased for all qualification groups, the sign of a qualification's share change determines the sign of its contribution to this interaction effect, while the magnitude its affected by the magnitudes of both its share and average income change. Thus the signs in this column are the same as those in column 1; the relative magnitudes also largely mirror those in column 1.

We now consider the changes in the value of human capital over each of the three intercensal periods. The results for the aggregate decomposition of human capital analysis are presented in panels B to D of Table 7, while the qualification group contributions to the changes in the value of human capital in the intercensal periods, shown in Appendix Tables A6a to A6c, also help shed light on the aggregate changes.

First, comparing the results across the panels in Table 7 suggests the aggregate 1986-2001 changes tends to disguise quite a lot of variation, both across time and across alternative populations defined by labour force status. For example, the change in average incomes of employed workers increased most strongly between 1986 and 1991 (8.1%), was slowest over 1991-96 (3.2%), and increased strongly again from 1996 to 2001 (7.2%). In contrast, the growth in average incomes of labour force participants was around 5% in each of the first two periods, and was 7.2% between 1996 and 2001, while the growth in average incomes across the population rose steadily over the period from 3.8% from 1986-91 to 9.3% from 1996-2001. The relative temporal differences in magnitudes for the employed workers and the broader populations are consistent with the changing nature of the employed and labour force populations over the business cycle. That is, the unemployed and not in the labour force constituted larger shares of the population in 1991, which lowered the income growth of the labour force and wider population relative to that of employed workers between 1986 and 1991, and raised it during the subsequent periods.

Second, the relative contributions of changes in the qualification mix and incomes also varied substantially across the subperiods and populations, although the relatively small changes in the human capital during any particular period make the individual numbers somewhat unreliable. For instance, while the change in skill-shares contributed positively to the change in average incomes of the employed population between 1986 and 1991, this effect was negative for the broader populations. These differences probably reflect differential employment selection effects over the business cycle, causing a relative increase in high-qualifications' shares and, consequently, decrease in the low skill shares of employed workers compared to the population.[24]

Third, although we find that the changes in incomes generally account for the majority of the overall change in average incomes over the period, the increase in skills between 1986 and 1991 contribute relatively strongly to the change in incomes over that period – eg, for the employed workers the changing qualification mix accounted for 32% of the increase in incomes and 47-67% across the labour force and whole population. During the subsequent period, 1991-1996, we find that the interaction effects between changing skill shares and changing average incomes was negative, implying that, on average, incomes fell for qualifications whose shares increased over this period and vice-versa. Appendix Table A6b shows this occurred for all qualifications except the "higher degree", "6th form", "school certificate" groups. The "bachelor degree" qualification group had a negative interaction effect for employed workers and the labour force, but a positive

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[24] For example, the university share increased from 7.6% to 9.6% for employed workers, compared to an increase from 6.7 to 8. for the whole population; and the shares with no qualifications fell from 32.9% to 25.9% of workers compared to a fall from 35.9% to 30.7% for the population.

interaction for the whole population. One interpretation of this finding is that increases in the supply of skilled workers outpaced demand causing their incomes to fall.

The final analysis we report on involves the relationships between the changes in relative incomes and the shares of different qualifications over the 4 census years. Figure 5 presents a graphical summary of the movements in incomes (relative to the "no qualifications" group) and shares for each qualification group over the period, adjusted for changes in age composition[25]. For the "no qualifications" group we also show (as the dashed line) the relative changes in income over time (relative to its 1986 level), in order to give a sense of the absolute change in incomes over the period. Horizontal movements measure changes in qualification shares in the population, while vertical movements measure changes in incomes. On such a graph, increases in relative demand generate movements in a North-East direction, assuming that the aggregate labour supply schedule is upward sloping. Similarly, assuming downward sloping demand, an increase in relative supply generates a South-East shift.

First, the dashed line shows a small drop in average incomes of this group occurred between 1986 and 1991, followed by modest increases to 1996 and 2001. The average incomes of each of the other qualification groups increased between 1986 and 1991, and over the full period between 1986 and 2001, both relative to the "no qualifications" group and in absolute terms.

Second, it is apparent from Figure 5 that both University-level and school-level qualifications' shares have generally increased over the period, at the expense of "other post-school" and "no qualifications" shares.[26] However, the increase in incomes of these groups, relative to the "no qualifications" group, was not monotonic over each 5 year interval of the period: in fact, only the average incomes of the "school certificate" group increased in each 5 year period.

The observed movements for the university-level groups are consistent with a net increase in relative demand between 1986 and 1991, followed by a subsequent net increase in relative supply between 1991 and 1996, and roughly equal increases in demand and supply between 1996 and 2001. The patterns of change for the school-level qualifications are somewhat similar, bearing in mind the caveat of the 1986-91 change associated with the apparent rise in the "post-school" share: the changes are roughly consistent with a steady increase in supply of these qualifications over that period which, with the exception of the 1991-96 period, was generally matched by an increase in demand.

On the other hand, employment movements dominate the changes for both the "other post-school qualifications" and "no qualifications" groups. The relative incomes of these groups changed very little, but the groups' shares fell steadily (except for the 1986-91 change for the "other post-school" group, mentioned earlier) from 30 and 36%, respectively, in 1986 to 22 and 21% in 2001.

The corresponding figures for employed workers and for the labour force, presented in Appendix Figures A5a and A5b, are qualitatively similar to those discussed here for the

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[25] Older cohorts have lower average educational attainment, but higher average incomes (due to experience effects). We adjusted for experience effects by removing the variation in incomes that was explained by different age groups using a log wage regression that included both age and qualification dummies, and recovering the coefficients for the qualification groups.

[26] We believe that the apparent increase in the "other post-school" share between 1986 and 1991, at the expense of the "school certificate" and "6th form" shares, is largely spurious and due to the inclusion, in the 1991 census, of many qualifications from short-term vocational courses, which makes that year's qualification less comparable to the others.

full population. The real incomes of employed workers with no qualifications actually increased, and was essentially static for this qualification group in the labour force, between 1986 and 1991 suggesting possible income-based selection effects on the composition of these respective groups, in comparison to the overall population, over the business cycle.

6   Conclusion

We have presented a variety of analyses in this paper on the changing nature of qualifications, employment and incomes of the working age population (aged 20-59) over the period from 1986 to 2001, and how these changes may be related. First, we show a general upskilling occurred between 1986 and 2001 that is evident across a wide range of job-groups and labour force states. Abstracting from this aggregate pattern, we find that the upskilling arose due to a rise in the proportion of the population with university and school-level qualifications, and a decline in the proportions with other post-school qualifications and no qualifications.

Second, using regression-based analysis of the relationship between employment growth indicates that qualification-related factors account for around one-third of the variation in employment growth, regardless of whether industry and occupation effects are controlled for. Employment growth was strongest in job-groups that had high initial levels of skilled workers but appears to be only weakly related to subsequent upskilling. Furthermore, the relationship between employment growth and initial skill-intensity does not reflect primarily industry or occupation-related factors. The absence of a relationship between growth in skill-intensity and growth in employment weakens the case that an upskilling in qualifications causes employment growth.

Third, the value of human capital, as measured by average annual incomes, increased about 20% between 1986 and 2001. Around 75% of this increase can be attributed to general increases in incomes across qualifications at constant qualification shares, while between 15-20% appears to be due to the effects of upskilling at constant incomes, and the remaining 8% to the interaction of upskilling and increasing incomes. At the individual qualification level, the results are consistent with the notion that the upskilling that occurred appears to have been in response to increase in demand for skills.

The patterns differ somewhat for particular subperiods, as well as across different populations defined according to labour market status. These differences appear to reflect a combination of business cycle effects, which affect both the aggregate level changes as well as cause differential selection into different work force states over time, and also apparently secular changes in product and factor markets trends, such as skill acquisition.

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Tables

Table 1 - Qualification Distributions of Population Aged 20-59, 1986-2001

Qualification Group	1986	1991	1996	2001
A: Employed Workers				
Higher degree	2.9	3.4	4.0	4.8
Bachelor's degree	4.7	6.2	8.1	10.3
Other post-school qual	32.7	38.6	31.2	23.9
Higher school qual	2.2	2.6	4.3	5.1
6th form qual	7.2	6.9	9.5	11.1
School certificate	12.5	11.5	12.5	14.8
Other school qual	0.4	1.7	4.7	4.8
No qual	32.9	25.9	24.2	18.5
Not specified	4.4	3.2	1.5	6.6
Employed Totals	1,288,389	1,242,210	1,420,155	1,483,074
Average Income	$29,120	$31,461	$32,579	$34,964
Total reporting Income	1,261,749	1,222,578	1,360,005	1,418,496
B: Unemployed				
Higher degree	1.4	1.4	2.7	2.7
Bachelor's degree	3.5	4.2	6.0	6.7
Other post-school qual	19.0	30.8	21.4	16.4
Higher school qual	4.4	3.4	5.1	5.7
6th form qual	6.5	5.7	6.5	7.6
School certificate	13.3	11.4	10.3	12.1
Other school qual	0.5	1.6	6.7	6.4
No qual	45.3	37.3	39.3	29.7
Not specified	6.2	4.1	2.0	12.6
Unemployed Totals	69,624	124,944	103,821	102,585
Average Income	$10,347	$12,058	$11,524	$11,606
Total reporting Income	61,869	117,537	93,150	88,872
C: Not in the Labour Force				
Higher degree	1.0	1.0	1.7	2.2
Bachelor's degree	2.5	3.0	4.2	5.9
Other post-school qual	17.2	21.8	19.1	13.6
Higher school qual	3.1	3.6	4.6	5.9
6th form qual	5.9	5.2	6.9	8.5
School certificate	12.9	11.1	10.6	12.3
Other school qual	0.6	2.3	8.0	9.2
No qual	46.0	42.8	42.1	29.9
Not specified	10.9	9.2	2.7	12.5
Not in LF Totals	329,277	417,462	380,970	369,036
Average Income	$8,445	$10,797	$11,263	$11,560
Total reporting Income	329,185	352,596	340,317	310,782

Qualification Group	1986	1991	1996	2001
D: Population Aged 20-59				
Higher degree	2.5	2.7	3.3	4.0
Bachelor's degree	4.2	5.3	7.0	9.0
Other post-school qual	29.1	34.1	27.4	20.9
Higher school qual	2.4	2.9	4.3	5.1
6th form qual	7.0	6.4	8.5	10.1
School certificate	12.6	11.4	11.6	13.8
Other school qual	0.5	1.8	5.3	5.5
No qual	35.9	30.7	27.7	20.5
Not specified	5.7	4.7	4.8	11.0
Population Totals	1,687,287	1,784,616	1,965,312	2,019,261
Average Income	$24,874	$25,810	$27,441	$29,822
Total reporting Income	1,594,914	1,692,714	1,793,475	1,818,168

Notes: Entries are percentages of the column totals for each panel. Average incomes are in constant 2001 dollar values, adjusting using the CPI (excluding GST effects for 1986 incomes). The 1996 and 2001 populations in panel D also include those who did not-specify labour force status.

Table 2 - Educational Attainment of the working age population & Expected Years of Schooling - Selected OECD countries (1998/99)

Country	Average Years of Education	Educational Attainment[a]			Expected Years of Tertiary Schooling			
		Lower secondary or less	Higher secondary & post-school	Tertiary	Schooling		Tertiary Schooling	
					Full-time	Part-time	Full-time	Part-time
OECD		36	43	22	15.4	1.2	2.0	0.5
NZ	11.8	26 (72)	46 (107)	27 (123)	15.2	2.0	2.0	1.0
UK[b]	11.9	18 (50)	57 (133)	25 (114)	14.7	4.2	1.7	0.9
Australia	12.3	43 (119)	31 (72)	27 (123)	14.3	5.6	1.7	1.3
US	12.7	13 (36)	51 (119)	35 (159)	15.3	1.9	2.0	1.6
Canada	12.9	20 (56)	42 (98)	39 (177)	15.3	1.2	2.0	0.7
Germany	13.5	19 (53)	58 (135)	23 (105)	17.1	0.1	2.0	0

Notes: Working Age population is 15-64 years old.

[a] Entries are percentages of the population (numbers in parentheses are relative to OECD average of 100)
[b] Post-secondary non-tertiary education is counted as Tertiary education for the UK and as post-school for other countries in the table.

Source: OECD (2001) Table A2.1a for educational attainment; Tables C1.1 & C3.2 for expected years of schooling. See OECD (2000) for Average Years of Education.

Table 3 - Disaggregated Field of Study Distributions for Degree Qualifications, Population Aged 20-59: 1996-2001

Field of Study	1996		2001		1996-01
Natural & Physical Sciences	30984	(15.3%)	36165	(13.7%)	16.7%
Information Technology	4218	(2.1%)	6804	(2.6%)	61.3%
Engineering and Technical	15474	(7.6%)	17424	(6.6%)	12.6%
Architecture and Building	3072	(1.5%)	4194	(1.6%)	36.5%
Agriculture and Environment	5805	(2.9%)	5619	(2.1%)	-3.2%
Health	17514	(8.6%)	28209	(10.7%)	61.1%
Education	14799	(7.3%)	23862	(9.0%)	61.2%
Management and Commerce	36405	(17.9%)	49338	(18.7%)	35.5%
Society and Culture	62700	(30.9%)	70485	(26.7%)	12.4%
Creative Arts	5298	(2.6%)	8856	(3.4%)	67.2%
Food and Hospitality	108	(0.1%)	90	(0.0%)	-16.7%
Not Specified	6426	(3.2%)	12921	(4.9%)	101.1%
Total	202818	(100%)	263991	(100%)	30.2%

Notes: The population includes only those that specify whether they were employed, unemployed or not in the labour force. The percentages in parentheses are row percentages.

Table 4a - Skill-Intensity – Employed Workers, Aged 20-59

Population	Skill Intensity[a]		Percent Change			
Sub-group	1986	2001	1986-01	1986-91	1991-96	1996-01
All Workers	1.00	1.04	3.6	2.6	0.3	0.6
Gender						
Males	1.01	1.00	2.1	2.4	0.0	-0.3
Females	0.98	1.00	5.7	3.1	0.9	1.6
Age						
20-24	1.00	1.02	5.7	2.7	2.0	1.0
25-29	1.02	1.04	5.3	2.2	0.2	2.8
30-39	1.01	1.01	3.1	3.0	-0.4	0.4
40-49	0.99	1.00	4.5	3.0	0.7	0.7
50-59	0.97	0.96	2.3	1.9	0.2	0.2
Region						
Northland	0.98	0.96	1.2	2.1	-0.9	0.0
Auckland	1.01	1.02	4.5	2.9	0.5	1.0
Waikato	0.99	0.98	2.9	2.5	0.2	0.2
Bay of Plenty	0.99	0.97	2.0	2.3	-0.4	0.1
Gisborne	0.97	0.96	2.4	2.6	0.0	-0.1
Hawke's Bay	0.98	0.96	2.1	2.1	0.0	0.0
Taranaki	0.98	0.96	1.7	1.9	-0.3	0.1
Manawatu-Wanganui	0.99	0.98	2.8	2.4	0.2	0.2
Wellington	1.04	1.05	5.0	3.1	1.0	0.9
West Coast	0.97	0.95	1.3	1.9	-0.7	0.1
Canterbury	1.00	1.00	3.1	2.4	0.2	0.4
Otago	1.00	1.01	3.8	2.6	0.7	0.5
Southland	0.97	0.95	2.0	1.8	0.1	0.0
Tasman	0.98	0.97	2.1	2.0	0.0	0.1
Nelson	1.01	0.99	2.0	2.2	-0.5	0.2
Marlborough	0.98	0.96	1.2	1.3	0.0	-0.2
Area Outside	0.96	0.93	0.7	2.7	-2.1	0.2

Table 4a - Skill-Intensity – Employed Workers, Aged 20-59

Population	Skill Intensity[a]		Percent Change			
Sub-group	1986	2001	1986-01	1986-91	1991-96	1996-01
Industry						
1. Pastoral	0.95	0.94	2.4	1.6	0.8	0.0
2. Horticulture	0.96	0.94	1.6	1.0	0.5	0.1
3. Agriculture S.	0.93	0.92	1.5	3.3	-1.3	-0.3
4. Primary incl. Fishing	0.97	0.93	-0.2	1.8	-1.0	-0.9
5. Food/Tobacco	0.94	0.92	1.8	1.6	0.7	-0.6
6. Clothing	0.92	0.90	1.3	1.9	0.1	-0.7
7. Wood/Paper M.	0.96	0.93	0.3	1.9	-0.7	-0.8
8. Publishing	1.00	0.99	3.3	1.9	1.1	0.3
9. Chemical M.	0.98	0.96	1.0	1.8	-0.1	-0.6
10. Metal/Minerals M.	0.96	0.93	0.3	2.1	-0.3	-1.4
11. Machinery M.	0.98	0.97	2.8	2.3	0.9	-0.5
12. Energy/Water Supp.	1.02	1.05	7.1	2.3	1.8	2.8
13. Construction	0.98	0.95	0.2	1.9	-0.6	-1.1
14. Construction S.	0.99	0.94	-1.9	1.9	-2.2	-1.6
15. Wholesale Trade	0.98	0.97	2.3	1.8	0.6	-0.1
16. Retail Trade	0.95	0.94	2.3	2.4	0.2	-0.3
17. Hospitality S.	0.94	0.95	4.1	2.8	2.9	-1.6
18. Transport/Storage	0.96	0.94	1.7	2.0	0.2	-0.5
19. Communication S.	0.98	0.99	4.2	3.1	0.2	0.9
20. Finance/Insurance	1.01	1.04	6.2	1.4	2.3	2.4
21. Business S.	1.10	1.08	1.5	0.6	0.2	0.7
22. Government	1.05	1.07	5.2	1.8	1.3	2.0
23. Education	1.18	1.17	2.2	0.6	0.3	1.3
24. Health	1.08	1.06	2.4	1.6	0.2	0.6
25. Entertainment	1.08	1.08	3.1	2.3	-0.2	1.0
26. Sport/Recreation	0.97	0.99	5.8	3.4	1.4	0.9
27. Personal S.	0.97	0.95	1.2	1.7	0.6	-1.1
28. Residual Cat.	0.96	0.90	-2.4	3.2	-3.5	-2.1
Occupation						
1. Administrators	1.15	1.08	-3.0	3.2	0.1	-6.1
2. Managers	1.01	1.02	5.2	3.4	1.1	0.6
3. Science Prof.	1.26	1.17	-3.9	-1.0	-2.0	-1.0
4. Health Prof.	1.21	1.22	4.3	0.7	1.1	2.4
5. Teaching Prof.	1.23	1.24	4.4	1.6	1.5	1.3
6. Other Prof.	1.24	1.23	2.6	1.9	1.8	-1.2
7. Science Assoc.	1.09	1.06	0.6	-0.1	0.5	0.2
8. Health Assoc.	1.11	1.11	3.6	1.2	0.9	1.5
9. Other Assoc.	1.07	1.03	-0.1	0.5	-0.2	-0.4
10. Clerks	0.96	0.97	4.1	2.2	0.6	1.3
11. Customer S.	0.96	0.96	3.1	1.2	1.3	0.7
12. Personal S.	0.95	0.94	2.9	2.9	0.5	-0.6
13. Sales	0.93	0.94	4.5	2.6	1.3	0.5

Population Sub-group	Skill Intensity[a]		Percent Change			
	1986	2001	1986-01	1986-91	1991-96	1996-01
14. Ag/Fisheries	0.95	0.93	1.7	1.8	0.2	-0.2
15. Building Trade	1.01	0.95	-2.7	1.7	-1.7	-2.6
16. Machinery	1.01	0.96	-1.9	2.3	-1.6	-2.5
17. Precision	0.98	0.94	-0.8	2.5	-1.5	-1.7
18. Craft	0.95	0.91	-0.7	3.4	-1.3	-2.7
19. Plant Oper.	0.94	0.90	-0.4	2.5	-1.9	-0.9
20. Machine Oper.	0.93	0.88	-1.5	-0.8	-0.1	-0.6
21. Drivers	0.91	0.88	0.5	1.7	-0.5	-0.8
22. Building S.	0.96	0.91	-2.7	0.8	-2.2	-1.3
23. Labourers	0.90	0.89	2.4	2.0	0.9	-0.6
24. Residual Cat.	0.93	0.91	0.9	5.5	-2.2	-2.1

Notes: Analysis is based on the sub-population of employed workers in each year. See Appendix Table A1 for a more detailed description of the industry and occupation codes for each year.

[a] For the entire work force (first row), the skill intensity is measured relative to the skill intensity in 1986. For subgroups, the skill intensity is measured relative to the average skill intensity of the work force in each year.

Table 4b - Skill-Intensity – Labour Force, Aged 20-59

Population	Skill Intensity[a]		Percent Change			
Sub-group	1986	2001	1986-01	1986-91	1991-96	1996-01
All Workers	1.00	1.03	3.3	2.6	0.3	0.4
Gender						
Males	1.01	1.00	1.7	2.2	0.0	-0.5
Females	0.98	1.00	5.5	3.3	0.7	1.5
Age Groups						
20-24	0.99	1.01	4.8	2.6	1.4	0.6
25-29	1.02	1.04	4.7	1.9	0.2	2.5
30-39	1.01	1.01	2.8	2.9	-0.3	0.2
40-49	0.99	1.00	4.3	3.0	0.6	0.6
50-59	0.97	0.96	2.2	2.0	0.1	0.1
Region						
Northland	0.98	0.96	0.8	2.1	-1.1	-0.2
Auckland	1.01	1.02	4.1	2.8	0.6	0.7
Waikato	0.98	0.98	2.7	2.5	0.1	0.1
Bay of Plenty	0.99	0.97	1.7	2.2	-0.5	0.0
Gisborne	0.97	0.96	2.0	2.4	-0.2	-0.1
Hawke's Bay	0.97	0.96	2.0	2.0	0.0	0.0
Taranaki	0.98	0.96	1.5	1.9	-0.4	0.0
Manawatu-Wanganui	0.99	0.98	2.6	2.5	0.1	0.0
Wellington	1.04	1.05	4.7	3.1	0.8	0.8
West Coast	0.97	0.95	0.9	1.8	-0.8	-0.1
Canterbury	1.00	1.00	2.9	2.5	0.1	0.3
Otago	1.01	1.01	3.6	2.6	0.5	0.4
Southland	0.97	0.95	1.8	1.8	0.1	-0.1
Tasman	0.98	0.97	1.9	2.0	-0.1	-0.1
Nelson	1.01	0.99	1.6	2.1	-0.6	0.1
Marlborough	0.98	0.96	1.1	1.4	0.0	-0.3
Area Outside	0.97	0.93	-0.1	2.5	-2.6	0.0
Labour Force Status						
Employed	1.00	1.00	3.4	2.7	0.2	0.5
Unemployed	0.95	0.94	2.6	3.5	-0.4	-0.6

Notes: Analysis is based on the sub-population of the labour force in each year.

[a] For the entire labour force (first row), the skill intensity is measured relative to the skill intensity in 1986. For subgroups, the skill intensity is measured relative to the average skill intensity of the labour force in each year.

Table 4c - Skill-Intensity – Population, Aged 20-59

Population	Skill Intensity[a]		Percent Change			
Sub-group	1986	2001	1986-01	1986-91	1991-96	1996-01
All Workers	1.00	1.02	2.4	2.6	-0.2	0.1
Gender						
Males	1.03	1.00	-0.2	1.9	-1.0	-1.1
Females	0.97	1.00	5.2	3.4	0.6	1.2
Age Groups						
20-24	0.99	1.00	2.8	2.6	0.2	-0.1
25-29	1.03	1.04	3.6	1.6	-0.1	2.0
30-39	1.02	1.01	1.8	2.8	-0.8	-0.2
40-49	0.99	1.00	3.9	3.3	0.3	0.3
50-59	0.96	0.95	1.9	2.1	0.0	-0.2
Region						
Northland	0.98	0.94	-1.2	1.6	-1.8	-1.0
Auckland	1.01	1.01	2.7	2.7	-0.1	0.1
Waikato	0.98	0.98	2.1	2.5	-0.2	-0.2
Bay of Plenty	0.98	0.97	0.7	2.0	-0.9	-0.4
Gisborne	0.96	0.95	0.9	1.7	-0.4	-0.3
Hawke's Bay	0.97	0.96	1.1	1.9	-0.4	-0.3
Taranaki	0.98	0.96	0.9	2.0	-0.9	-0.3
Manawatu-Wanganui	0.99	0.98	2.0	2.6	-0.2	-0.3
Wellington	1.04	1.06	4.0	3.0	0.3	0.7
West Coast	0.96	0.94	0.2	1.8	-1.1	-0.5
Canterbury	1.00	1.00	2.6	2.8	-0.2	0.0
Otago	1.01	1.02	3.5	2.9	0.1	0.4
Southland	0.96	0.96	1.9	2.1	-0.1	-0.1
Tasman	0.99	0.97	1.3	2.4	-0.2	-0.8
Nelson	1.01	1.00	1.2	2.6	-1.2	-0.1
Marlborough	0.98	0.97	0.7	1.7	-0.3	-0.7
Area Outside	0.96	0.94	0.0	4.2	-2.8	-1.2
Labour Force Status						
Employed	1.02	1.03	3.4	3.4	-0.1	0.1
Unemployed	0.95	0.95	2.5	4.8	-0.9	-1.3
Not in labour force	0.93	0.93	2.8	2.0	0.9	-0.1
Not specified	0.00	0.76	.	.	.	0.0

Notes: Analysis is based on the sub-population in each year.

[a] For the entire population (first row), the skill intensity is measured relative to the skill intensity in 1986. For subgroups, the skill intensity is measured relative to the average skill intensity of the population in each year.

Table 5 - Regression Analysis of Employment Growth, 1986-2001

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Higher degree	0.965					0.733	0.723	0.700	0.721
	(0.053)					(0.042)	(0.050)	(0.039)	(0.023)
Bachelor's degree	1.276					1.052	1.035	0.995	1.023
	(0.043)					(0.034)	(0.042)	(0.032)	(0.019)
Other post-school	0.228					0.168	0.165	0.172	0.188
	(0.022)					(0.017)	(0.021)	(0.016)	(0.009)
Higher school	1.230					1.148	1.136	1.134	1.143
	(0.061)					(0.046)	(0.054)	(0.042)	(0.025)
Sixth form	0.908					0.850	0.840	0.854	0.866
	(0.036)					(0.028)	(0.032)	(0.025)	(0.015)
School certificate	0.676					0.638	0.647	0.649	0.655
	(0.029)					(0.022)	(0.026)	(0.020)	(0.012)
Other school	2.060					1.967	2.051	2.011	2.009
	(0.134)					(0.101)	(0.118)	(0.091)	(0.053)
Not specified	0.640					0.587	0.593	0.576	0.574
	(0.044)					(0.033)	(0.039)	(0.030)	(0.018)
Industry		Y		Y		Y		Y	
Occupation			Y	Y			Y	Y	
Industry-Occupation					Y				Y
R2	0.325	0.372	0.241	0.464	0.678	0.621	0.482	0.695	0.910
Marginal R2									
Qualifications	0.325					0.249	0.241	0.231	0.232
Industry		0.372		0.223		0.296		0.213	
Occupation			0.241	0.092			0.157	0.074	
Industry-Occupation					0.678				0.585

Notes: The dependent variable is $demp_{ioq,8601} = (Emp_{ioq,01} - Emp_{ioq,86})/(0.5(Emp_{ioq,86} + Emp_{ioq,01}))$. All specifications are based on population growth in 4473 industry-occupation-qualification cells, and are weighted by 1986 cell size, $Emp_{ioq,86}$. . The qualification-specific population changes are measured relative to the change of the no-qualifications group.

Table 6 - Correlation of Employment Changes by Qualification, 1986-2001

	Controls	Higher degree	Bachelor's degree	Post-school	Higher school	Sixth form	School certificate	Other school	No Quals
Higher Degree	None	**0.497**							
	Ind	**0.322**							
	Ind, Occ	**0.313**							
	Ind*Occ	**0.238**							
Bachelor's Degree	None	0.839	**0.354**						
	Ind	0.749	**0.250**						
	Ind, Occ	0.744	**0.253**						
	Ind*Occ	0.655	**0.179**						
Post-School	None	0.717	0.742	**0.347**					
	Ind	0.528	0.591	**0.183**					
	Ind, Occ	0.483	0.560	**0.132**					
	Ind*Occ	0.138	0.215	**0.036**					
Higher School	None	0.672	0.744	0.803	**0.398**				
	Ind	0.458	0.590	0.633	**0.219**				
	Ind, Occ	0.421	0.570	0.549	**0.191**				
	Ind*Occ	0.174	0.357	0.037	**0.118**				
Sixth Form	None	0.603	0.681	0.795	0.922	**0.371**			
	Ind	0.358	0.507	0.636	0.862	**0.218**			
	Ind, Occ	0.314	0.484	0.554	0.842	**0.191**			
	Ind*Occ	-0.039	0.179	-0.095	0.726	**0.100**			
School Certificate	None	0.591	0.642	0.819	0.845	0.937	**0.382**		
	Ind	0.315	0.422	0.657	0.714	0.889	**0.204**		
	Ind, Occ	0.254	0.382	0.561	0.664	0.870	**0.168**		
	Ind*Occ	-0.172	-0.023	-0.173	0.391	0.741	**0.079**		
Other School	None	0.506	0.636	0.588	0.679	0.731	0.700	**0.217**	
	Ind	0.323	0.555	0.432	0.529	0.622	0.559	**0.239**	
	Ind, Occ	0.288	0.541	0.326	0.476	0.581	0.500	**0.221**	
	Ind*Occ	0.113	0.413	-0.081	0.312	0.429	0.304	**0.192**	
No Quals	None	0.577	0.588	0.820	0.740	0.817	0.922	0.602	**0.324**
	Ind	0.286	0.341	0.657	0.514	0.675	0.849	0.465	**0.170**
	Ind, Occ	0.228	0.303	0.557	0.430	0.622	0.817	0.396	**0.141**
	Ind*Occ	-0.188	-0.130	-0.144	-0.012	0.255	0.616	0.177	**0.071**

Notes: The first row of each block (labelled "none") is based on the raw population changes across industry-occupation cells for each pair of qualifications; the second, third and fourth rows control for industry, industry and occupation, and industry-occupation interaction effects respectively, using the residuals from the regressions reported in Table 4, columns (2), (4) and (5). The diagonal entries in **bold** are the within qualification group variances; all other entries are correlations of population changes for pairs of qualifications. We have omitted the correlations pertaining to the 'not specified' qualification group.

Table 7 - Decomposition of Changes in the Value of Human Capital, 1986-2001

	Employed Workers	Labour Force	Whole Population
A: 1986 – 2001			
1. Percentage change in value of Human Capital	19.5	18.2	18.7
Percentage due to change in:			
2. Qualification-shares	18.2	18.1	13.0
3. Qualification-incomes	73.9	72.2	77.7
4. Interaction	7.9	9.7	9.3
B: 1986 – 1991			
1. Percentage change	8.1	5.5	3.8
Percentage due to change in:			
2. Qualification-shares	32.4	47.4	67.6
3. Qualification-incomes	62.0	45.1	23.0
4. Interaction	5.6	7.5	9.4
C: 1991 – 1996			
1. Percentage change	3.2	4.6	4.6
Percentage due to change in:			
2. Qualification-shares	36.7	28.2	17.8
3. Qualification-incomes	73.8	80.7	91.8
4. Interaction	-10.5	-8.9	-9.6
D: 1996 – 2001			
1. Percentage change	7.2	7.2	9.3
Percentage due to change in:			
2. Qualification-shares	10.0	9.2	-9.3
3. Qualification-incomes	88.7	90.4	91.9
4. Interaction	1.3	0.5	17.4

Notes: The value of human capital here is defined as the average annual income across the relevant population, and the decomposition is constructed as follows:

$$\overline{Y}_1 - \overline{Y}_0 = \sum_q \left\{ (s_{q1} - s_{q0}).y_{q0} + s_{q0}.(y_{q1} - y_{q0}) + (s_{q1} - s_{q0}).(y_{q1} - y_{q0}) \right\}$$

where s_{qt} denotes the qualification-q share of the population in year-t, y_{qt} denotes qualification-q's average income in year-t. The first term, reported in row 2, is the effect of changing qualification shares, holding incomes constant (this is also the change in skill intensity discussed earlier); the second, reported in row 3, is the effect of changing average qualification incomes, holding shares constant; and the third, reported in row 4, is the interaction effect associated with these two changes.

Table 8 - Decomposing the Change in the Value of Human Capital: Contributions by Qualification Group, 1986-2001

Qualification	Employed Workers			Labour Force			Whole Population		
	Qualification Shares	Qualification Incomes	Interaction	Qualification Shares	Qualification Incomes	Interaction	Qualification Shares	Qualification Incomes	Interaction
Higher	15.4	4.9	3.1	16.2	4.9	3.1	15.1	4.0	2.7
Degree	(84.6)	(6.6)	(39.2)	(89.8)	(6.8)	(31.8)	(93.7)	(5.5)	(28.2)
Bachelor's	41.1	5.3	6.4	42.8	5.6	6.6	38.5	5.0	6.1
Degree	(225.7)	(7.2)	(80.9)	(237.1)	(7.7)	(67.7)	(239)	(6.8)	(63.1)
Post	-49.7	26.1	-7.0	-52.5	25.5	-6.8	-44.8	23.7	-6.1
School	(-272.6)	(35.3)	(-89.4)	(-290.8)	(35.2)	(-70.5)	(-277.9)	(31.9)	(-63.5)
Higher	15.4	0.8	1.1	15.4	1.2	1.5	13.3	1.6	1.9
School	(84.5)	(1.1)	(14.1)	(85.3)	(1.6)	(15.4)	(82.3)	(2.1)	(19.4)
6th Form	19.7	7.0	3.7	20.2	7.5	3.8	17.7	7.7	3.8
	(108.4)	(9.5)	(47.3)	(111.6)	(10.4)	(39.6)	(110.1)	(10.4)	(39.7)
School	10.4	11.8	2.1	10.1	12.7	2.1	7.0	14.6	1.8
Certificate	(57.2)	(15.9)	(27)	(55.7)	(17.5)	(21.3)	(43.2)	(19.7)	(18.7)
Other	18.4	0.4	4.5	20.0	0.4	4.5	20.4	0.3	3.7
School	(100.7)	(0.6)	(57.7)	(110.5)	(0.6)	(46.2)	(126.8)	(0.4)	(38.8)
No	-62.3	15.8	-6.9	-65.7	13.3	-5.7	-59.8	13.8	-5.7
Quals	(-341.8)	(21.4)	(-88.1)	(-363.7)	(18.4)	(-58.5)	(-370.7)	(18.6)	(-58.5)
Not Specified	9.7	1.8	0.9	11.7	1.2	0.7	8.6	3.4	1.4
	(53.3)	(2.4)	(11.2)	(64.5)	(1.7)	(6.9)	(53.4)	(4.6)	(14.1)
Total	18.2	73.9	7.9	18.1	72.2	9.7	16.1	74.2	9.7

Notes: Entries are percentages of the total change in the value of human capital: these entries sum to the total in the final row for each column. Numbers in parentheses are percentages of the total entry in the final row

Figures

Figure 1 - Relationship Between Population Average income and Skill Intensity, 1986
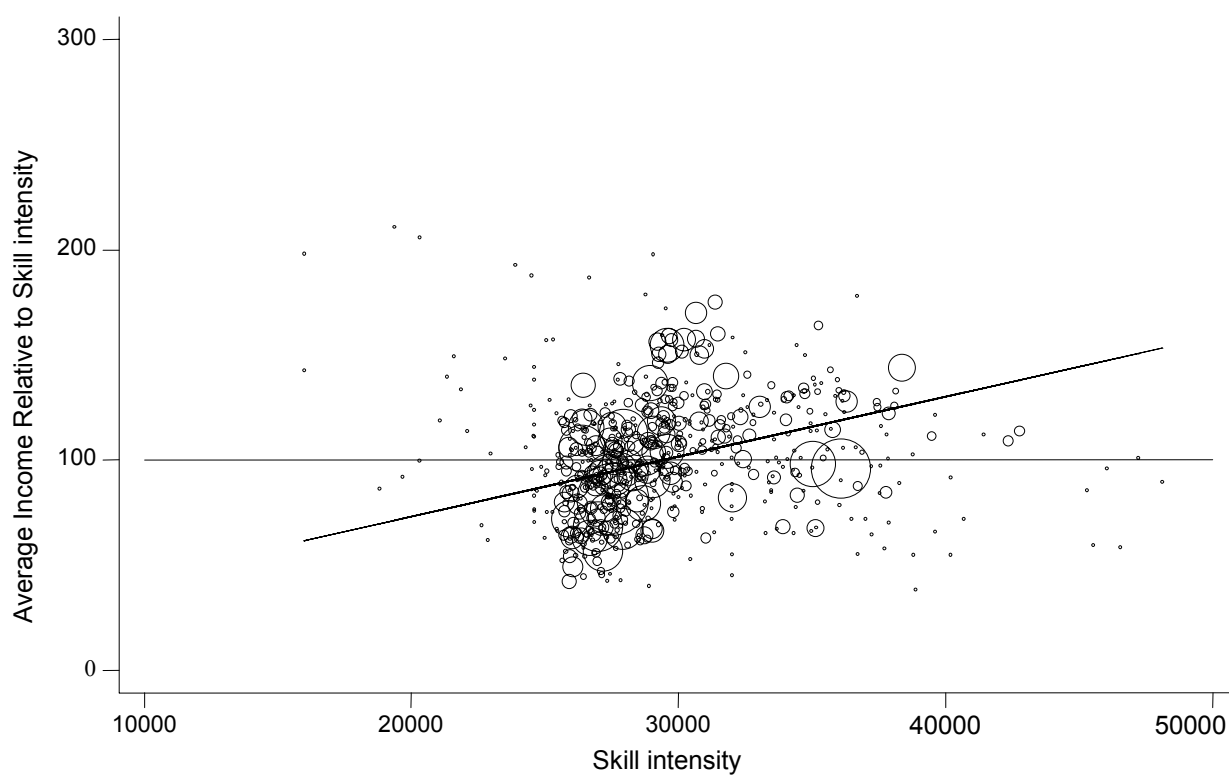
Figure 2a - Employment by Occupation and Industry, 1986
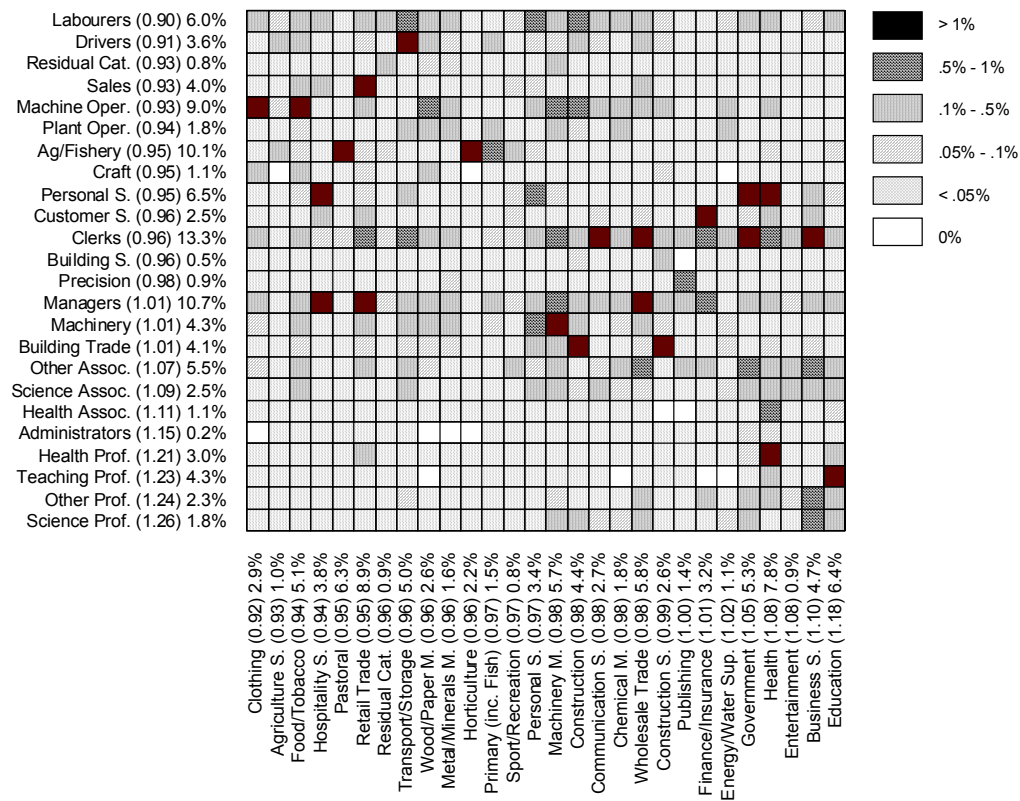
Figure 2b - Employment by Occupation and Industry, 1991
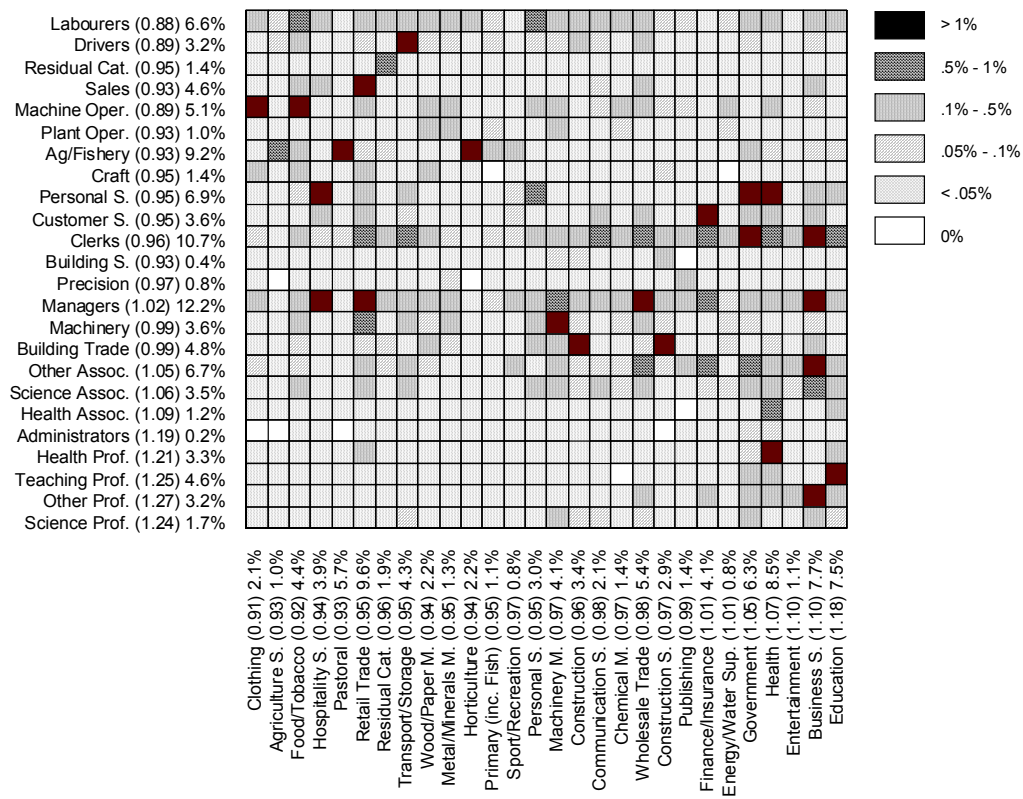
Figure 2c - Employment by Occupation and Industry, 1996
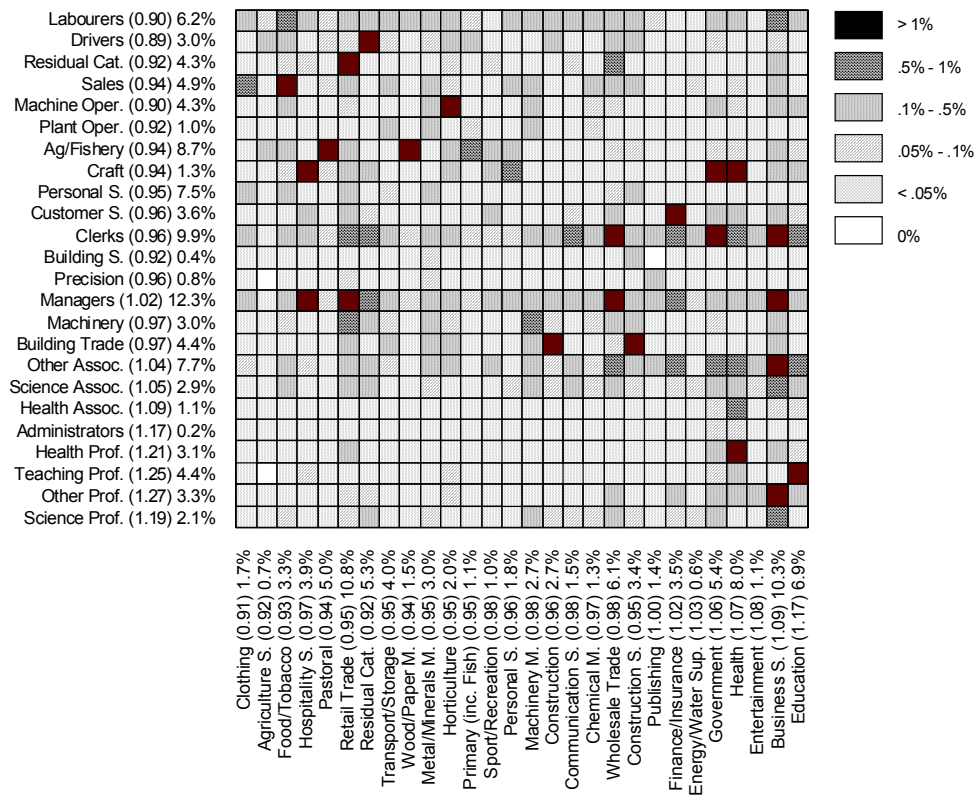
Figure 2d - Employment by Occupation and Industry, 2001
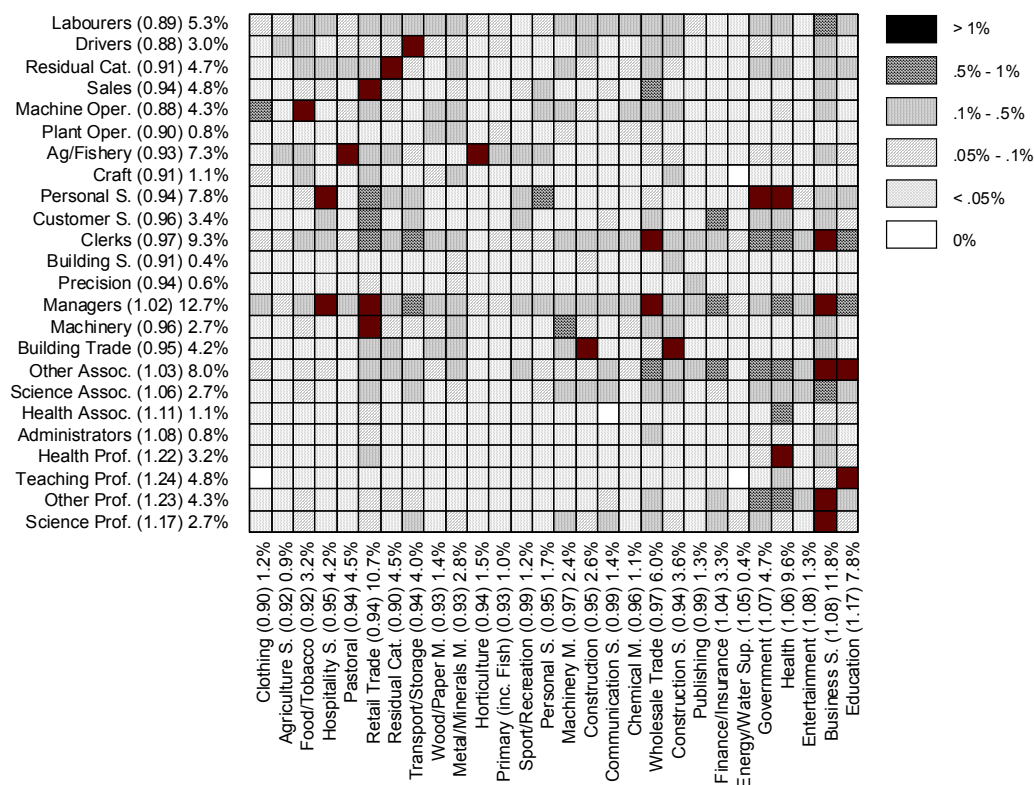
Notes: Industries and occupations are ranked by their 1986 skill intensity, based on the employed population with specified incomes. The year-specific industry and occupation employment shares are reported on the axes (and skill intensities are reported in parentheses). The top left-hand corner represents the industry-occupation cells with the lowest skill intensity, while the bottom right-hand corner represents the industry-occupation cells with the highest skill intensity.

Figure 3 - Change in Industry-Occupation Populations, 1986-2001
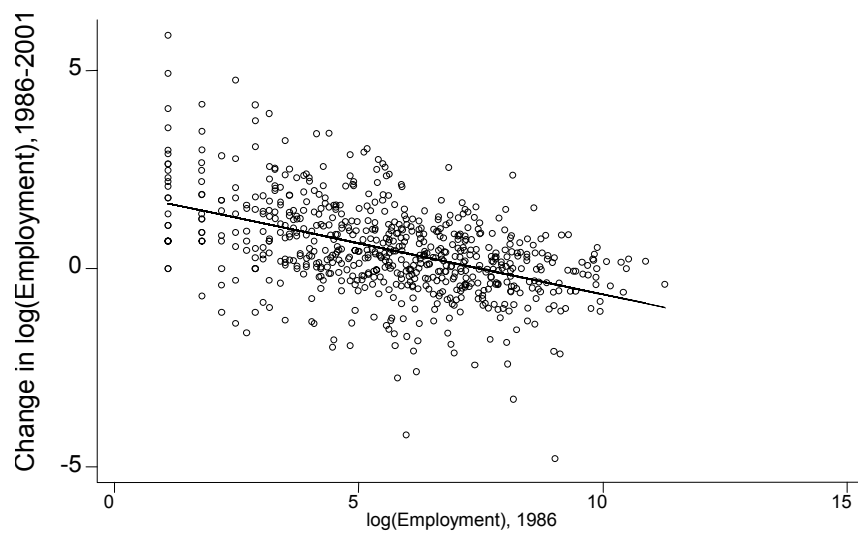
Figure 4 - Skill Intensity, Upskilling, and Population Growth, 1986-2001
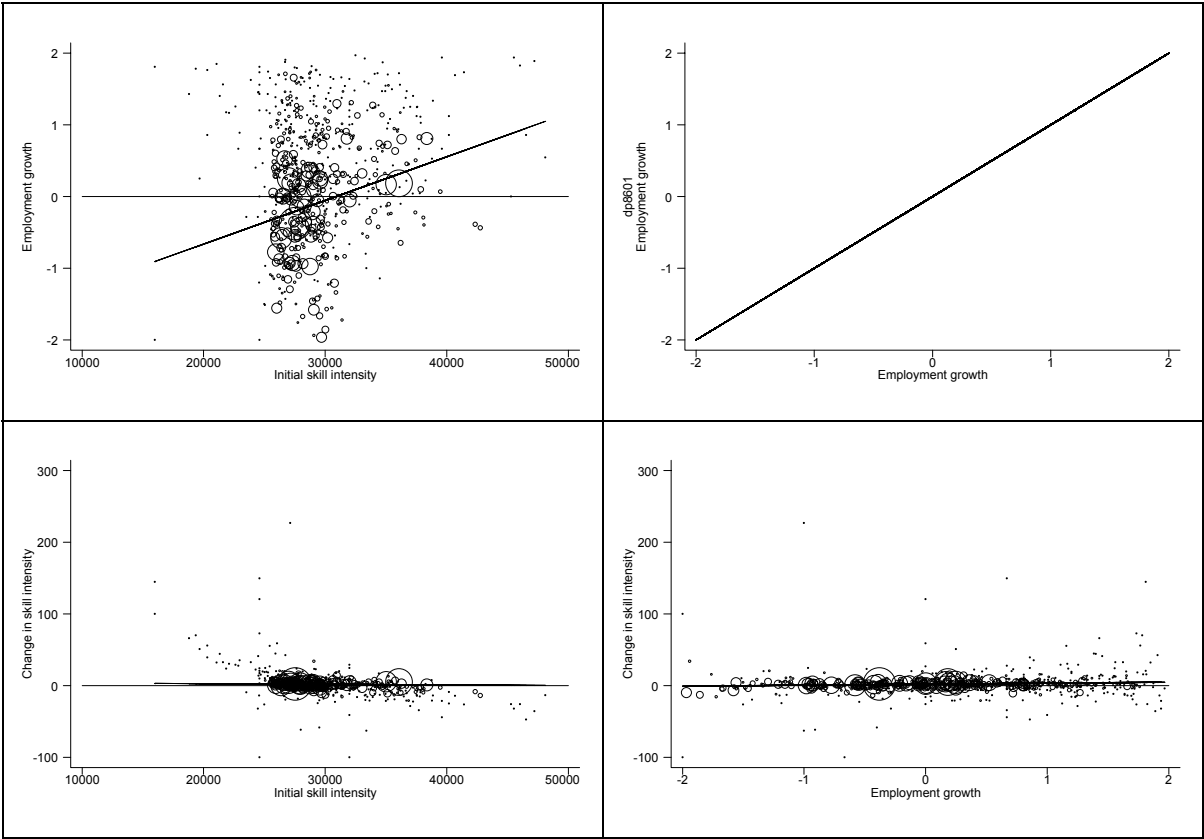
Figure 5 - Relative Income and Population-share movements, 1986-2001
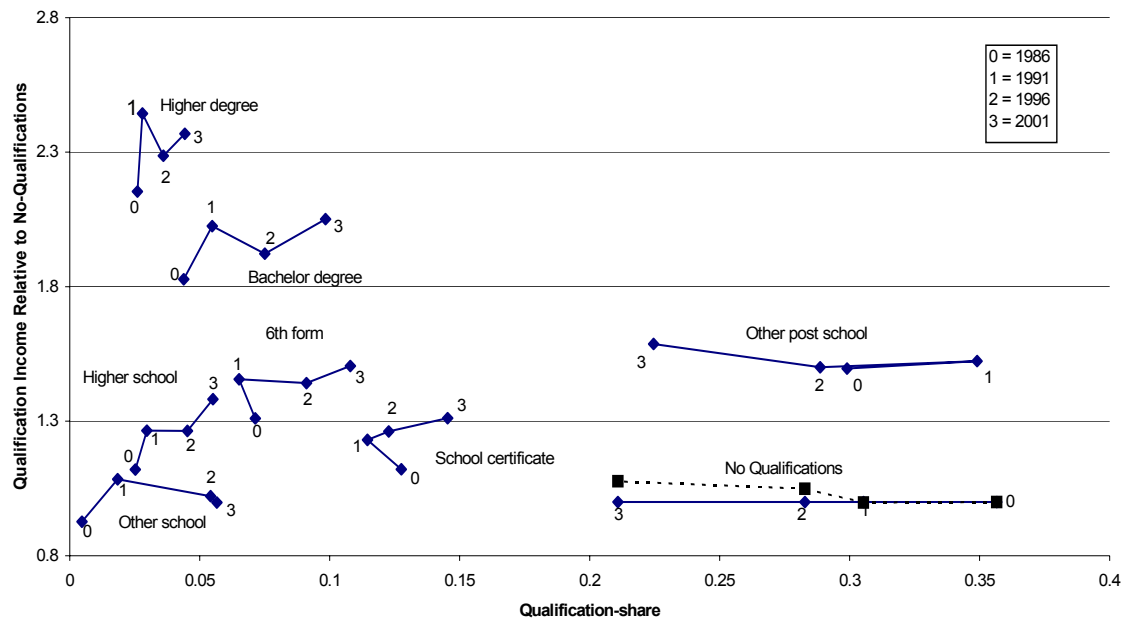
Notes: Incomes have been adjusted to control for age effects.

Appendix

Table A1 - Description of Industry and Occupation Codes

A: 1986 and 1991 Industry Codes

Industry	NZSIC Codes	Description
1	1111 – 1114	Agriculture
2	1115 – 1119	Horticulture
3	112	Agricultural Services
4	12,13, 2	Forestry, Logging and Mining
5	31	Food, Beverage, Tobacco
6	32	Textile, Apparel and Leathergoods
7	33, 341	Wood Processing and Wood Product Manufacture, Paper and Paper Products
8	342	Printing, Publishing and Allied Industries
9	35	Rubber, Petroleum, Chemicals
10	36,37,39	Other Manufacturing Industries
11	38	Manufacture of Fabricated Metal Products, Machinery and Equipment
12	4	Electricity, Gas, Steam Water
13	51, 52	Construction
14	53	Ancillary Construction Services
15	61	Wholesale Trade
16	62	Retail Trade
17	63	Restaurants and Hotels
18	71	Transport and Storage
19	72	Communication
20	81,82	Finance and Insurance
21	83	Real Estate and Business
22	91	Public Administration and Defence
23	931,932	Education Services, Research and Scientific Institutes
24	933,934,935,939	Medical, Dental, other Health and Veterinary Services, Welfare Services, Business, Professional and Labour Associations, Religious and other Community Services
25	941, 942	Motion Picture and Other Entertainment Services, Libraries, Museums, Botanical and Zoological Gardens and other Cultural Services
26	943, 944,945	Racing and Associated Services, Sporting and Recreation Clubs and Sports People, Amusement and Recreational Services
27	92, 95,96	Sanitary and Cleaning Services, Personal and Household Services, International and Extra-Territorial Bodies
28	R	Residual Categories

Notes: The 1986 Census classification of industries is based on the NZSIC75; the 1991 classification is based on the NZSIC87.

Table A1 - Description of Industry and Occupation Codes

B: 1996 and 2001 Industry Codes

Industry	ANZSIC96 Codes	Description
1	A012 – A015	Grain, Sheep and Beef Cattle Farming,Dairy Cattle Farming, Poultry Farming, Other Livestock Farming
2	A011,A016	Horticulture and Fruit Growing, Other Crop Growing
3	A02	Services to Agriculture, Hunting and Trapping
4	B, A03, A04	Mining, Forestry and Logging, Commercial Fishing
5	C21	Food, Beverage and Tobacco
6	C22	Textile, Clothing, Footwear and Leather Manufacturing
7	C23	Wood and Paper Product Manufacturing
8	C24	Printing, Publishing and Recorded Media
9	C25	Petroleum, Coal, Chemical and Associated Product Manufacturing
10	C26, C27, c29	Non-Metallic Mineral Product Manufacturing,Metal Product Manufacturing
11	C28	Machinery and Equipment Manufacturing
12	D	Electricity, Gas and Water Supply
13	E41	General Construction
14	E42	Construction Trade Services
15	F	Wholesale Trade
16	G	Retail Trade
17	H	Accommodation, Cafes and Restaurants
18	I	Transport and Storage
19	J	Communication Services
20	K	Finance and Insurance
21	L	Property and Business Services
22	M81, M82, Q963	Government Administration and Defence, Public Order and Safety Services
23	N84	Education
24	O86,O87,Q962,Q961	Health and Community Services
25	P91, P92	Motion Picture, Radio and Television Services,Libraries, Museums and the Arts
26	P93, Q9511	Sport and Recreation, Video Hire Outlets
27	Q9519, Q952, Q97	Personal and Household Goods Hiring nec, Other Personal Services, Private Households Employing Staff
28	R	Residual Categories

Notes: The 1996 and 2001 Census classification of industries is based on the ANZSIC96.

Table A1 - Description of Industry and Occupation Codes

C: 1986, 1991, 1996, 2001 Occupation Codes

Occupation	NZSCO Code	Description
1	11	Legislators and Administrators
2	12	Corporate Managers
3	21	Physical, Mathematical and Engineering Science Professionals
4	22	Life Science and Health Professionals
5	23	Teaching Professionals
6	24	Other Professionals
7	31	Physical Science and Engineering Associate Professionals
8	32	Life Science and Health Associate Professionals
9	33	Other Associate Professionals
10	41	Office Clerks
11	42	Customer Services Clerks
12	51	Personal and Protective Services Workers
13	52	Salespersons, Demonstrators and Models
14	61	Market Oriented Agricultural and Fishery Workers
15	71	Building Trades Workers
16	72	Metal and Machinery Trades Workers
17	73	Precision Trades Workers
18	74	Other Craft and Related Trades Workers
19	81	Industrial Plant Operators
20	82	Stationary Machine Operators and Assemblers
21	83	Drivers and Mobile Machinery Operators
22	84	Building and Related Workers
23	91	Labourers and Related Elementary Service Workers
24	97, 99	Residual Categories

Notes: The Census classification of occupations is based on NZSCO68 (1986), NZSCO90 (1991), NZSCO95 (1996), and NZSCO99 (2001) classifications.

Table A2 - Disaggregated Qualifications Distributions, Population Age 20-59: 1986-2001

	Higher Degree	Bachelor Degree	Other Post-school	Higher School	Sixth School	School Certificate	Other School	No Quals	Not Spec.
Year									
1986	2.6	4.4	30.1	2.4	7	12.6	0.5	35.1	5.4
1991	2.9	5.5	35.3	2.8	6.5	11.4	1.8	29.4	4.3
1996	3.5	7.3	28.4	4.3	8.8	11.8	5.2	26.8	3.9
2001	4.2	9.4	21.7	5.1	10.4	14	5.4	20	9.8
Gender									
Male									
1986	3.2	5.2	34.2	2.7	6.6	10.4	0.2	33	4.6
1991	3.4	6.2	38.4	3.2	5.9	9.2	1.4	28.5	3.7
1996	4	7.7	30.3	4.7	7.8	9.9	4.5	26.9	4.1
2001	4.5	9	22.4	5.5	9.4	12.7	5	21	10.5
Female									
1986	1.9	3.5	25.5	2	7.6	15.1	0.7	37.4	6.3
1991	2.3	4.8	32	2.4	7.2	13.7	2.2	30.5	4.9
1996	3	6.8	26.5	3.8	9.8	13.8	5.9	26.7	3.7
2001	4	9.7	21	4.7	11.4	15.4	5.7	19	9.2
Age Groups									
20-24									
1986	0.9	4.8	25.1	6.8	13.4	16.7	0.3	27.1	4.9
1991	0.9	6.1	31.4	7.8	11.4	13.3	1	22.8	5.3
1996	1.6	8.2	23.8	16.1	12.6	10.7	3.9	17.3	5.6
2001	2	10.5	18.4	18.3	12.2	10.8	3.8	13.5	10.6
25-29									
1986	2.3	6.1	30.7	2.4	9.6	15.6	0.3	28.6	4.5
1991	2.1	7	34.2	2.8	10.1	13.5	1.2	24.8	4.4
1996	3.2	9.1	26.2	3.8	12	13.2	4	23.2	5.2
2001	4.2	13	20.8	7.7	13.2	12.8	4.2	14.3	10
30-39									
1986	3.3	5.1	31.4	1.7	6.1	13.1	0.5	33.3	5.3
1991	3.3	6.4	36.5	2.1	7	12.7	1.4	26.4	4.3
1996	3.7	7.8	28.7	2.3	10.6	12.8	4.6	24.8	4.7
2001	4.4	9.9	21.3	3.2	12.3	15.1	5.5	18.5	9.8
40-49									
1986	3.1	3	29.9	1	3.5	9.9	0.5	42.7	6.3
1991	3.7	4.4	34.9	1.7	3	9.6	2.3	35.9	4.5
1996	4.2	6.3	29.1	2	5.7	11.7	6	30.6	4.4
2001	4.6	8.2	22.8	2.4	9.4	15	5.9	21.2	10.5
50-59									
1986	2.1	1.9	26.7	1.3	4	8.5	0.7	47.1	7.7
1991	2.4	2.4	31.5	1.6	2.2	8	3.4	43.1	5.3
1996	3	3.9	26.6	1.6	3.3	8.8	7.7	40.4	4.7
2001	3.9	5.6	19.2	2.2	4.9	12.6	6.9	30.3	14.1
Region									
Northland									
1986	1.4	2.5	30	1.3	6.1	13.4	0.4	38	6.8

| | Qualification | | | | | | | | |
	Higher Degree	Bachelor Degree	Other Post-school	Higher School	Sixth School	School Certificate	Other School	No Quals	Not Spec.
1991	1.4	2.7	34.7	1.5	5.3	12.1	1.5	35.3	5.5
1996	1.5	3.3	27.3	2.2	7.4	13.2	4.4	33.3	7.3
2001	1.8	4.7	20.4	2.8	9	16.1	3.3	25.4	16.6
Auckland									
1986	2.7	4.7	29.8	2.7	7.4	12.9	0.5	33.3	6
1991	2.9	6.1	34.8	3.2	6.6	11.3	2.5	27.3	5.3
1996	3.7	8.5	27.1	4.4	8.3	10.4	7.3	24.2	6.1
2001	4.7	11.2	19.3	5.5	9.6	11.9	9.6	16.5	11.7
Waikato									
1986	1.8	3.2	28.5	1.8	6.4	12.7	0.4	39.2	6
1991	1.9	4.1	33.5	2.4	6	11.8	1.8	34.4	4.2
1996	2.6	5.3	27.6	3.7	8.2	12.4	4.4	31.7	4.2
2001	3	7	21.3	4.3	10	15.2	3.6	24.4	11.2
Bay of Plenty									
1986	1.7	2.7	29.9	1.5	6.5	13.1	0.5	38.6	5.6
1991	1.5	3.1	35.5	1.8	6	11.8	1.6	34.6	4.1
1996	1.7	4.2	29.1	2.6	8.3	12.6	4.5	32.5	4.5
2001	2.2	5.7	22.7	3.2	10.1	15.6	3.4	24.2	12.9
Gisborne									
1986	1.3	2.5	26.2	1.5	6.2	13.4	0.3	43.1	5.5
1991	1.3	2.8	30.5	2.2	5.6	12.1	0.9	37.7	6.9
1996	1.3	3.7	26.3	2.9	8.2	12.7	3.6	34.4	6.9
2001	1.7	5.1	20.3	3.6	10.1	15.4	1.9	27.2	14.6
Hawke's Bay									
1986	1.4	2.8	27.5	1.6	6.7	13.2	0.4	41.4	5
1991	1.3	3.3	31.9	2	6.4	12.5	1.4	37.2	4
1996	1.6	4.3	27	2.7	8.5	12.8	4.3	33.6	5.1
2001	1.9	5.8	21.5	3.5	10.1	15.5	3	26.2	12.5
Taranaki									
1986	1.5	2.7	29.4	1.3	5.6	12.8	0.4	41.6	4.7
1991	1.4	3.2	34.4	1.5	5.2	11.6	1.2	37.3	4.1
1996	1.7	4	28.1	2.2	7.8	13.3	3.9	34.8	4.1
2001	1.9	5.3	23.2	3	9.1	16.4	2.3	27.2	11.4
Manawatu-Wanganui									
1986	2.4	3.4	27.1	2.8	6.8	12.5	0.4	39.1	5.6
1991	2.7	4.1	32.4	3	6.4	11.4	1.2	34.4	4.5
1996	3.2	5.3	26.4	4.7	8.5	12.1	4	31.5	4.1
2001	3.4	6.8	21.1	5.3	10.1	14.8	2.5	24.9	11.1
Wellington									
1986	4.6	7.1	29.3	3.2	8.1	11.4	0.5	29.5	6.2
1991	5.1	9	34	3.5	7.2	9.8	2.2	24.4	4.9
1996	5.9	11.2	27.2	5	9.2	9.8	4.9	22.4	4.3
2001	6.9	13.6	21	6.1	10.6	11.6	5.1	16.1	9
West Coast									
1986	1.1	2.3	27	1.3	5.4	13	0.4	43.7	5.9
1991	1.1	2.5	31.6	1.7	5.4	12.2	1	38.8	5.7
1996	1.5	2.8	25.1	2.8	8.2	13.8	4	37.3	4.5
2001	1.8	3.9	19.9	3.2	10	16.1	1.9	30.4	12.8

	Higher Degree	Bachelor Degree	Other Post-school	Higher School	Sixth School	School Certificate	Other School	No Quals	Not Spec.
					Qualification				
Canterbury									
1986	2.5	4.2	29.3	2.9	7.3	12.8	0.4	35.5	5
1991	2.7	5.2	34.9	3.4	6.9	11.9	1.5	29.7	3.9
1996	3.4	6.7	27.8	5.3	9.5	12.5	4.7	26.8	3.3
2001	4.1	8.3	21.8	6.1	11.4	14.8	4.1	20.9	8.5
Otago									
1986	2.9	4.8	29.2	3.6	6.3	11.6	0.4	36.1	5.1
1991	3.3	6.2	33.9	4.3	5.8	10.4	1.3	29.7	5.1
1996	4.5	7.2	27.1	7.2	8.1	11.3	4.6	26.4	3.5
2001	5	9.2	21.8	7.9	9.9	13.8	3.2	20.1	9.2
Southland									
1986	1.1	2.7	26	1.2	5.4	12.9	0.3	43.8	6.5
1991	1.2	3.1	30.2	1.6	5.4	13.1	0.9	41	3.6
1996	1.3	4.1	25.8	2.5	8.2	14.7	3.6	36.5	3.2
2001	1.6	5.3	21	3.1	9.9	17.9	1.7	29.4	10
Tasman									
1986	1.6	3.1	29.8	1.7	6.5	13.6	0.4	37.2	6
1991	1.8	3.4	35.4	2	6.2	12.6	1.5	31.8	5.2
1996	2	4.2	30.4	2.7	9.3	14	4.3	29.2	3.7
2001	2.4	5.5	24	3.4	11.1	16.3	3.7	22.2	11.4
Nelson									
1986	2.4	3.7	34.2	1.5	7	11.9	0.5	33.6	5.3
1991	2.6	4.2	39.8	2	6.5	11.3	1.6	29.4	2.6
1996	2.8	5.8	31.3	3.4	8.8	12.3	4.3	27	4.2
2001	3.4	7.3	25.5	4	10.6	14.3	3.9	20.9	10.1
Marlborough									
1986	1.3	2.7	30.8	1.4	6.9	13.6	0.4	37.3	5.5
1991	1.3	2.8	35.5	2	6.4	12.7	1.1	32.4	5.7
1996	1.6	3.7	30.2	2.7	9.7	14	3.9	30.2	4.1
2001	2.1	4.9	23.2	3.8	11.4	17	2.9	24.1	10.5
Outside									
1986	0	0.6	33.1	2.3	4.7	11.6	0.6	37.2	10.5
1991	0.7	2.1	40	1.4	3.4	9.7	0	37.9	4.8
1996	2.6	1.3	26.8	2	7.2	9.8	2	39.2	8.5
2001	2.8	4.2	16.7	3.5	9.7	12.5	0.7	28.5	21.5
Industry									
Pastoral									
1986	0.9	2.2	23.4	1.8	7.4	15.9	0.4	42.3	5.6
1991	0.7	2.6	28.5	2.3	7.9	16.5	1.3	37.1	3.1
1996	1	3.7	25.9	3.4	10.6	17.7	3.8	33.7	0.3
2001	1.2	4.4	20.8	4	13	21.1	2.2	27.3	6
Horticulture									
1986	1.5	3.3	23.9	2.3	8.3	15.4	0.5	39.6	5.3
1991	1.1	3.5	29.1	2.8	7.3	14.5	2.2	35.5	4
1996	1.7	4.4	25.3	3.9	9.8	15.1	5.5	33.9	0.4
2001	2.3	5.6	18.9	4.6	11.4	17.7	6.4	26.1	7
Agriculture Services									
1986	0.7	1.4	22	1.4	6	13.9	0.2	49.3	5.2

	Higher Degree	Bachelor Degree	Other Post-school	Higher School	Sixth School	School Certificate	Other School	No Quals	Not Spec.
					Qualification				
1991	1.1	2.8	28.7	2.2	6.9	13.4	1.2	40.4	3.4
1996	1	2.8	21.8	3.3	9	16.6	4.1	40.7	0.7
2001	1.2	3.4	16.4	3.6	10.8	18.7	3.2	33.5	9.1
Primary (inc. Fishing)									
1986	1.7	3.2	29.3	1.4	4.6	10.8	0.2	43.5	5.2
1991	1.5	3.5	36.6	1.4	4.1	9.6	0.7	38.9	3.6
1996	1.8	3.8	28.4	2.3	7	13.3	3.5	39.3	0.6
2001	1.9	4	21.7	2.7	8.9	16.5	1.8	32.2	10.5
Food and Tobacco									
1986	0.9	2	22.5	1.6	5	12.2	0.3	50.7	4.8
1991	0.9	2.5	27.5	1.8	4.8	12	1.3	45.5	3.7
1996	1.3	4.4	22.2	3.1	7.6	13.7	5	42	0.7
2001	1.7	4.9	15.4	3.7	9.4	16.9	4.5	34.7	8.8
Clothing									
1986	0.6	1.3	17.4	1.4	4.6	13.7	0.5	54.2	6.2
1991	0.5	1.6	23.7	2.1	4.5	13.2	2.7	47.4	4.3
1996	0.7	2.9	18.9	2.6	7.3	13.6	7.7	45.5	0.9
2001	0.8	3.6	12.8	3.2	8.8	16.5	9.5	35.6	9.1
Wood and Paper									
1986	0.9	2	31.2	1.5	4.9	11.8	0.3	42.8	4.5
1991	0.6	2.1	39	1.7	4.7	11.2	1.5	35.9	3.3
1996	0.9	3.2	30.6	2.7	7.7	13.1	4.5	36.8	0.6
2001	1.2	3.7	22.6	3.1	9.5	17.9	3.7	29.6	8.7
Publishing									
1986	2.2	2.9	36.6	2.7	8.3	13.9	0.7	28.5	4.3
1991	1.9	3.7	43.6	3.2	7.7	12.2	2.5	22	3.3
1996	2.9	6.9	34.5	5.1	11.2	13.5	5.5	20.1	0.3
2001	3.7	9.5	25.5	5.6	13	16	6.9	15.6	4.3
Chemical									
1986	2.1	5.1	27.9	2.2	6.6	12.2	0.5	38.9	4.4
1991	2.2	5.8	33.8	2.4	5.7	11.4	2.2	33	3.5
1996	2.5	7.2	27.2	3.6	8.5	12.2	6.4	32	0.5
2001	2.9	8.3	19.4	3.8	10.4	15.4	8.2	25	6.6
Metal and Minerals Manufacturing									
1986	1.2	2.9	27.8	2	5.5	12.4	0.4	43	4.7
1991	1.1	3.7	34.7	2.3	5.4	11.7	1.7	36.2	3.2
1996	0.9	3.4	32.8	2.7	7.9	13.2	5.1	33.4	0.6
2001	1.2	3.8	23.2	3.3	9.9	17.4	6.6	27	7.6
Machinery Manufacutring.									
1986	0.8	2.1	38.3	1.6	4.8	11.8	0.4	36.1	4.1
1991	0.8	2.7	46.5	1.8	4.4	10.3	1.8	28.8	3
1996	1.4	4.7	41.4	2.8	7.4	11.4	4.9	25.6	0.4
2001	2.1	5.8	32.2	3.6	9.5	15.2	6.6	19.2	5.8
Energy and Water Supply									
1986	1	3.7	50.6	1.3	4.8	7.5	0.2	27.2	3.7
1991	1.4	4.9	56.6	1.1	4.2	7.1	1	21	2.7
1996	3.5	9.3	44.3	3	7.4	9.3	3.5	19.4	0.2
2001	6.2	14	32.8	4.8	11.4	12.2	3	11.8	3.9

	Qualification								
	Higher Degree	Bachelor Degree	Other Post-school	Higher School	Sixth School	School Certificate	Other School	No Quals	Not Spec.
Construction									
1986	0.7	2.1	40.7	1.2	4	9.5	0.2	37.2	4.3
1991	0.5	1.9	49.3	1.4	3.7	9	1.1	30.2	3
1996	0.7	2.3	42.8	2.5	6.7	11.9	3.5	29	0.5
2001	0.8	3	33.9	3	8.9	16.2	3	23.4	7.7
Construction Services									
1986	0.3	0.7	51.3	0.8	3.6	9.5	0.3	29.8	3.7
1991	0.3	1	58.1	1.1	3.7	8.5	1.3	23.4	2.6
1996	0.4	1.5	44.9	2.4	6.9	12	3.7	27.8	0.4
2001	0.5	2	34	3	9.5	16.3	4.3	23.6	6.8
Wholesale Trade									
1986	1.8	4.4	28.1	3	10	16.4	0.5	31.8	4
1991	1.7	5.3	34	3.3	9.1	14.9	2.1	26.3	3.2
1996	2.1	7.5	27	5.4	12.8	15.6	5.3	24	0.3
2001	2.5	8.5	20.8	5.8	14.7	18.9	5.4	18.9	4.5
Retail Trade									
1986	0.8	1.6	27.9	1.9	7.3	15.8	0.5	39.2	4.9
1991	0.8	2.3	35.1	2.8	7	15.1	2.1	31.2	3.8
1996	0.9	3.8	28.8	5.8	10.2	15.4	5.8	28.9	0.4
2001	1.2	5.1	21.2	6.9	12.1	18.4	6.6	22.4	6
Hospitality Services									
1986	0.9	1.9	21.6	3	7.3	14.9	0.6	43.6	6.1
1991	0.9	2.9	30.3	4	6.6	13.3	2.7	34.5	4.8
1996	2.6	5.3	26.9	7.9	9.6	12.5	7.1	27.6	0.5
2001	1.9	5.8	19.4	8.9	11.4	15.4	8.6	21.7	6.9
Transport and Storage									
1986	0.7	1.7	30	2.1	7.2	12.8	0.4	40.3	4.9
1991	0.7	2.3	35.6	2.7	7.5	12.6	1.8	33.5	3.3
1996	1.1	4	28.8	4.1	10.4	13.9	5.3	31.9	0.5
2001	1.4	5.1	20.8	4.9	12.7	16.8	5	26.8	6.4
Communication Services									
1986	0.6	2.4	35.6	2.2	9.5	15.4	0.4	29.8	4.1
1991	1.4	4.4	41.7	2.7	7.9	13.1	1.5	24	3.3
1996	2.5	7.5	27	5.8	13	15.7	5.1	23	0.3
2001	3.3	9.9	18.8	8	15.9	18.2	4.1	17.5	4.3
Finance and Insurance									
1986	2.3	6.2	22	5.7	24.2	21.4	0.6	14.1	3.4
1991	2.5	7.4	27	6.1	21	18.5	2.3	12.2	3.1
1996	3.8	11.7	21.3	8	22.1	17.4	4.9	10.6	0.2
2001	5.1	15.7	18.3	8.5	20.8	16.9	4.7	7.8	2.2
Business Services									
1986	5.4	18	32.8	3.5	10.2	12	0.6	14.1	3.4
1991	5.2	18.1	37.3	3.4	8.7	10.5	2	12.2	2.8
1996	7.4	18.9	27.5	5	10.9	11.2	4.3	14.7	0.2
2001	8.6	20.4	21.5	6	12.1	12.3	4.7	11	3.4
Government									
1986	5.7	7.9	31.8	4.4	14.4	14	0.5	17.9	3.5
1991	6.3	9	36.9	4.3	12.3	11.5	1.6	15	3.2

	Higher Degree	Bachelor Degree	Other Post-school	Higher School	Sixth School	School Certificate	Other School	No Quals	Not Spec.
				Qualification					
1996	7.7	11.6	29.7	5.8	14.9	12.4	3.8	14	0.2
2001	9.6	14.5	23.5	7.3	16	13.8	2.9	9.5	2.9
Education									
1986	14.7	16	47.8	0.9	2.6	4.4	0.4	11.3	1.9
1991	14.6	17.3	48.2	1.1	2.3	4.3	0.9	9.6	1.7
1996	14.3	20.9	40.4	2.2	4.4	5.8	2.3	9.5	0.2
2001	16	24.1	32.2	3	6	7.1	2.3	6.9	2.5
Health									
1986	7.6	6.4	48.1	1.5	4.1	7.5	0.4	21	3.5
1991	7.8	7.3	53.3	1.3	3	6.5	1.3	17.1	2.6
1996	8.8	8.7	45.5	2.3	5.4	8.7	3.6	16.6	0.3
2001	8.3	14.3	34.8	3	7.1	10.7	3.7	13.4	4.8
Entertainment									
1986	8.4	9.3	33.5	5.9	12.2	10.7	0.6	15.6	3.8
1991	9.1	11.4	37.6	6.3	10.7	8.8	2.2	10.7	3.1
1996	7.7	14.9	30.3	9.1	12.8	9.3	4.5	11.2	0.2
2001	8.3	17.7	24.7	10	14.1	10.1	4.4	8.2	2.5
Sport and Recreation									
1986	1.7	3.2	25.5	2.9	8.6	14.6	0.5	37.8	5.2
1991	1.7	4.8	35.3	3.9	7.6	14.2	2.1	27	3.5
1996	2.4	7.1	28.6	7.9	11.8	14.3	5.5	22.1	0.3
2001	2.7	9.6	22.6	10	13.5	16.1	5.2	15.6	4.7
Personal Services									
1986	0.7	1.1	39.7	1.2	4.6	10.6	0.4	37.1	4.7
1991	0.8	1.5	45.4	1.7	4.3	10	1.6	31.4	3.5
1996	0.9	2.8	40.8	3.8	7.8	11.6	4.7	27	0.5
2001	1	3.6	30.7	5	10.7	16.1	5.4	20.1	7.3
Residual Category									
1986	1.8	3	24.2	1.8	5	11.1	0.4	38	14.6
1991	2	4	33.4	2.6	4.9	10.3	1.8	33.6	7.3
1996	1.5	3.2	24	2.6	4.8	7.9	6.4	27.2	22.3
2001	1.7	3.8	11.4	3.9	6.6	10.8	6.2	19.2	36.4
Occupation									
Administrators									
1986	16.3	13.1	29.6	3.8	9.4	10.2	0.6	13.2	3.7
1991	18.2	16.3	34.5	3.2	5.7	6.9	2	10.1	3
1996	17.1	20.2	26.5	4.4	9.5	8.9	3.8	9.4	0.3
2001	10.4	16.6	24.4	5.2	11.4	11.9	5.7	11	3.3
Managers									
1986	2.7	5	32.5	3	10.1	14.3	0.4	27.8	4.2
1991	4	7.4	37.5	3.7	8.6	12.8	2.3	20.6	3.1
1996	4.8	10.6	30.2	4.8	11.7	13.5	5.5	18.7	0.3
2001	5.6	12.4	23	5.6	14.1	16.2	5.8	13.6	3.6
Science Professionals									
1986	15.2	31.4	38.5	3	5.3	3.2	0.2	1.9	1.3
1991	12.9	30.9	44.5	1.9	2.9	2.1	0.9	2.9	1
1996	12.4	27.6	41	3.4	5.1	3.6	2.2	4.7	0.1
2001	13.5	27.5	29.3	5.8	8.3	6.3	4.2	3.5	1.5

	Qualification								
	Higher Degree	Bachelor Degree	Other Post-school	Higher School	Sixth School	School Certificate	Other School	No Quals	Not Spec.
Health Professionals									
1986	15.4	12.4	68.8	0.3	0.6	0.7	0	1.2	0.5
1991	16.5	12.8	68.3	0.2	0.2	0.4	0.1	1.1	0.3
1996	20.2	13.3	60.1	0.6	1.2	1.6	0.8	2.1	0.1
2001	18.4	27.5	43.9	1.5	2	2.1	1.8	1.6	1.1
Teaching Professionals									
1986	16.3	19.9	56.5	0.4	1	1.6	0.1	3.3	0.9
1991	17.1	22.6	55.8	0.3	0.6	0.9	0.2	1.8	0.7
1996	18.8	26.8	47.2	1	1.8	1.5	0.8	2	0.1
2001	19.8	31.6	38.6	1.8	2.6	1.9	1.2	1.4	1.1
Other Professionals									
1986	13.7	35	26.6	3	7.6	5.4	0.2	6.3	2.2
1991	14.3	37.9	29.9	2.5	5.4	3.8	0.9	3.7	1.6
1996	15.4	44.4	19.3	3.4	6.9	4.5	2.2	3.8	0.1
2001	17	39.5	17.5	4.6	8.6	5.9	2.8	3	1.2
Science Associates									
1986	2.9	6.4	64	4	7.8	5.3	0.2	7	2.4
1991	3	6.6	63.4	3.4	7.2	6.5	1.2	6.7	2.1
1996	4.6	9.8	49.2	6.4	10.7	7.9	3.1	8.1	0.2
2001	5.2	12.8	39.9	7.9	12.1	9.2	4.5	6.3	2.2
Health Associates									
1986	6.3	4.7	66.4	2.8	6.1	4.5	0.1	6.8	2.1
1991	6.3	5.8	72.9	1.4	2.9	3.1	0.6	5.6	1.5
1996	7	10.5	62	2.4	4.4	5.1	2	6.4	0.2
2001	7.7	16.9	49.1	3.5	7.1	6.6	2.6	4.2	2.2
Other Associates									
1986	6.1	8.3	37.5	4	11.2	12.3	0.4	16.5	3.7
1991	4.9	9.4	41.6	4.3	10.4	11.2	2	13.2	3
1996	4.9	11.3	33.6	6	13.3	12.6	4.6	13.4	0.2
2001	4.7	12.6	27	7.3	15	15	4.4	10.6	3.3
Clerks									
1986	0.9	2.2	24.3	3.1	13.2	20.4	1	29.8	5
1991	0.9	3	31.3	3.4	12.4	19.2	2.9	22.6	4.3
1996	1.6	5.1	23.4	5.6	16.1	20.4	6.3	21.2	0.3
2001	2.9	6.7	18.3	6.4	18.3	22.5	5.2	15.9	3.8
Customer Services									
1986	0.7	1.8	19.4	4.1	20.6	23.9	0.8	24	4.7
1991	0.6	2.3	24.5	4.6	18.5	21.5	2.6	21.1	4.3
1996	1.1	4.5	20.8	7.8	19.4	20.8	6	19.2	0.4
2001	1.6	6.6	16.7	8.8	18.5	21.9	5.7	16.1	4.1
Personal Services									
1986	0.7	1.3	27.1	2.7	7.7	14.2	0.5	40.2	5.7
1991	0.7	2	37	3.4	7.1	12.2	2	31.1	4.4
1996	1	3.3	31.6	6.5	10	12.8	6	28.2	0.5
2001	1.2	4.2	25.2	7	11.1	15.3	6.9	21.7	7.5
Sales									
1986	0.5	1.1	19.6	2.2	7.6	17.8	0.6	45.1	5.5
1991	0.6	2	26.1	3.4	7.8	17.5	2.1	36.2	4.3

	Higher Degree	Bachelor Degree	Other Post-school	Higher School	Sixth School	School Certificate	Other School	No Quals	Not Spec.
						Qualification			
1996	0.8	3.7	21.3	8	12	17.5	5.9	30.3	0.5
2001	1.1	5.1	16.7	9.2	13.8	20.1	5.6	23	5.3
Agriculture and Fishery									
1986	0.9	2.2	23.5	1.9	7.2	15.2	0.3	43.2	5.5
1991	0.8	2.7	29.4	2.4	7.3	15.2	1.5	37.5	3.4
1996	1	3.5	25.6	3.5	10	16.5	4.3	35.4	0.4
2001	1.1	4	20.4	4	12.1	19.6	3.2	28.6	7
Building Trade									
1986	0.2	0.5	59.8	0.8	2.7	7	0.2	25.5	3.3
1991	0.2	0.6	66.5	0.9	2.6	6.1	0.9	19.9	2.4
1996	0.3	0.9	56.2	2	4.9	9.3	3.2	22.8	0.5
2001	0.3	1	42.4	2.5	7.5	15	4.3	19.7	7.4
Machinery Trade Workers									
1986	0.2	0.2	59.5	0.7	2.6	7.7	0.2	25.9	3.1
1991	0.1	0.3	69.2	0.8	2.1	5.5	0.8	19	2.1
1996	0.1	0.6	59.6	1.6	4.4	8.5	2.9	21.8	0.4
2001	0.3	0.9	45.8	2.1	6.8	14.5	4.6	18.3	6.7
Precision Trade Workers									
1986	0.4	0.7	44.2	1.4	5.2	11.8	0.6	31.9	3.8
1991	0.5	0.9	53.5	1.9	4.9	10.1	1.9	23.4	2.9
1996	0.6	1.7	42.5	3.5	8.4	12.1	5.3	25.4	0.5
2001	0.7	2.8	30.3	4.1	10.6	17	7.9	20.3	6.4
Craft									
1986	0.4	0.6	33.2	1.4	3.8	11.4	0.4	43.9	4.9
1991	0.2	0.6	47.3	1.4	3.2	9.3	1.5	33.1	3.3
1996	0.3	1.2	38	2.5	6.2	12.1	4.7	34.4	0.6
2001	0.4	1.6	23.9	3.1	8.6	17.1	6.5	29.1	9.9
Plant Operators									
1986	0.3	0.7	30.3	1.1	3.4	9.8	0.3	48.5	5.7
1991	0.4	1	37.9	1.7	3.8	10.1	1.4	40.3	3.4
1996	0.4	1.3	27.6	2.6	6.5	12.6	4.8	43.4	0.8
2001	0.7	2	19.2	2.7	8.6	17.1	4.7	35.5	9.5
Machine Operators									
1986	0.3	0.6	25.9	1.2	3.7	11.5	0.3	51.5	5
1991	0.2	0.7	22.4	1.8	4	12.4	1.9	52.6	4
1996	0.4	1.3	18.4	2.5	6.8	13.4	6.6	49.8	0.8
2001	0.5	1.8	12.5	3.2	8.2	16.8	7.2	39.5	10.2
Drivers									
1986	0.2	0.4	16.7	1	3.6	11.9	0.2	60.7	5.2
1991	0.2	0.5	22.8	1.4	3.7	11.8	1.1	54.9	3.7
1996	0.2	0.8	18	2.3	6.1	13.9	4.8	53.1	0.7
2001	0.4	1.2	11.4	2.6	7.7	18.1	3.4	45.1	10.1
Building Services									
1986	0.2	0.5	39.7	1.2	3.4	9.8	0.1	40.8	4.4
1991	0.2	0.5	42.2	1.1	4.7	10.3	1.3	36.6	3.2
1996	0.2	0.8	29.9	2.5	7.9	14.5	3.8	39.7	0.8
2001	0.3	1.6	21	2.9	9.1	19.2	3.8	32.9	9.3
Labourers									

	Higher Degree	Bachelor Degree	Other Post-school	Higher School	Sixth School	School Certificate	Other School	No Quals	Not Spec.
					Qualification				
1986	0.2	0.6	12.2	1.4	3.9	12.2	0.4	63.1	5.9
1991	0.2	0.8	18.1	2.1	4.5	12.4	1.8	55.8	4.2
1996	0.5	1.7	16.4	3.7	7.2	13	6.3	50.4	0.8
2001	0.5	2.1	11.4	4	8.4	16.6	5.8	41.3	9.8
Residual Categories									
1986	1.1	1.7	19.5	2	3.8	10.4	0.3	46.4	14.8
1991	2.1	3.7	30.9	2.6	5.2	10.2	1.7	35.1	8.4
1996	2.3	4	22	2.7	4.8	6.9	6	24.1	27.1
2001	2.6	4.2	10.3	3.8	6.4	9.8	6	19.4	37.6

Notes: All distributions based on respect population subgroups with and without income specifed.

Table A3 - Disaggregated Field of Study Distributions, Population Age 20-59: 1996-2001

	Field of Study												
	Natural, Physical Science	Info. Tech.	Engineering, Related Technical	Architecture Building	Agric. Environ.	Health	Education	Management & Commerce	Society and Culture	Creative Arts	Food, Hospitality, Personal	Not Spec.	Total
Total													
1996	38511	11250	141237	45951	28677	86223	61275	112359	87219	20472	31557	76710	741447
2001	43521	19914	108060	34794	23952	85599	68325	117519	100503	23670	21324	38211	685425
96-01	5010	8664	-33177	-11157	-4725	-624	7050	5160	13284	3198	-10233	-38499	-56022
	(13.0%)	(77.0%)	-(23.5%)	-(24.3%)	-(16.5%)	-(0.7%)	(11.5%)	(4.6%)	(15.2%)	(15.6%)	-(32.4%)	-(50.2%)	-(7.6%)
Qualifications													
Higher degree													
1996	13023	1059	4014	654	1401	10029	4491	6588	20661	1650	33	2106	65712
2001	14244	1788	4674	1005	1182	10140	7086	12222	23070	2166	27	4185	81789
96-01	1221	729	660	351	-219	111	2595	5634	2409	516	-6	2079	16077
	(9.4%)	(68.8%)	(16.4%)	(53.7%)	-(15.6%)	(1.1%)	(57.8%)	(85.5%)	(11.7%)	(31.3%)	-(18.2%)	(98.7%)	(24.5%)
Bachelor degree													
1996	17961	3159	11460	2418	4404	7485	10308	29817	42039	3648	75	4320	137106
2001	21921	5016	12750	3189	4437	18069	16776	37116	47415	6690	63	8736	182202
96-01	3960	1857	1290	771	33	10584	6468	7299	5376	3042	-12	4416	45096
	(22.0%)	(58.8%)	(11.3%)	(31.9%)	(0.7%)	(141.4%)	(62.7%)	(24.5%)	(12.8%)	(83.4%)	-(16.0%)	(102.2%)	(32.9%)
Other post-school													
1996	7527	7032	125763	42879	22872	68709	46476	75954	24519	15174	31449	70284	538629
2001	7356	13110	90636	30600	18333	57390	44463	68181	30018	14814	21234	25290	421434
96-01	-171	6078	-35127	-12279	-4539	-11319	-2013	-7773	5499	-360	-10215	-44994	-117195
	-(2.3%)	(86.4%)	-(27.9%)	-(28.6%)	-(19.8%)	-(16.5%)	-(4.3%)	-(10.2%)	(22.4%)	-(2.4%)	-(32.5%)	-(64.0%)	-(21.8%)

Notes: Field of Study is available only for post-school qualifications. The population includes only those that specify whether they were employed, unemployed or not in the labour force. The percentages in parentheses are percentage changes in the population counts between 1996 and 2001. Changes between 1996 and 2001 in the way that respondents with 'other post-school' qualifications were selected and classified makes the comparison of information on field of study for non-degree post-school qualifications problematic (see footnote 9 in text). .

Table A4a - Regression Analysis of Employment Growth, 1986-1991

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Higher degree	0.213					0.184	0.256	0.213	0.230
	(.040)					(.032)	(.032)	(.028)	(.016)
Bachelor's degree	0.378					0.326	0.389	0.345	0.364
	(.032)					(.025)	(.025)	(.022)	(.013)
Other post-school	0.279					0.330	0.340	0.338	0.358
	(.015)					(.012)	(.012)	(.011)	(.006)
Higher school	0.316					0.242	0.258	0.238	0.243
	(.041)					(.031)	(.030)	(.026)	(.015)
Sixth form	0.075					0.057	0.077	0.058	0.063
	(.026)					(.020)	(.019)	(.017)	(.010)
School certificate	0.065					0.062	0.073	0.067	0.069
	(.020)					(.015)	(.015)	(.013)	(.008)
Other school	1.260					1.215	1.255	1.231	1.226
	(.091)					(.069)	(.067)	(.058)	(.034)
Not specified	-0.042					-0.114	-0.100	-0.111	-0.112
	(.028)					(.021)	(.021)	(.018)	(.010)
Industry		Y		Y		Y		Y	
Occupation			Y	Y			Y	Y	
Industry-Occupation					Y				Y
Rsq	0.182	0.239	0.273	0.427	0.738	0.375	0.409	0.557	0.878
Marginal Rsq									
Qualifications	0.182					0.136	0.136	0.130	0.140
Industry		0.239		0.154		0.193		0.148	
Occupation			0.273	0.188			0.227	0.182	
Industry-Occupation					0.678				0.696

Notes: The dependent variable is $demp_{ioq,8691} = (Emp_{ioq,91} - Emp_{ioq,86})/(0.5(Emp_{ioq,86} + Emp_{ioq,91}))$. All specifications are based on population growth in 4473 industry-occupation-qualification cells, and are weighted by 1986 cell size, $Emp_{ioq,86}$. The qualification-specific population changes are measured relative to the change of the no-qualifications group.

Table A4b - Regression Analysis of Employment Growth, 1991-1996

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Higher degree	0.211					0.196	0.171	0.205	0.195
	(0.033)					(0.027)	(0.033)	(0.026)	(0.016)
Bachelor's degree	0.364					0.322	0.323	0.322	0.328
	(0.026)					(0.021)	(0.027)	(0.021)	(0.013)
Other post-school	-0.122					-0.125	-0.128	-0.115	-0.124
	(0.015)					(0.012)	(0.015)	(0.012)	(0.007)
Higher school	0.523					0.507	0.490	0.501	0.507
	(0.037)					(0.029)	(0.035)	(0.028)	(0.017)
Sixth form	0.397					0.396	0.376	0.394	0.401
	(0.025)					(0.019)	(0.024)	(0.019)	(0.011)
School certificate	0.169					0.160	0.157	0.160	0.162
	(0.020)					(0.016)	(0.019)	(0.015)	(0.009)
Other school	0.943					0.924	0.924	0.923	0.922
	(0.045)					(0.035)	(0.042)	(0.033)	(0.021)
Not specified	-1.421					-1.447	-1.453	-1.453	-1.459
	(0.034)					(0.026)	(0.032)	(0.025)	(0.015)
Industry		Y		Y		Y		Y	
Occupation			Y	Y			Y	Y	
Industry-Occupation					Y				Y
Rsq	0.434	0.237	0.088	0.280	0.476	0.663	0.509	0.700	0.901
Marginal Rsq									
Qualifications	0.434					0.426	0.421	0.420	0.425
Industry		0.237		0.192		0.229		0.191	
Occupation			0.088	0.043			0.075	0.037	
Industry-Occupation					0.678				0.467

Notes: The dependent variable is $demp_{ioq,9196} = (Emp_{ioq,96} - Emp_{ioq,91})/(0.5(Emp_{ioq,91} + Emp_{ioq,96}))$. All specifications are based on population growth in 4646 industry-occupation-qualification cells, and are weighted by 1991 cell size, $Emp_{ioq,91}$. The qualification-specific population changes are measured relative to the change of the no-qualifications group.

Table A4c - Regression Analysis of Employment Growth, 1996-2001

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Higher degree	0.431					0.335	0.304	0.290	0.289
	(0.021)					(0.018)	(0.021)	(0.018)	(0.015)
Bachelor's degree	0.498					0.431	0.379	0.370	0.365
	(0.016)					(0.014)	(0.016)	(0.014)	(0.011)
Other post-school	-0.008					-0.051	-0.058	-0.064	-0.063
	(0.011)					(0.009)	(0.011)	(0.009)	(0.007)
Higher school	0.427					0.408	0.398	0.401	0.397
	(0.020)					(0.017)	(0.019)	(0.017)	(0.013)
Sixth form	0.410					0.401	0.389	0.397	0.397
	(0.015)					(0.013)	(0.014)	(0.012)	(0.010)
School certificate	0.433					0.422	0.422	0.422	0.423
	(0.014)					(0.012)	(0.013)	(0.011)	(0.009)
Other school	0.236					0.233	0.222	0.228	0.229
	(0.020)					(0.017)	(0.018)	(0.016)	(0.013)
Not specified	0.849					1.099	0.956	1.073	1.178
	(0.032)					(0.030)	(0.034)	(0.029)	(0.024)
Industry		Y		Y		Y		Y	
Occupation			Y	Y			Y	Y	
Industry-Occupation					Y				Y
Rsq	0.410	0.150	0.109	0.230	0.390	0.579	0.484	0.627	0.792
Marginal Rsq									
Qualifications	0.410					0.429	0.375	0.397	0.402
Industry		0.150		0.121		0.169		0.143	
Occupation			0.109	0.080			0.074	0.048	
Industry-Occupation					0.678				0.382

Notes: The dependent variable is $demp_{ioq,9601} = (Emp_{ioq,01} - Emp_{ioq,96})/(0.5(Emp_{ioq,96} + Emp_{ioq,01}))$. All specifications are based on population growth in 4948 industry-occupation-qualification cells, and are weighted by 1996 cell size, $Emp_{ioq,96}$. The qualification-specific population changes are measured relative to the change of the no-qualifications group.

Table A5a - Correlation of Employment Changes by Qualification, 1986-1991

	Controls	Higher degree	Bachelor's degree	Post-school	Higher school	Sixth form	School certificate	Other school	No Quals
Higher Degree	None	**0.34**							
	Ind	**0.27**							
	Ind, Occ	**0.21**							
	Ind*Occ	**0.16**							
Bachelor's Degree	None	0.73	**0.22**						
	Ind	0.65	**0.18**						
	Ind, Occ	0.55	**0.13**						
	Ind*Occ	0.36	**0.09**						
Post-School	None	0.71	0.82	**0.18**					
	Ind	0.61	0.77	**0.14**					
	Ind, Occ	0.48	0.67	**0.09**					
	Ind*Occ	0.11	0.40	**0.03**					
Higher School	None	0.58	0.70	0.77	**0.18**				
	Ind	0.47	0.65	0.73	**0.17**				
	Ind, Occ	0.34	0.55	0.64	**0.14**				
	Ind*Occ	0.06	0.31	0.33	**0.09**				
Sixth Form	None	0.56	0.69	0.80	0.85	**0.15**			
	Ind	0.43	0.63	0.76	0.84	**0.14**			
	Ind, Occ	0.26	0.50	0.66	0.80	**0.11**			
	Ind*Occ	-0.10	0.20	0.28	0.68	**0.06**			
School Certificate	None	0.60	0.68	0.83	0.79	0.88	**0.14**		
	Ind	0.46	0.60	0.78	0.77	0.86	**0.12**		
	Ind, Occ	0.28	0.44	0.66	0.71	0.81	**0.08**		
	Ind*Occ	-0.16	0.02	0.12	0.50	0.66	**0.04**		
Other School	None	0.42	0.55	0.59	0.55	0.57	0.65	**0.17**	
	Ind	0.33	0.52	0.57	0.56	0.58	0.67	**0.19**	
	Ind, Occ	0.15	0.37	0.42	0.45	0.46	0.56	**0.15**	
	Ind*Occ	-0.11	0.15	0.06	0.25	0.26	0.38	**0.12**	
No Quals	None	0.61	0.65	0.81	0.67	0.74	0.91	0.63	**0.14**
	Ind	0.46	0.55	0.75	0.62	0.69	0.89	0.64	**0.11**
	Ind, Occ	0.28	0.36	0.61	0.51	0.58	0.84	0.51	**0.07**
	Ind*Occ	-0.22	-0.19	-0.12	0.10	0.16	0.63	0.30	**0.03**

Notes: The first row of each block (labelled "none") is based on the raw population changes across industry-occupation cells for each pair of qualifications; the second, third and fourth rows control for industry, industry and occupation, and industry-occupation interaction effects respectively, using the residuals from the regressions reported in Table A4a, columns (2), (4) and (5). The diagonal entries in **bold** are the within qualification group variances; all other entries are correlations of population changes for pairs of qualifications. We have omitted the correlations pertaining to the 'not specified' qualification group.

Table A5b - Correlation of Employment Changes by Qualification, 1991-1996

	Controls	Higher degree	Bachelor's degree	Post-school	Higher school	Sixth form	School certificate	Other school	No Quals
Higher Degree	None	**0.34**							
	Ind	**0.27**							
	Ind, Occ	**0.21**							
	Ind*Occ	**0.16**							
Bachelor's Degree	None	0.73	**0.22**						
	Ind	0.65	**0.18**						
	Ind, Occ	0.55	**0.13**						
	Ind*Occ	0.36	**0.09**						
Post-School	None	0.71	0.82	**0.18**					
	Ind	0.61	0.77	**0.14**					
	Ind, Occ	0.48	0.67	**0.09**					
	Ind*Occ	0.11	0.40	**0.03**					
Higher School	None	0.58	0.70	0.77	**0.18**				
	Ind	0.47	0.65	0.73	**0.17**				
	Ind, Occ	0.34	0.55	0.64	**0.14**				
	Ind*Occ	0.06	0.31	0.33	**0.09**				
Sixth Form	None	0.56	0.69	0.80	0.85	**0.15**			
	Ind	0.43	0.63	0.76	0.84	**0.14**			
	Ind, Occ	0.26	0.50	0.66	0.80	**0.11**			
	Ind*Occ	-0.10	0.20	0.28	0.68	**0.06**			
School Certificate	None	0.60	0.68	0.83	0.79	0.88	**0.14**		
	Ind	0.46	0.60	0.78	0.77	0.86	**0.12**		
	Ind, Occ	0.28	0.44	0.66	0.71	0.81	**0.08**		
	Ind*Occ	-0.16	0.02	0.12	0.50	0.66	**0.04**		
Other School	None	0.42	0.55	0.59	0.55	0.57	0.65	**0.17**	
	Ind	0.33	0.52	0.57	0.56	0.58	0.67	**0.19**	
	Ind, Occ	0.15	0.37	0.42	0.45	0.46	0.56	**0.15**	
	Ind*Occ	-0.11	0.15	0.06	0.25	0.26	0.38	**0.12**	
No Quals	None	0.61	0.65	0.81	0.67	0.74	0.91	0.63	**0.14**
	Ind	0.46	0.55	0.75	0.62	0.69	0.89	0.64	**0.11**
	Ind, Occ	0.28	0.36	0.61	0.51	0.58	0.84	0.51	**0.07**
	Ind*Occ	-0.22	-0.19	-0.12	0.10	0.16	0.63	0.30	**0.03**

Notes: The first row of each block (labelled "none") is based on the raw population changes across industry-occupation cells for each pair of qualifications; the second, third and fourth rows control for industry, industry and occupation, and industry-occupation interaction effects respectively, using the residuals from the regressions reported in Table A4b, columns (2), (4) and (5). The diagonal entries in **bold** are the within qualification group variances; all other entries are correlations of population changes for pairs of qualifications. We have omitted the correlations pertaining to the 'not specified' qualification group.

Table A5c - Correlation of Employment Changes by Qualification, 1996-2001

	Controls	Higher degree	Bachelor's degree	Post-school	Higher school	Sixth form	School certificate	Other school	No Quals
Higher	None	**0.13**							
Degree	Ind	**0.12**							
	Ind, Occ	**0.11**							
	Ind*Occ	**0.10**							
Bachelor's	None	0.45	**0.07**						
Degree	Ind	0.34	**0.05**						
	Ind, Occ	0.37	**0.06**						
	Ind*Occ	0.27	**0.05**						
Post-	None	0.41	0.47	**0.08**					
School	Ind	0.26	0.22	**0.05**					
	Ind, Occ	0.21	0.25	**0.04**					
	Ind*Occ	0.02	-0.01	**0.03**					
Higher	None	0.25	0.52	0.50	**0.09**				
School	Ind	0.09	0.35	0.26	**0.07**				
	Ind, Occ	0.03	0.35	0.13	**0.06**				
	Ind*Occ	-0.13	0.21	-0.18	**0.05**				
Sixth	None	0.27	0.50	0.55	0.81	**0.06**			
Form	Ind	0.11	0.32	0.32	0.73	**0.05**			
	Ind, Occ	0.06	0.35	0.21	0.69	**0.04**			
	Ind*Occ	-0.16	0.16	-0.21	0.60	**0.03**			
School	None	0.26	0.40	0.55	0.69	0.88	**0.05**		
Certificate	Ind	0.12	0.21	0.32	0.58	0.83	**0.04**		
	Ind, Occ	0.06	0.25	0.19	0.49	0.80	**0.03**		
	Ind*Occ	-0.18	0.01	-0.27	0.34	0.71	**0.02**		
Other	None	0.24	0.42	0.46	0.67	0.71	0.67	**0.17**	
School	Ind	0.08	0.20	0.23	0.55	0.58	0.52	**0.13**	
	Ind, Occ	0.03	0.20	0.14	0.50	0.53	0.46	**0.12**	
	Ind*Occ	-0.08	0.07	-0.06	0.42	0.45	0.36	**0.11**	
No	None	0.36	0.35	0.63	0.46	0.64	0.77	0.45	**0.05**
Quals	Ind	0.24	0.14	0.43	0.27	0.51	0.70	0.23	**0.04**
	Ind, Occ	0.19	0.17	0.32	0.11	0.41	0.63	0.12	**0.03**
	Ind*Occ	-0.07	-0.19	-0.19	-0.28	0.03	0.37	-0.16	**0.02**

Notes: The first row of each block (labelled "none") is based on the raw population changes across industry-occupation cells for each pair of qualifications; the second, third and fourth rows control for industry, industry and occupation, and industry-occupation interaction effects respectively, using the residuals from the regressions reported in Table A4c, columns (2), (4) and (5). The diagonal entries in **bold** are the within qualification group variances; all other entries are correlations of population changes for pairs of qualifications. We have omitted the correlations pertaining to the 'not specified' qualification group.

Table A6a - Decomposing the Change in the Value of Human Capital: Contributions by Qualification Group, 1986-1991

Qualification	Employed Workers			Labour Force			Whole Population		
	Qualification Shares	Qualification Incomes	Interaction	Qualification Shares	Qualification Incomes	Interaction	Qualification Shares	Qualification Incomes	Interaction
Higher Degree	9.0	7.9	1.2	10.5	10.4	1.3	8.9	13.9	1.1
	(27.8)	(12.7)	(21.5)	(22.2)	(23.1)	(16.9)	(13.1)	(60.4)	(11.3)
Bachelor's Degree	25.8	9.1	2.8	35.2	11.1	3.2	42.3	13.2	3.4
	(79.4)	(14.7)	(50.4)	(74.3)	(24.6)	(42.7)	(62.5)	(57.6)	(36)
Other Post-school	80.7	13.7	2.5	120.7	2.6	0.5	155.2	-7.4	-1.3
	(249)	(22)	(44.1)	(254.8)	(5.8)	(6.4)	(229.5)	(-32.3)	(-13.7)
Higher School	5.5	2.1	0.4	7.0	2.8	0.5	11.0	2.7	0.5
	(16.8)	(3.4)	(7.4)	(14.9)	(6.3)	(6.5)	(16.3)	(11.8)	(5.4)
6th Form	-4.9	6.3	-0.3	-8.3	6.9	-0.4	-15.1	9.1	-0.7
	(-15)	(10.2)	(-6.1)	(-17.6)	(15.4)	(-5.8)	(-22.3)	(39.6)	(-7.9)
School Certificate	-11.6	9.2	-0.8	-18.0	9.5	-0.8	-28.9	14.1	-1.4
	(-35.9)	(14.8)	(-13.7)	(-38)	(21)	(-11)	(-42.7)	(61.4)	(-14.7)
Other School	12.9	0.9	2.6	18.8	1.2	3.5	27.8	1.5	4.3
	(39.7)	(1.4)	(47.1)	(39.6)	(2.7)	(47.1)	(41)	(6.4)	(45.7)
No Qualification	-72.6	10.7	-2.2	-100.3	-1.1	0.2	-112.0	-23.4	3.4
	(-223.9)	(17.2)	(-40.2)	(-211.8)	(-2.5)	(2.9)	(-165.6)	(-101.8)	(36.5)
Not Specified	-12.3	2.2	-0.6	-18.3	1.7	-0.4	-21.6	-0.7	0.1
	(-38)	(3.6)	(-10.6)	(-38.6)	(3.7)	(-5.8)	(-31.9)	(-3)	(1.4)
Total	32.4	62.0	5.6	47.4	45.1	7.5	67.6	23.0	9.4

Notes: Entries are percentages of the total change in the value of human capital: these entries sum to the total in the final row for each column. Numbers in parentheses are percentages of the total entry in the final row.

Table A6b - Decomposing the Change in the Value of Human Capital: Contributions by Qualification Group, 1991-1996

Qualification	Employed Workers			Labour Force			Whole Population		
	Qualification Shares	Qualification Incomes	Interaction	Qualification Shares	Qualification Incomes	Interaction	Qualification Shares	Qualification Incomes	Interaction
Higher Degree	31.7	4.0	0.7	26.4	2.0	0.4	27.2	0.8	0.2
	(86.3)	(5.4)	(-6.7)	(93.7)	(2.4)	(-4.7)	(153)	(0.8)	(-1.9)
Bachelor's Degree	87.5	-2.6	-0.8	63.4	-0.4	-0.1	56.9	1.7	0.5
	(238.5)	(-3.6)	(7.8)	(224.7)	(-0.5)	(1.5)	(319.8)	(1.8)	(-5.5)
Other Post-School	-242.2	30.1	-5.8	-171.1	35.3	-6.8	-165.1	40.4	-8.0
	(-660.1)	(40.8)	(54.7)	(-606.7)	(43.7)	(76.6)	(-927.7)	(44)	(83)
Higher School	53.0	-8.8	-5.7	36.0	-4.9	-3.1	27.4	-1.4	-0.7
	(144.6)	(-11.9)	(53.8)	(127.7)	(-6.1)	(34.3)	(154)	(-1.5)	(6.9)
6th Form	81.5	4.3	1.7	55.5	5.8	2.2	47.9	8.5	2.9
	(222)	(5.9)	(-15.8)	(196.8)	(7.2)	(-24.5)	(269.4)	(9.2)	(-29.7)
School Certificate	26.5	17.2	1.4	16.1	16.5	1.2	4.0	22.8	0.4
	(72.3)	(23.3)	(-13.7)	(56.9)	(20.5)	(-13.3)	(22.6)	(24.8)	(-4.3)
Other School	85.9	-0.5	-1.0	63.4	-0.6	-1.1	65.5	-0.3	-0.5
	(234)	(-0.7)	(9.2)	(224.6)	(-0.8)	(12.9)	(367.9)	(-0.3)	(5.3)
No Qualification	-43.1	32.0	-2.1	-30.0	27.5	-1.8	-48.2	40.6	-3.9
	(-117.5)	(43.3)	(20.1)	(-106.4)	(34)	(19.7)	(-270.8)	(44.2)	(40.2)
Not Specified	-44.0	-1.9	1.0	-31.4	-0.4	0.2	2.1	-21.1	-0.6
	(-120.1)	(-2.5)	(-9.3)	(-111.4)	(-0.5)	(-2.4)	(11.6)	(-23)	(6)
Total	36.7	73.8	-10.5	28.2	80.7	-8.9	17.8	91.8	-9.6

Notes: Entries are percentages of the total change in the value of human capital: these entries sum to the total in the final row for each column. Numbers in parentheses are percentages of the total entry in the final row.

Table A6c - Decomposing the Change in the Value of Human Capital: Contributions by Qualification Group, 1996-2001

Qualification	Employed Workers			Labour Force			Whole Population		
	Qualification Shares	Qualification Incomes	Interaction	Qualification Shares	Qualification Incomes	Interaction	Qualification Shares	Qualification Incomes	Interaction
Higher Degree	19.1	3.4	0.7	17.9	4.1	0.8	14.1	3.2	0.7
	(190.9)	(3.8)	(52.3)	(194.5)	(4.6)	(176.8)	(-151.5)	(3.4)	(3.8)
Bachelor's Degree	44.3	8.0	2.3	42.3	9.2	2.5	33.3	7.1	2.1
	(443.3)	(9.1)	(172.3)	(460.2)	(10.1)	(549.1)	(-357.7)	(7.7)	(12)
Other Post-School	-106.6	37.2	-8.7	-104.4	36.7	-8.6	-79.7	30.6	-7.3
	(-1067.5)	(41.9)	(-669.1)	(-1135.7)	(40.6)	(-1884.6)	(857.9)	(33.3)	(-41.9)
Higher School	10.4	6.0	1.2	9.9	6.2	1.2	8.2	4.7	1.0
	(103.6)	(6.8)	(91)	(108.1)	(6.9)	(262.7)	(-88.2)	(5.1)	(5.5)
6th Form	22.1	11.4	1.9	21.9	11.3	1.9	17.5	8.9	1.6
	(220.8)	(12.9)	(148.6)	(238.3)	(12.5)	(424.1)	(-188.7)	(9.7)	(9.3)
School Certificate	29.7	11.3	2.1	29.3	11.3	2.1	22.0	10.1	1.9
	(297)	(12.7)	(163)	(318.4)	(12.5)	(469.3)	(-236.2)	(11)	(10.7)
Other School	1.2	2.7	0.1	0.8	2.8	0.0	2.0	1.6	0.1
	(11.9)	(3.1)	(4.3)	(8.9)	(3.1)	(8.9)	(-21.5)	(1.7)	(0.4)
No Qualification	-65.6	7.7	-1.8	-67.0	8.0	-1.9	-61.1	10.2	-2.6
	(-657.1)	(8.6)	(-139.1)	(-729.2)	(8.9)	(-420.1)	(656.9)	(11.1)	(-15.1)
Not Specified	55.6	1.1	3.6	58.5	0.7	2.3	34.5	15.6	20.1
	(557)	(1.2)	(276.6)	(636.5)	(0.7)	(513.8)	(-370.9)	(17)	(115.3)
Total	10.0	88.7	1.3	9.2	90.4	0.5	-9.3	91.9	17.4

Notes: Entries are percentages of the total change in the value of human capital: these entries sum to the total in the final row for each column. Numbers in parentheses are percentages of the total entry in the final row.

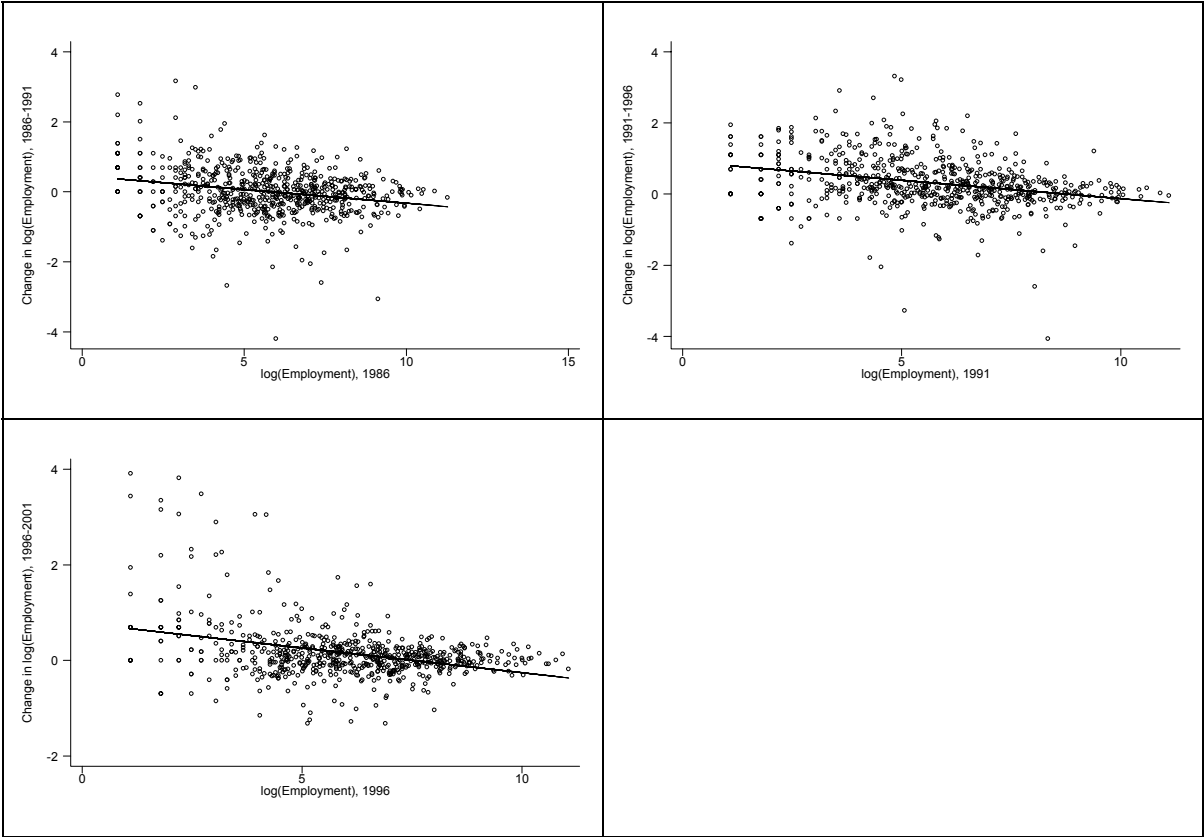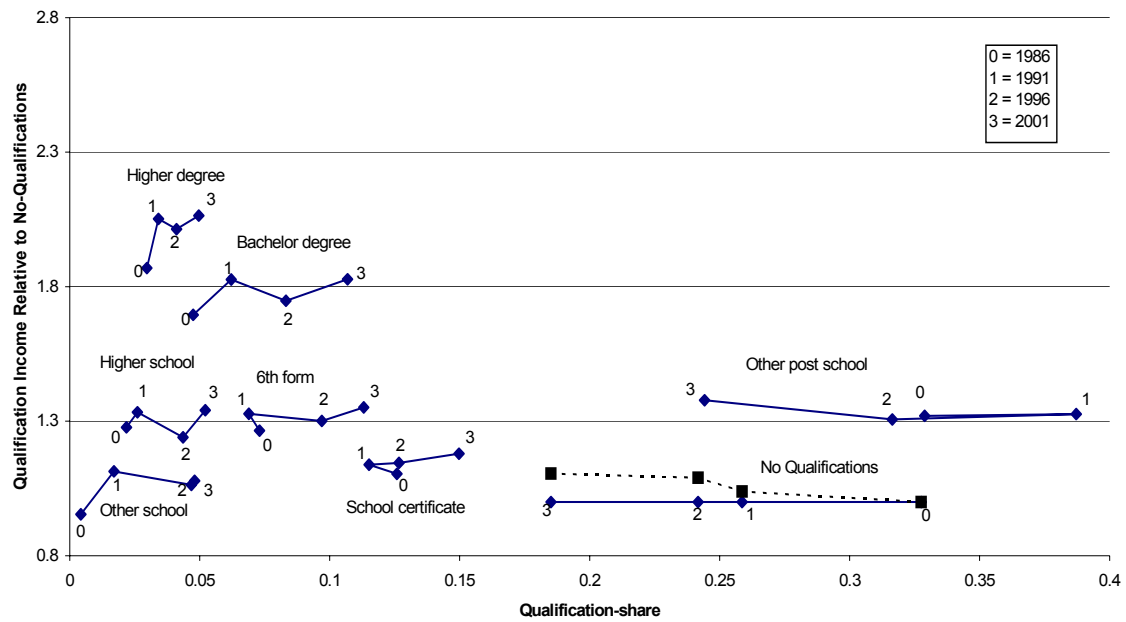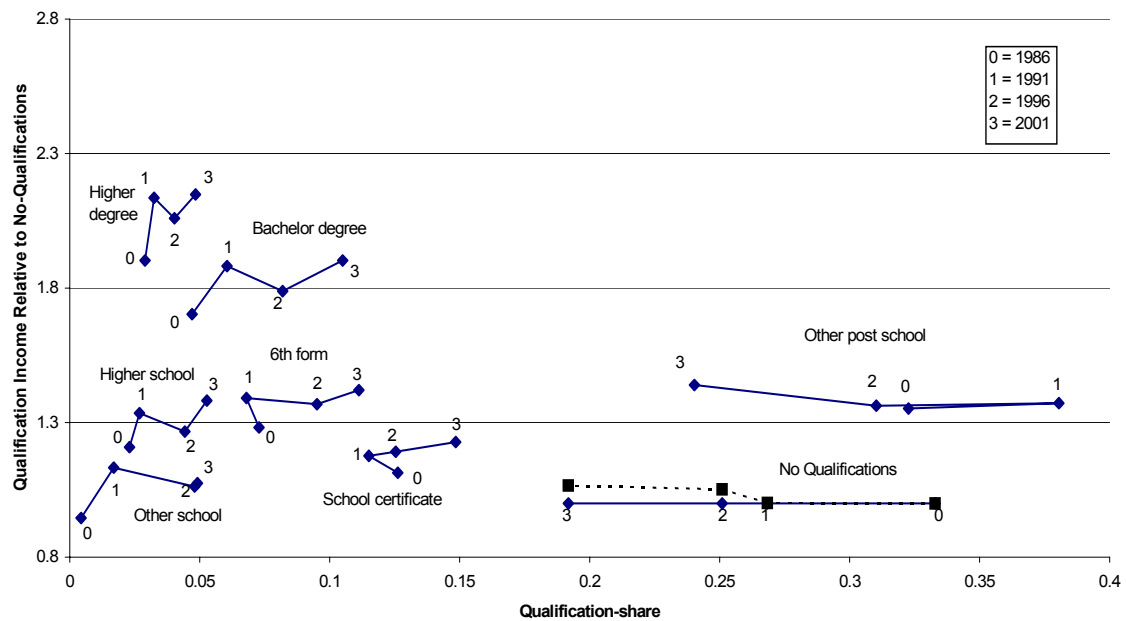## Figure A1 - Change in Industry-Occupation Populations, 1986-2001

Figure A2a - Relative Income and Employment-share movements, 1986-2001

Notes: Incomes have been adjusted to control for age effects.

Figure A2b - Relative Income and Labour Force-share movements, 1986-2001

Notes: Incomes have been adjusted to control for age effects.