Job Mobility and Wage Dynamics

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Access to the data used in this study was provided by Statistics New Zealand under conditions designed to give effect to the security and confidentiality provisions of the Statistics Act 1975. Only people authorised by the Statistics Act 1975 are allowed to see data about a particular person or firm. The tables in this paper contain information about groups of people so that the confidentiality of individuals is protected.

The results are based in part on tax data supplied by Inland Revenue to Statistics New Zealand under the Tax Administration Act 1994. This tax data must be used only for statistical purposes, and no individual information is published or disclosed in any other form, or provided back to Inland Revenue for administrative or regulatory purposes.

Any person who had access to the unit-record data has certified that they have been shown, have read and have understood section 81 of the Tax Administration Act 1994, which relates to privacy and confidentiality. Any discussion of data limitations or weaknesses is in the context of using the Linked Employer-Employee Database (LEED) for statistical purposes, and is not related to the ability of the data to support Inland Revenue's core operational requirements.

Careful consideration has been given to the privacy, security and confidentiality issues associated with using tax data in this project. A full discussion can be found in the LEED Project Privacy Impact Assessment paper (Statistics New Zealand, 2003).

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Abstract

Matched employer-employee data research has found that workers' wages are affected by the characteristics of the firms they work in, and that higher skilled workers tend to be employed by higher paying firms. This paper examines the contribution of workers' job mobility to their wage dynamics. We focus on the possible trade-off between moving to a better paying firm and losing a firm-tenure specific component of earnings, and examine what types of workers benefit from changing firms, rather than staying with their existing employer.

Our analysis provides four main findings. First, although the raw earnings gains to job-movers and stayers are about the same, we find that, after controlling for observable differences, job-movers have about 1.3 percent lower annual earnings growth than non-movers. Second, we estimate that job-movers gain 0.3 percent per year on average from moving to higher paying firms, but lose 1.6 percent in transitory earnings associated with changing jobs. The gains from moving to better firms are larger for both younger and new entrant workers, while the transitory earnings losses are smaller. We interpret these findings as being due to an earnings growth trade-off for workers between moving to a higher paying firm and losing their tenure-related earnings at their existing firm.

Third, we estimate that, on average, workers gain (almost) all of the change in firm earnings premiums when they change jobs. However, such gains are not equally shared by all workers. In particular, our estimates suggest that it is the higher ability workers (as measured by the estimated worker earnings premiums) whose earnings gain (or lose) the most from moving to a firm with higher (or lower) earnings premiums.

Finally, we find that workers' earnings also benefit on average from a change in the average earnings of their co-workers. Controlling for other factors, we estimate that a 1 standard deviation change in the estimated average peer earnings is associated with about 0.25 percent change in a worker's earnings on average.

Keywords

Earnings, Linked Employer-Employee Data, worker mobility, job turnover.

Contents

Tables

Figures

Appendix tables and figures

1. Introduction

Workers can expect wage changes to be related to their experience, for a given set of human capital characteristics. In addition, workers who remain in their jobs may expect wage gains related to their job-tenure at the firm. In contrast, workers who change jobs will lose their accumulated tenure premium but may increase their wage if they move to a higher paying firm or find a better firm-match.

In this paper, we provide a preliminary analysis of the relationship between workers' job mobility and wage dynamics in New Zealand, and investigate the influence of firm characteristics on the size of wage gains experienced by job-movers.[1] Employers differ in their human resource practices and pay structures, yet much of the literature on wage dynamics relies largely on panel studies of workers, and has been unable to identify whether wage changes for job-movers depend on or are related to the change in characteristics of their employer.

Our analysis uses Statistics New Zealand's Linked Employer-Employee Database (LEED), which provides longitudinal employment and earnings data on individual workers, together with information on the firms that they work for. Such linked data facilitate the analysis of the contribution of firm characteristics to workers' wages and wage variability. Applying methods developed by Abowd, Kramarz and Margolis (1999) and Abowd, Creecy and Kramarz (2002), research has found that workers' wages are affected by their firms' characteristics, and that higher skilled workers tend to be employed by higher paying firms.[2] In previous research (Maré and Hyslop, 2006), we estimated that permanent firm differences account for between 10 and 25 percent of the variation in workers' earnings and, also that permanent worker and firm components of job earnings are positively correlated.

We extend our previous analysis of the relationship between worker and firm earnings premiums and workers' earnings levels, and focus on the contribution of workers' job mobility to their earnings dynamics. We begin by estimating indexes of workers' and firms' earnings premiums, and then examine the evolution of worker earnings as they move between firms offering different average premiums. In particular, we examine the trade-offs to individual workers between staying with their current employer, and moving to a firm with a different earnings premium. We analyse the contribution to earnings growth of changes in the estimated firm earnings' premiums when workers change firms. We examine what types of workers benefit more or less from changing firms versus staying with their existing employer.[3] However, we also analyse the effects of a change in workers' average peer earnings premiums on workers' earnings changes.

In the next section, we briefly discuss some related literature to help place the analysis here in context. In section 3, we present our empirical approach and discuss some of

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[1] Our analysis is also related to an earlier study by Maloney (2006), who examined the job mobility and earnings patterns of workers in New Zealand using LEED.

[2] For example, Abowd, Kramarz, Lengermann and Pérez-Duarte (2004) estimate a negative correlation using French data and a small positive correlation in US data. Subsequent studies have confirmed and elaborated on their finding that estimated correlations can be negatively biased due to low turnover (Andrews et al., 2008; Maré and Hyslop, 2006).

[3] Andersson, Holzer and Lane (2003, 2005) examine earnings dynamics for low-wage workers. They analyse the relationship between wage changes and the pay premium of firms where they are subsequently employed, and find that "low earners were much more likely to increase their earnings if they gained employment at a higher-wage firm", implying an interaction between wage growth and changing firm effects.

the estimation issues, and section 4 contains a discussion of the LEED data. We present and discuss the results in section 5, and the paper concludes with a discussion.

2. A brief literature review

There is an extensive international literature both on job mobility and the related issue of the economic returns to firm-specific tenure (or seniority).[4] Job mobility can have two offsetting effects on workers' wages. First, via active job-search by workers and firms, it can result in a better match between workers and firms, in terms of job-specific productivity, and result in wage increases. Second, any tenure-related productivity and wage gains will be destroyed with any job-move. In addition, the wage implications associated with a job change depend very much on whether the move is voluntary or involuntary on the part of the worker (Gottschalk and Maloney, 1985). On average, voluntary "quits" are associated with wage increases, while involuntary "layoffs" are associated with wage cuts. Light (2005) reports that workers who change jobs experience smaller wage gains than those who stay with their employer, with voluntary movers gaining 1.4 percent (men) to 1.7 percent (women) more than movers generally. Men who change jobs voluntarily have higher wage growth than non-movers.[5]

Thus, there is a potentially complex relationship between workers' job mobility and their wage dynamics. This is further complicated by the possible endogeneity of workers' decisions to change jobs, and also the empirical magnitude(s) associated with match-quality and tenure-productivity effects. A number of US studies have used alternative methods and approaches to control for the possible endogeneity of job-moves, in measuring the contribution of firm-specific tenure to workers' wages. For example, Topel (1986), Abraham and Farber (1987), Altonji and Shakotko (1987), and Altonji and Williams (2005) each conclude that the returns to tenure are relatively small; while Topel (1991) finds large and significant returns to tenure. Buchinsky et al. (2008) provides a recent attempt to unify the literature, using a structural approach that explicitly models the individual's decision to change jobs and their decision to work, as well as their wage equation, and conclude that the returns to tenure are significantly positive and larger even than Topel's (1991) estimates. This suggests that there may be small to large loss-of-tenure related wage losses associated with changing jobs.

Empirically, most jobs have short-tenure, but long-tenure jobs are also common (Farber, 1999).[6] In addition, the job separation hazard rate exhibits negative duration dependence, so that longer jobs have a lower probability of ending. While most job moves are associated with wage gains, a substantial fraction (20–40 percent) of moves is associated with wage cuts (Jolivet, Postel-Vinay and Robin, 2005). Declining hazard rates could be due to either heterogeneity in individual workers' propensity to change jobs, and/or due to state dependence effects, whereby past job-mobility (or lack of it) directly affects the probability of separating in the future.

Linked employer-employee data have been used in a number of recent studies to shed further light on the issue of wage dynamics and turnover. Such data enable a clearer

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[4] Farber (1999) provides a useful summary.

[5] Light (2005) reports that 80 to 90 percent of moves are voluntary. New Zealand estimates are scarce. Herzog (1996) reports a lower proportion of voluntary moves (half to two-thirds) during 1985 to 1994; a period of substantial job loss and structural change. The proportion of moves that are voluntary is likely to be higher than this during our study period, when employment growth was strong.

[6] Statistics New Zealand (2007) estimates from LEED that 42 percent of jobs at 31 March 2006 had been ongoing for less than 1 year, while 12 percent had been ongoing for at least 7 years.

identification of the interaction of worker turnover and firms' pay policies, analysing the contributions of heterogeneous firms' pay policies (Abowd, Kramarz and Roux, 2006); export opportunities (Kaplan and Verhoogen, 2006); and the process of endogenous mobility and matching (Postel-Vinay and Robin, 2006, Cornellissen and Hübler, 2007, Gruetter and Lalive, 2009). At the core of each of these studies is a two-way fixed effect model of wage determination, in some cases with additional explicit modeling of tenure effects or mobility. There is consistent evidence of a high degree of heterogeneity across firms – not only in wage premiums paid, but also in starting wages and tenure profiles, with starting wage and within-firm wage growth being inversely related.

Workers are more likely to leave low-paying firms, consistent with self-selective job mobility. Gruetter and Lalive (2009) find that the identity of the firm is a more important factor in wage determination when workers are entering from unemployment than when they are making more self-selected job-to-job moves. Andersson et al (2003, 2005) document the significant influence that firm pay policies have on patterns of wage growth for low-earning workers. They find that low earning workers are much more likely to increase their pay if they gain employment with a higher-wage firm.

The only empirical analysis of the relationship between job mobility and wages in New Zealand that we are aware of is a recent study using LEED data by Maloney (2006). Maloney uses 5 years of monthly data from April 1999 – March 2004 and focuses on prime aged (aged 25–54 in April 1999) male workers. He further restricts the analytical sample of job-movers to those workers who have at least one year of continuous employment with a firm prior to a job move and at least one year of employment with a firm after the move. As a comparison group, he selects a sample of job-stayers who have at least two years of continuous employment with the same firm over the period. Maloney's analysis then compares the patterns of monthly earnings trends of the job-movers over the two years around their move and the job-stayers. He first shows that job-movers experience, on average, about 0.2 percent higher earnings growth than stayers. However, after controlling for age differences of movers and stayers, and differences in characteristics such as firm size, average monthly earnings and the worker's tenure and earnings at the start of the first (12-month) period, Maloney finds that job-movers earnings fall by 0.3–0.5 percent on average relative to the wages of job-stayers over the two year period. He also estimates that about one-third of the change in the average earnings of workers in the firm(s) a worker is employed by is reflected in the worker's earnings change over the period.[7]

Our analysis in this paper differs from Maloney's in several dimensions. First, we have a longer period of LEED data (9 versus 5 years), focus on annual earnings, and consider all workers who have employment in pairs of consecutive years, rather than restricting attention to movers who make a single move between stable (one-year or more) jobs.[8] Second, our earnings measure is an annualised full-time equivalent (FTE) earnings rate, which we estimate from monthly data using an algorithm discussed in detail in Maré and Hyslop (2006). Third, we incorporate explicit measures of the change in firm's earnings premiums, based on estimates from a two-way (worker and firm) fixed effects regression specification, and the worker's average peer earnings, and examine their

[7] We interpret that this largely reflects the effect of job-changers moving between firms with different pay levels; however, it may be capturing average wage changes within firms, due, for example, to worker mobility and/or general earnings adjustments.

[8] We examine the potential influence of impact of the selection criterion by examining a subsample of workers who have at most a single job change over our study period. This comparison is presented in Table 6 and discussed in section 5.2.

contributions to worker's wage changes.[9] We believe this is akin to Maloney's approach of examining the contribution of the change in the firm-average earnings on worker's earnings change, but separated and modelled more explicitly.

Notwithstanding these differences in sample selection and methodology, our results are somewhat larger than those of Maloney. In particular, we also find that job-movers raw average earnings gains are slightly larger than those of job-stayers, but that regression-adjusted movers' earnings gains are lower than those of stayers. Beyond these results, we believe our analysis provides some useful preliminary evidence on the average earnings change associated job-match quality versus tenure loss, and what types of workers do make earnings gains from moving.

3. Empirical approach

We use a two-stage procedure to estimate the relationship between workers' earnings growth and changing firm characteristics. Following Maré and Hyslop (2006, 2008), we first estimate the permanent firm and worker components of log(FTE earnings) across all jobs, using two-way fixed effects estimation. Second, we analyse earnings growth for workers according to whether they are movers or stayers. In particular, we examine variation in the degree to which workers' earnings growth is related to the changing characteristics of the firms in which they are employed and the changing mix of workers with whom they work.

3.1. Components of earnings rates and change

In the first stage of our analysis, we estimate an additive log-linear two-way fixed effects model for the log(FTE annual earnings) of worker-*i*, employed in firm-*j*, in year-*t* (y_{ijt}). We regress y_{ijt} on a vector of worker-level observable characteristics (X_{it}), time-invariant fixed worker (θ_i) and firm (ψ_j) effects, and an idiosyncratic earnings component (ε_{ijt}):

$$y_{ijt} = X'_{it}\beta + \theta_i + \psi_j + \varepsilon_{ijt}. \qquad (1)$$

The vector X_{it} consists of sex-specific age-quartics and time-effects; the worker effect θ_i represents the portable earnings premium of worker-*i* and reflects factors such as their ability and motivation; similarly, the firm effect ψ_j represents the earnings premium paid by firm-*j* to each of their workers and reflects the firm's pay structure; and the residual term $\varepsilon_{ijt} = m_{ijt} + \tau_{ijt} + \upsilon_{ijt}$, where m_{ijt} is a, possibly time-varying, component capturing match-quality, τ_{ijt} captures tenure effects, and υ_{ijt} is a random idiosyncratic component.

In the second stage of our analysis we focus on individual worker level earnings and, more specifically, year-to-year earnings changes. To facilitate this the data are aggregated to worker-year observations, by taking the FTE employment weighted average of the workers earnings, and the estimate components from equation (1), across all the jobs the worker held during a year. Based on the estimates of equation (1), we can express worker-*i*'s earnings rate as,

$$y_{it} = X'_{it}\hat{\beta} + \hat{\theta}_i + \hat{\psi}_{j(i),t} + \hat{\varepsilon}_{it} \qquad (1')$$

where a caret (^) denotes an estimate obtained from estimating equation (1), and $\hat{\psi}_{j(i),t}$ is the average estimated firm effect across all firms that worker-*i* worked for in year-*t*. Based on equation (1′), the implied year-to-year change in worker-*i*'s earnings rate is

[9] Note, being a time-invariant 'fixed-effect', the change in the firm-effect of job-stayers is, by construction, zero.

$$\Delta y_{it} = \Delta X'_{it}\hat{\beta} + \Delta\hat{\psi}_{j(i),t} + \Delta\hat{\varepsilon}_{it}\,. \qquad (2)$$

The contributions and interpretations of earnings change are different for movers and stayers.[10] The first component captures the effect of changes in individual characteristics, in particular, changes in work experience, and is common to both movers and stayers. However, the second term, the change in the firm premium ($\Delta\hat{\psi}_{j(i),t}$) is zero for workers who do not change firms, and reflects the impact of moving to a higher- or lower-paying firm for movers. The final term in equation (2), $\Delta\hat{\varepsilon}_{it}$, also captures different effects for movers and stayers. Assuming match-quality effects are time-invariant ($m_{ijt} = m_{ij}$) and ignoring idiosyncratic components, for workers who stay with the same firm, $\Delta\hat{\varepsilon}_{it}$ captures the additional wage growth associated with an additional year's tenure at the firm ($\Delta\tau_{ijt}$) plus any idiosyncratic change ($\Delta\upsilon_{ijt}$). In contrast, for workers who move from firm-*j* to firm-*k*, $\Delta\hat{\varepsilon}_{it}$ captures the change in match-quality associated with the move ($m_{ik} - m_{ij}$) less any tenure premium that is lost as a result of the move (τ_{ijt-1}) plus any idiosyncratic change ($\upsilon_{ikt} - \upsilon_{ijt}$). If workers choose to move only if the move leads to a higher wage, the sum of these terms is likely to be positive for voluntary moves.

3.2. Estimation issues

Equation (1) is estimated on job-level information, with one observation for each observed combination of worker, firm and year. This regression is estimated by ordinary least squares (OLS) by adapting Abowd, Creecy, Kramarz's (2002) conjugate gradient algorithm using all job-year observations in LEED, weighted by contemporaneous FTE employment (see Maré and Hyslop, 2006, 2008 for further details). The OLS estimates are unbiased estimates under the assumption of exogenous matching.

In the presence of tenure and match effects that are correlated with worker and firm components, $\hat{\theta}_i$ and $\hat{\psi}_j$ will reflect the average match quality and tenure for each worker and firm respectively, in addition to the underlying productivity-related characteristics.[11] If match and tenure effects are positively correlated with both worker and firm components, they will induce a positive correlation between these components.

We follow the approach of Andersson, Holzer and Lane (2003) and interpret the estimated firm and worker components from equation (3) as summary measures of worker earning ability and firm pay structures (including average match quality and tenure). An alternative approach is to formally model the wage dynamics associated with tenure and the process of matching.[12]

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[10] Note that, because our second stage analysis focuses on changes in FTE earnings, we thus use only the balanced sample of workers who work in each pair of consecutive years.

[11] Similarly, the observable demographic earnings profiles ($X'_{it}\beta$) will also reflect the average match quality and tenure effects at different stages of the life cycle. Woodcock (2008) derives formulae for the 'bias', and implements a random effects identification strategy to obtain separate estimates of match effects.

[12] Abowd, Kramarz and Roux (2006) develop an econometric model to study the simultaneous determination of worker mobility and wage rates. Postel-Vinay and Robin (2006) advocate the use of matched employer-employee data for the estimation of structural job search models.

Assuming the first-stage regression model (1) is correctly specified, the implied earnings-change regression, equation (2), has unitary coefficients on $\Delta X'_{it}\hat{\beta}$ and $\Delta\hat{\psi}_{j(i),t}$. However, either non-random selection of the balanced sample of workers with consecutive year employment, or lagged FTE employment weighting of our second-stage change analysis (while the first-stage levels regression is estimated weighted by contemporaneous FTE employment), may result in non-unitary coefficients. For these reasons, we estimate change regressions of the following form:

$$\Delta y_{it} = \lambda_X . \Delta\left(X'_{it}\hat{\beta}\right) + \lambda_\psi . \Delta\hat{\psi}_{j(i),t} + u_{it} \qquad (3)$$

Also, in our subsequent analysis we examine the relative contribution of the change in firm-effects to a worker's earnings change across different groups of workers, and we will also include other covariates, such as the change in the worker-i's peer average earnings, that may affect their earnings change. For instance, it's possible that the coefficients of this equation vary according to the worker's initial wage level. For example, new entrant workers may benefit most from moving to a high-wage firm, alternatively they may benefit least if there is segmentation along occupational lines so that they do not receive the full firm-premium.

4. Data description

The data that we use for the analysis are from the Statistics New Zealand Linked Employer-Employee Database (LEED), which uses information from tax and statistical sources to construct a record of paid jobs. Since April 1999, all employers in New Zealand are required to file a monthly record with Inland Revenue (IRD) called an Employer Monthly Schedule (EMS), which lists all paid employees at that firm during the month, the earnings they received and the amount of tax that was deducted at source. Two types of recipients are covered by EMS: those who have Pay-As-You-Earn (PAYE) tax deducted, who are employees; and those who pay withholding tax, who are a subset of the self-employed. Because the selection and coverage of which self-employed workers have tax withheld is unknown, we use only information on PAYE-deducted (employee) jobs.[13] We use all the available data on PAYE employee jobs in New Zealand during the nine March-years from April 1999 to March 2008.

Firms (employers) and workers (employees) are identified by unique, confidential identifiers based on their IRD tax numbers. For workers, this represents a single identifier over time, enabling workers to be tracked longitudinally and across the firms that they work for. In the IRD data, employers are identified as the legal or administrative unit to which the EMS return relates, and do not equate to any consistent conception of a firm. That is, legal and/or other administrative changes can trigger a change in an employer's IRD identifier, with no effective change in the economic structure of the firm. Statistics New Zealand has used a range of administrative data to identify continuing enterprises even when IRD identifiers change. We use continuing enterprises, as defined in the Longitudinal Business Frame (LBF) (Seyb, 2003) as our definition of firms.

[13] In addition to regular firm-worker employment jobs being identified in the LEED, several other relationships involving PAYE tax deductions can also be identified by particular "employer" identifiers. These are working-age social welfare taxable benefits; earnings-related accident compensation payments from the Accident Compensation Corporation (ACC); Student Allowance payments (SA); Paid Parental Leave (PPL) payments; and New Zealand Superannuation (NZS) retirement pensions. In what follows, we make a distinction between LEED earnings from employment-jobs and other LEED income from these other (non-employment) sources.

Conceptually, the LEED covers the universe of PAYE employment relationships and earnings in New Zealand over the period. In addition, there is limited information on the characteristics of workers and firms: age, sex, and location of workers; and industry and location of firms. One limitation of the LEED data for the current project is that it contains only monthly earnings information, without any measure of monthly hours of work. As a result, we cannot accurately distinguish between hourly wages hours worked in terms of the variation in earnings. For example, low monthly earnings may be due to either a low hourly wage and/or low hours worked. In order to create a proxy for the hourly wage rate, we estimate a 'full-time-equivalent' (FTE) annual employment measure, using information on multiple jobs, monthly earnings, and receipt of income from non-employment sources. The algorithm is more fully described in Maré and Hyslop (2006, 2008). Annual earnings are divided by FTE to create a FTE earnings rate measure, which we convert to constant (2008) dollars, using the CPI.

Table 1 presents descriptive statistics of the balanced sample of worker-year observations that is used in the analysis.[14] The analysis is weighted by each worker's previous year's (lagged) FTE employment.[15] The first row presents the summary statistics for the full sample, and subsequent blocks of rows summarise various subsamples. The mean log(FTE earnings) is 10.70 (approximately $45,000), and the average change in log(FTE earnings) is 0.036. The average age of workers is 38.4 years, and 46 percent are female.

We characterise workers as job-stayers if their (FTE-weighted) average firm fixed effect is the same in both years, and as job-movers if their average firm effect changes. To be a job-stayer essentially requires that they work for a single firm in both the current and previous year, while movers generally have some different combination of employers in each year.[16] Owing to the way that we measure moves, a single job change will generally appear as a two-year job-change episode and such job changes will thus entail gains that are twice as large as indicated by the annual changes. A little over one-half (53 percent) of workers are characterised as year-to-year job-stayers. In rows 2 and 3 of Table 1 we describe the characteristics of the subsamples of movers and stayers. On average, stayers' FTE earnings are about 20 percent higher than movers, and stayers are more likely to be male and are about 5 years older, while the log(FTE earnings) growth rates are about the same for movers and stayers.

The next pair of rows presents the characteristics of males and females. Males earn more on average (the difference in average log(FTE earnings) is 0.27, about 30 percent), but have about the same average earnings growth, are slightly younger (0.9 years), and are more likely to stay in the same job. Table 1 next describes outcomes by age group. Not surprisingly, younger workers (aged 20–29) have 25–30 percent (0.25 log points) lower average earnings than prime aged or older (30–44 or 45–59) workers,

[14] That is, the sample of paired observations for which a worker worked in consecutive years.

[15] A description of the effects of the balanced sample selection and weighting scheme is provided in Appendix 1.

[16] However, there are several ways in which a worker may be classed as a mover, including the possibility that they have the same set of (multiple) employers in each year but with the relative earnings from each changing over time. A further consequence of defining a worker as a job mover based on changing average firm effect between the last and this year is that job changes that occur during a year will result in the worker being classified as a mover both in that year and the subsequent year. Appendix Table A2 summarises the number of jobs held by job-movers and stayers. For job-movers, about one-third have a single job in the current year and, of these, two-thirds had 2 jobs in the previous year while 10 percent had just 1 job; and nearly one-half (44 percent) had 2 jobs in the current year, of which one-half had a single job in the previous year and one-third had 2 jobs.

but substantially stronger growth (over 6 percent versus 2.8 and 1.8 percent for 30–44 and 45–59 year olds respectively). Younger workers are also more likely to change jobs (62 percent change jobs compared to 54 and 38 percent of the prime aged and older workers). While this latter finding may reflect the benefits of moving to better jobs, it may also simply reflect different employment patterns over the life cycle.

The next pair of rows presents the average characteristics of four subsamples defined by the quartiles of the estimated worker fixed-effects from the first stage of estimation. Unsurprisingly, there is a strong positive earnings gradient across these skill-quartiles. In addition, workers in the lower quartiles are substantially more likely to be female and movers than in higher quartiles. However, there are not systematic earnings growth differences across quartiles or between movers and stayers.

The final sample stratification in Table 1 is by the pattern of employment transitions observed in the LEED data over the nine year sample period. In particular, we define "Continuing" workers as those who work in each of the nine years. We define "Entering" workers as those who do not work in the first year and make a single transition into LEED employment during the period. "Exiting" workers are those who work in the first year and make a single transition out of LEED employment during the period, and "Miscellaneous" workers are all other workers, who have miscellaneous LEED transition experiences. The composition of these groups reflects various life cycle patterns. For example, Entrants are predominantly young, with an average age about 6 years younger than the overall average, and are more likely to be job-movers; in contrast, Continuers are primarily prime aged and less likely to change jobs; the Miscellaneous group is also younger and has a greater fraction of females, reflecting the intermittent work patterns of women during child-rearing ages.

5. Results

We begin our analysis of the effects of a worker's job-mobility on their earnings by summarising the results of the first-stage estimation.

5.1. Descriptive analysis

Table 2 presents a summary for the full balanced sample, and the same sets of subsamples described in Table 1.[17] For each sample, we describe the average log(FTE earnings), and estimated firm fixed effects and residual earnings from the first-stage regression, the average change in each of these, and the average change from move-years relative to stay-years over the sample period. As outlined above, residual earnings changes reflect tenure-related in-job wage growth (net of life-cycle growth) for job-stayers, and a combination of the loss of tenure-related wage premiums and the potential for mobility-related wage gains for movers.

For the full sample, presented in row 1, the contribution to wage growth from changes in the estimated firm fixed-effect is 0.002 (0.2 percent), while the average residual change is -0.001 (-0.1 percent). Firm-effect changes are associated only with job-moves. Thus, column 5 shows that the average firm-effect change associated with job changes is 0.3 percent per year. The final column in Table 2 shows the average residual change associated with annual job-moves versus job-stays. For the full sample, this is -1.6 percent per year. These latter two results suggest that, on average, job-moves are

[17] To describe the effects of selection on year-to-year continuing workers, and weighting by lagged FTE employment, Appendix table A1 presents summary statistics for all worker-year observations, years 2–9 observations, and the balanced sample weighted by contemporaneous FTE employment.

associated with workers moving to better paying firms, but at the cost of losing time-varying tenure and other residual earnings associated with staying with a firm.[18]

The subsequent rows present analogous results for subsamples. The next two rows (for movers and stayers) show that the average -0.016 annual difference in residual earnings growth for job-changing versus staying is due to a 0.010 (1.0 percent) fall in residual earnings for movers and a 0.006 (0.6 percent) gain in residual earnings for stayers. In addition, this panel also shows that movers work for firms with lower fixed effects and have negative residual earnings, on average, than job-stayers.

These patterns of positive firm-effect changes, and negative residual earnings changes, for job-movers versus stayers are broadly true across almost all the subgroups considered in Table 2.[19] Average firm-effect gains associated with moving are particularly strong (1–1.2 percent per annum) for younger (20–29 year old) and "Entering" workers, suggesting the importance of "job-shopping" early in a worker's career. These two groups of workers also have smaller residual earnings loss associated with moving versus staying relative to the overall sample, which is consistent with such workers not having built up much firm-specific tenure.

One concern with interpreting the changes in firm-effects and residual earnings as reflecting causal effects of moving versus staying, is that such changes may simply reflect heterogeneity in which workers change jobs. One partial control for this issue is to condition on both the number of paired-years observed and the number of move-years, and compare the changes during years in which workers change jobs with changes during years when they don't change jobs. We have done this for each of the LEED sample transition groups, and the results are qualitatively the same as the more parsimonious summary presented in the final panel of Table 2.

In summary, the patterns described here are consistent with workers changing jobs to better paying firms, but at the cost of the loss of firm-specific returns to tenure relative to workers who stay with the firm. The results imply the average annual returns to an additional year of tenure for job-stayers is about 0.6 percent, while the accumulated average tenure loss is about 1.6 percent for job-movers.

5.2. Regression analysis

We wish to identify the contribution to wage growth of changes in which firm workers work in. Table 3 summarises the relationship between the level of wages and the estimated first-stage components, as in equation (1'), as well as the relationship between wage changes and changes in components, as in equation (3).

The first column reports a level regression, weighted using the same (FTE) weights as used in the first stage regression. If this regression were run on exactly the same sample as the first stage regression, the coefficients on each covariate would be

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[18] These changes for movers may result from one or more job changes. For movers who are observed in each year and who make a single job change, the annual change in firm-effect associated with moving is 0.4 percent and the corresponding change in transitory earnings is -1.4 percent. For this highly selective group, the gains from firm upgrading are larger, and the loss in transitory earnings is smaller, than for movers generally. For this group, the overall gains from moving accrue for two years, giving gains of 0.8 percent from a higher firm effect and a transitory loss of 2.8 percent for the job change episode.

[19] The only exceptions are that the groups of 45–59 year old and "Exiting" workers who move jobs lose 0.002 (0.2 percent) in terms of the estimated firm effects. Exiting workers also have large (4.4 percent) residual earnings losses from moving versus staying. These patterns may reflect aspects of later-career employment changes over the life cycle.

precisely 1. Thus, the deviations from 1 reflect the non-randomly selected nature of the balanced sample.[20] The R-squared for this regression shows the same degree of fit as in our first stage estimated regression, with worker demographics, and worker and firm fixed effects, and time effects accounting for 91 percent of the cross-sectional variation in log wages.

Next, to provide a sense of the effect of using lagged FTE employment weights, the second column contains the results of the regression using these weights. The estimated coefficients from this regression are further from 1, except on the demographics variable, suggesting that the lagged FTE weights tends to accentuate the effects of non-randomness associated with the balanced sample selection.

The third and fourth columns provide analogous estimates for the regression of annual wage change on the change in wage components weighted, respectively, by current and lagged FTE employment. The estimated coefficients on the three components (estimated firm fixed effects, worker demographics and time effects) are now all less than 1, and vary somewhat between the two sets of estimates. The coefficients on the change in firm effects are 0.94 (weighted by current FTE employment) and 0.97 (weighted by lagged FTE employment): the latter implying that workers moving between firms gain 97 percent of the difference in firm wage premiums in the year that they move. The estimated coefficients on the change in worker demographics and change in time effects are both much lower than 1 and more variable across the two columns.

In our subsequent analysis, in order to provide a more flexible specification when we include additional variables, we replace the change in the estimated year effects in the earnings-change regressions with separate year dummy variables. Column 5 shows that replacing the estimated time effects components with explicit year dummies makes no appreciable difference in estimates for the contribution of firm fixed effects or demographic components, and the R-squared is also unchanged.

In the final specification reported in Table 3, we add a dummy variable for whether a job-change occurred. For observations where workers move between jobs, wage growth is estimated to be 0.013 log points (1.3 percent) lower. This contrasts with the higher raw wage growth for movers shown in Table 2. By including the demographic effects, the regression estimates control for the fact that younger workers have both higher rates of job change and higher rates of wage growth. The estimated coefficients on the firm and demographic effects are slightly higher in this specification than those in column (5).

We treat the specification reported in column (6) of Table 3 as the base specification for our analysis, and report results that extend this specification in Table 4. These extensions examine the possible influence of changing peers (co-workers) on wage growth, and whether workers with different abilities benefit differentially from gaining jobs with high-paying firms or high-ability peers. We repeat the results for this baseline specification in the first column of Table 4.

For the first extension, which we report in column (2), we add measures of changing peer demographics and peer fixed effects, and also the level of the worker's estimated fixed effect. The peer variables are calculated as FTE-weighted averages of the demographic and worker fixed effects estimates for co-workers with whom each worker

[20] Panel B of Appendix table A1 shows the effects on the average estimated components of losing the first year due to differencing (column 2) plus non-random balanced sample selection (column 3) relative to the full sample used in the first-stage estimation (column 1). Column 4 presents the means for the balanced sample weighted by lagged FTE employment.

works in a particular year, using estimates from the first stage regression.[21] Earnings growth is higher for workers who have an increase in their average peer fixed effects; while the change in peer demographics has a small negative impact on earnings growth. We also estimate a positive coefficient on the worker fixed effect, which suggests that workers with higher permanent earnings premiums also have higher earnings growth on average. For example, a one standard deviation increase in worker effect (about 0.35) is associated with about 0.4 percent stronger earnings growth per year. The inclusion of these additional covariates also reduces the estimated contribution of changing firm fixed effects. Although not reported separately, this reduction is largely due to the inclusion of the peer effects covariates rather than the worker effect, suggesting that the advantage of moving to a higher paying firm includes a benefit of working with 'better' co-workers.

In columns (3) – (6) we report the results of specifications that interact the worker effect (and its square in columns (4) and (6)) with the job mover dummy, the change in the firm effect, and the change in average peer fixed effects (in columns (5) and (6)). These interaction terms generally have significant coefficients, but are individually difficult to interpret. For this reason, in Figure 1 we present the estimated coefficients for each of the job-mover effect, change in firm fixed effects, and change in peer effects across worker effect profiles (ranging from two standard deviations below the mean worker effect to two standard deviations above).[22] These profiles are based on the final specification reported in Table 4, which includes linear and quadratic worker effect interactions with each of these three variables.

First, the job-mover (mobility) profile for workers is mildly non-linear and negatively sloped across the worker effect, implying an increasing earnings penalty associated with changing jobs for workers with higher fixed effects. That is, for workers with below-average to average earnings premiums, the earnings penalty associated with moving jobs is around -1 percent; and this penalty increases gradually to about -1.8 percent for workers with high earnings premiums.

Second, the estimated coefficient-profile associated with changing firm effects is approximately linear and positively sloped over the range of worker effects presented in Figure 1. This is centred on 0.99 for workers with fixed effect zero, and has a slope of about 0.3. The estimated relative gain associated with a change in firm effect is 0.6 for a worker effect of -0.7 (2 standard deviations below the average), and nearly double that (1.19) for a worker effect of 0.7 (2 standard deviations above the average). The contribution to a worker's earnings growth also depends on the size of the change in the firm fixed effect. For example, if a worker moves to a firm with a 1 standard deviation higher effect (0.09), the contribution to their wage growth is estimated to range from about 5.5 percent for low-effect workers to 10.9 percent for high-effect workers.

Third, the estimated profile associated with the change in average peer fixed effects is concave, but mostly increasing over the range of worker effects. The relative contribution ranges from -0.02 for low-effect (-0.7) workers to about 0.035 – 0.045 for

[21] To contribute to the estimation of the impact of peers, a worker must work with at least 1 FTE of other workers in the year. The regressions include dummies to absorb the cases where the change in peer demographics or peer fixed effects is due to having no peers in either year.

[22] In Appendix figure A1(a) we present the fractions of workers who change jobs and the average change in peer fixed effects across the range of worker fixed effects; and in Appendix figure A1(b) we show the average change in firm fixed effects of movers, and average change in peer fixed effects of movers and stayers across the range of worker fixed effects.

average to high-effect (0 – 0.7) workers. Again, expressing these effects in terms of the scale of the change in peer effects, the earnings growth for a worker who experiences a 1 standard deviation (0.08) increase in average peer effects is estimated to range from -0.2 percent for low-effect workers to 0.3 percent for average to high-effect workers. The magnitude of these effects is considerably smaller than those for changes in firm fixed effects.

We estimate the specification reported in column (6) of Table 4, separately for males and females, and also separately for 20–29, 30–44 and 45–59 year olds. The regression estimates and presented in Table 5, and the analogous coefficient profiles across worker effects are shown in Figure 2 for males and females, and in Figure 3 by age groups. The estimated mobility and change in firm effects profiles in Figure 2 are very similar for males and females; while the estimated peer effects profiles are about 0.025 higher for males than females.

The estimated profiles for the three age groups, presented in Figure 3, show somewhat different patterns. For mobility, shown in Figure 3(a), the effects are approximately linear and declining for prime aged workers (30-44 year olds), are steeper for older (45–59 year olds), and are weaker and convex for young workers (20–29 year olds) across the worker effect range. For older workers the worker effect is likely to be capturing a stronger average tenure effect, particularly for higher-effect workers, and the stronger negative effect of job change on workers' earnings likely reflect the loss in such a tenure component of their earnings.

We describe the patterns of the change in firm effects in Figure 3(b). The profiles across worker effects are both higher and (slightly) steeper for older workers than younger workers, while the profile for prime aged workers lies between the other two but is flatter. Thus, for a given change in firm effect associated with a job move, older workers tend to capture more of the change in their earnings, while the relative gradient across worker effects is similar for older and younger workers. In Figure 3(c) we present the profiles of the estimated change peer effect coefficients. The profile for young workers is steeper than for prime-aged and older workers.

All of the results presented above have been from analysis based on the full sample of paired-year worker observations. This data potentially confounds the experiences of workers who move voluntarily with a view to improving their earnings with the experiences of workers who make less systematic moves. In order to examine the robustness of our results to these effects, we now select a sample of more stable job movers and stayers. In particular, we select a sample of workers with the following characteristics: (i) they have at most a single transition into or out of LEED during the observation period (that is, they are either "Continuers", "Entrants", or "Exiters", as defined above); (ii) they hold multiple jobs in at most one year; and (iii) their firm FE ($\psi_{j(i)t}$) either changes at most once if they have a single job in each year, or changes in two consecutive years if they have multiple jobs in one year.[23] These criteria select workers who have either stable employment with a single firm (job-stayers), or experience a single job change. For an additional robustness check, we also select the balanced subsample of workers who work in each year of the sample (that is, the Continuers).

In Table 6 we compare the regression results based on all worker-year observations (presented in column (1)), with those based on the more selective sample of single job-

[23] Recall that, as discussed above, a typical job change (occurring during a year) will result in a change in the Firm FE both in the year of the change and the following year. Workers who change jobs between years (so that they hold a single job in each) will have a single change in their Firm FE.

movers and stayers (in column (3)), and the Continuers' subsample (in column (5)). For this exercise, we use the regression specification reported in column (2) of Table 4, and our main focus is the estimated effect of moving on workers' earnings growth. The estimated coefficient on the "Mover" dummy variable is similar across the three samples, suggesting that moving is associated with an annual fall in earnings of between 1.1 percent (for the sample of single movers and stayers) and 1.5 percent (for the subsample of Continuing workers).

To describe how the selected samples differ, we have also reported the means of the variables in the even numbered columns of Table 6. By construction, the two selected samples have much lower fractions of job-movers (14.9 and 10.0 percent versus 47.3 percent for the full sample of worker-year observations).[24] In addition, workers in these samples also have lower average earnings growth and Firm FE growth, and higher average Worker FE (θ_i) than the overall sample. Each of these differences reflects the relative selectivity of prime aged workers with higher worker-specific earnings premiums, who are more likely in stable career employment. We suspect this helps explain the larger loss in earnings associated with changing jobs for workers among the Continuers' subsample of single movers and stayers: that is, such workers are likely to have built up more firm-specific tenure over time, which is lost when changing jobs.

We also describe the residual earnings change trends over the period for the selected sample of single-movers and stayers. First, Figure 4(a) shows the average residual earnings change of the subsamples of job-staying Continuers, Entrants, and Exiters. In this figure we have aligned the years such that year-0 refers to the first year-change observed for Continuers (that is, 1999/2000–2000/01) and for Entrants, and the final year-change for Exiters. For Continuers, the average residual change is very small (less than 0.7 percent in magnitude in each year), and shows no particular trend. However, for Entrants, the average residual change is positive and quite large (3.3 percent) in the first year, and declines gradually to about zero in year-4, and then negative in years 5 and 6. This pattern is consistent with positive tenure effects during the early years of employment in a job, although the first year's change may be confounded by unusual LEED-entry effects. For Exiters, somewhat symmetrically, the average residual earnings change is small and positive 5 and 6 years before exit, turning negative in the 4 years leading up to exit, and a large (9.6 percent) positive change in the exit year. We suspect this large final-year change is due to a combination of accumulated leave, redundancy and other retirement payments to such workers.

Next, in Figure 4(b) we present analogous trends in average residual earnings changes for single job-moving Continuers, Entrants, and Exiters. In this figure, we have aligned the years such that year-0 refers to the year of observed job-change for each worker. There are two patterns we want to emphasise from this figure. First, Entrants have generally positive but declining residual changes in both their first-job (before year-0) and second-job (after year-0), again consistent with positive and declining tenure-related earnings growth during the early years of a job. The residual changes for Entrants are also generally larger in magnitude than those of either Continuers or Exiters, except during the final year of employment for Exiters where, again, there is a large (8.0 percent) average change. Continuing workers also have positive average residual earnings change in the years after a job change (years 2–5), consistent with positive but declining tenure-related earnings growth.

[24] We have also estimated regressions that control for worker fixed effects (rather than the estimated Worker FE from the first-stage regression) for these two samples. The estimated job-moving effects on workers' earnings remain negative and are somewhat larger (-1.5 and -1.8 percent per year for the two samples, or -3.0 percent and -3.6 percent respectively per move) than those reported in Table 6.

Second, there are quite striking residual-change patterns in the year of change and the following year. For Entrants who change jobs, the average residual change increases in year-0, suggesting newer (and younger) workers benefit from changing jobs. However, for Continuers and Exiters, the residual change falls in years-0 and 1 (to 0.0 and -2.1 percent for Continuers and -2.9 and -2.8 percent for Exiters). These patterns are also consistent with the loss of tenure-related earnings premiums when workers change jobs. Curiously, for both of these groups, the residual earnings change is, on average, positive (1.3 percent) in the year prior to a job change. We have no satisfactory explanation of this effect.

Finally, to describe the residual earnings changes around the point of a job-change further, in Figure 4(c) we show the pattern of average residual earnings change for all single-mover workers around the year of job-change on a smaller scale, and repeat the patterns for the job-moving Continuers shown in Figure 4(b). We believe this highlights the patterns shown in Figure 4(b). In particular, this shows the declining, and generally positive, average residual changes in the years prior to job-change; the saw-tooth positive-negative-postive average changes in the three years around a job-change; and the declining, and generally positive, changes in the later years. We suspect the year-0 zero average residual changes may be due to negative tenure-related effects associated with job change offsetting positive accumulated leave and redundancy payments in the final-year with a firm.

6. Concluding discussion

The paper provides a preliminary analysis of the relationship between workers' job mobility and their annual wage changes using LEED data. Our primary focus has been on to what extent workers *upgrade* their jobs over time by moving to higher paying firms, and the extent of the tradeoff between making wage gains from such upgrading and the loss of tenure-related earnings associated with changing firms.

The analysis provides the following tentative contributions. First, we conclude that, although job-movers have slightly higher raw annual earnings growth than job-stayers, when we control for other factors job-movers have on average lower earnings growth. Our estimated penalty associated with job moves depends on the particular regression specification: from our base specification the estimate is 1.3 percent per year. These results are somewhat larger than Maloney's (2006) LEED results, which were based on a more selective sample of job-movers and stayers, and a somewhat different methodology.

Second, workers who change jobs, on average, gain 0.3 percent per year from moving to a firm with a higher firm earnings premium, but lose 1.6 percent per year transitory earnings relative to workers who don't change jobs. For younger workers (aged 20–29) and those who enter LEED employment during the period, the extent of moving to better firms is larger (1.0 – 1.2 percent on average), while the associated transitory earnings losses are smaller (1.2 – 1.3 percent on average). We interpret these findings as being due to an earnings growth tradeoff for workers between moving to a higher paying firm and losing their tenure-related earnings at their existing firm. Our regression estimates also show that, on average, higher ability workers (as measured by higher worker fixed effects) and older workers experience greater earnings loss associated with a job move.

Third, consistent with our first-stage estimation, we estimate that, on average, workers gain (almost) all of the change in firm earnings premiums when they change jobs. However, such relative gains are not equally shared by all workers. In particular, our estimates suggest that it is the higher ability workers who make the greatest income gain (or loss) from moving to a firm with a higher (or lower) earnings premium. Andersson et al., (2005) emphasise the importance to low-paid workers of moving to a higher paying firm. We find that, while all workers appear to gain from a move to better

paying firms, higher ability workers benefit relatively more. We also estimate that older workers tend to receive more of the change in firm effects than younger workers.

Finally, we find that workers' earnings also benefit on average from a change in the average earnings premium of their co-workers. Controlling for other factors, we estimate that a 1 standard deviation change in the average peer effect provides about 0.25 percent change in a worker's earnings on average.

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8. Appendix 1

In this appendix we describe the selection and weighting effects in terms of the sample characteristics of the analysis sample versus wider population samples in the data. The first stage estimation of the log(FTE earnings) equations are weighted by contemporaneous FTE employment, while our second stage analysis examines year-to-year wage dynamics and is weighted by workers' lagged FTE employment. Appendix table A1 compares descriptive statistics of the balanced sample weighted by each worker's previous year's (lagged) FTE employment (column 4) as used in the analysis, and three samples weighted by workers' contemporaneous FTE employment (columns 1–3). These samples are the full sample of worker-year observations in all years (column 1) and the full sample of worker-year observations in years 2–9 (column 2), and the balanced subsample of observations for workers who also worked in the previous year (column 3).

Over the 9 years of the sample period, there are 18.4 million total worker-year observations (a little over 2 million per year on average) and FTE employment of 12.6 million workers (about 1.4 million per year). Dropping the first year observations (for comparability with the balanced sample), there are 16.6 million observations and FTE employment of 11.4 million. Of these, 14.5 million (FTE employment of 10.9 million) also had observations in the previous year, which represents a match rate of 88 percent of workers, and 95 percent of FTE employment.

A comparison of columns (2) and (3) shows that workers observed in consecutive years on average have higher earnings and are older than other workers in the sample. The year-to-year growth in the average log(FTE earnings) over the period for the full sample is 0.015 (1.5 percent) per year. In contrast, the average balanced sample log(FTE earnings) growth shown in Appendix table A1 is 0.056. The difference between these two averages is due partly to experience related wage-growth associated with ageing in the balanced sample, and partly to a selection effect of workers with lower than average initial year log(FTE earnings) and stronger wage growth being over represented in the balanced sample. For example, older workers, who have higher-earnings but lower earnings growth on average, will contribute to this latter selection effect because they are more likely to retire and so not be in the balanced sample.

The mean log(FTE earnings) of the balanced sample weighted by each worker's lagged FTE employment in column (4) are 1–3 percent higher than in column (3), while the average change in log(FTE earnings) is lower (0.036 versus 0.056) implying that workers with higher earnings and lower growth on average worked more in the previous year than current year.

Second, in panel B of Appendix table A1, we compare the averages of the various components from the first-stage two-way fixed effects regression of log(FTE earnings).

Table 1

Sample characteristics

Sample	Log (FTE Earn) (1)	Change in log (FTE Earn) (2)	Female (3)	Age (4)	Stayer (5)	Number of Observations (6)	Total FTE (7)
All	10.695	0.036	0.462	38.40	0.527	14,506,400	10,602,400
Movers	10.586	0.037	0.488	35.75	0.000	7,702,700	5,016,600
Stayers	10.793	0.036	0.439	40.78	1.000	6,803,700	5,585,800
Males	10.818	0.037	0.000	37.99	0.550	7,379,400	5,705,100
Females	10.552	0.036	1.000	38.88	0.500	7,127,000	4,897,300
				Age group:			
20-29	10.535	0.064	0.450	24.70	0.378	3,368,200	2,282,200
30-44	10.789	0.028	0.451	37.09	0.540	5,125,800	4,063,600
45-59	10.785	0.018	0.496	51.17	0.618	3,767,300	3,159,100
				Worker fixed-effects Quartiles:			
1 (Lowest)	10.276	0.025	0.722	41.46	0.474	4,449,900	2,650,600
2	10.527	0.038	0.499	35.92	0.463	3,761,600	2,650,600
3	10.733	0.044	0.361	35.65	0.524	3,385,600	2,650,600
4 (Highest)	11.245	0.038	0.266	40.56	0.646	2,909,200	2,650,600
				LEED Sample Transitions:			
Continuers	10.757	0.030	0.459	40.48	0.559	8,141,000	6,909,600
Entrants	10.545	0.073	0.459	32.11	0.430	2,937,300	1,614,900
Exiters	10.653	0.024	0.467	37.99	0.529	1,714,200	1,234,400
Miscellaneous	10.539	0.037	0.487	33.96	0.447	1,713,900	843,500

Notes: Based on LEED data from 1999/2000 – 2007/08. All means are weighted by lagged FTE employment. Earnings in constant (2008) $-values.

Table 2

Summary of Mover versus Stayer Earnings and Firm-effects changes

Sample	Levels			Changes			Move - Stay Changes		
	Log (FTE Earn) (1)	Firm effect (2)	Residual (3)	Log (FTE Earn) (4)	Firm effect (5)	Residual (6)	Log (FTE Earn) (7)	Firm effect (8)	Residual (9)
All	10.695	0.003	-0.002	0.036	0.002	-0.001	0.001	0.003	-0.016
Movers	10.586	-0.014	-0.013	0.037	0.003	-0.010	…	…	…
Stayers	10.793	0.018	0.008	0.036	0.000	0.006	…	…	…
Males	10.818	0.020	-0.001	0.037	0.001	0.000	0.002	0.003	-0.016
Females	10.552	-0.018	-0.003	0.036	0.002	-0.003	0.002	0.004	-0.015
				Age group:					
20-29	10.535	-0.006	-0.004	0.064	0.006	-0.009	0.001	0.010	-0.013
30-44	10.789	0.020	-0.003	0.028	0.000	-0.001	-0.011	0.001	-0.012
45-59	10.785	0.003	0.001	0.018	-0.001	-0.001	-0.019	-0.002	-0.017
				Worker fixed-effects Quartiles:					
1 (Lowest)	10.276	-0.037	-0.006	0.025	0.001	-0.004	-0.005	0.002	-0.013
2	10.527	-0.005	-0.006	0.038	0.003	-0.008	0.008	0.005	-0.015
3	10.733	0.009	-0.001	0.044	0.002	-0.002	0.012	0.005	-0.012
4 (Highest)	11.245	0.045	0.007	0.038	0.000	0.008	-0.008	0.000	-0.017
				LEED Sample Transitions:					
Continuers	10.757	0.012	-0.001	0.030	0.001	-0.002	-0.002	0.002	-0.012
Entrants	10.545	-0.023	0.002	0.073	0.007	0.007	0.025	0.012	-0.008
Exiters	10.653	0.002	-0.005	0.024	-0.001	-0.005	-0.030	-0.002	-0.044
Miscellaneous	10.539	-0.021	-0.009	0.037	0.002	-0.009	-0.007	0.003	-0.023

Notes: All estimates are weighted by lagged FTE employment. The difference between a “Move” and “Stay” change is calculated as the difference between the average change of move-year observations and the average of stay-year observations. “Continuing” workers work in each of the 9 years; “Entering” workers make a single transition into LEED employment; “Exiting” workers make a single transition out of LEED employment; “Miscellaneous” workers are all other workers. Changes are annual changes. A consequence of our definition of job change is that a job change is generally captured as a two-year job change episode (see text). The change associated with a job change is therefore obtained by doubling the change entries in the table.

Table 3

Regressions of log(FTE Earnings) change, all workers

	Levels		Changes			
	FTE Weights	Lag(FTE) Weights	FTE Weights	Lag(FTE) weights		
	(1)	(2)	(3)	(4)	(5)	(6)
Firm FE	1.016	1.035	0.938	0.965	0.965	0.967
	(.0003)	(.0002)	(.001)	(.001)	(.001)	(.001)
Demographics	0.987	0.995	0.916	0.781	0.779	0.814
	(.0003)	(.0002)	(.001)	(.001)	(.001)	(.001)
Time effects	0.998	0.978	0.814	0.863	…	…
	(.001)	(.001)	(.004)	(.005)		
Worker FE	1.007	1.012	…	…	…	…
	(.0003)	(.0002)				
Mover	…	…	…	…	…	-0.013
						(.0001)
Year controls	N	N	N	N	Y	Y
Young/old controls	N	N	Y	Y	Y	Y
R-squared	0.910	0.880	0.144	0.116	0.116	0.117

Notes: Robust standard errors are in parentheses. Regressions in columns 1 and 3 are estimated using FTE employment weights; all other regressions are estimated using lag(FTE employment) weights.

Table 4

Regressions of log(FTE Earnings) change

	1	2	3	4	5	6
Firm FE	0.967	0.958	0.964	0.991	0.963	0.988
	(.001)	(.001)	(.002)	(.002)	(.002)	(.002)
Demographics	0.814	0.811	0.811	0.817	0.812	0.817
	(.001)	(.001)	(.001)	(.001)	(.001)	(.001)
Mover	-0.013	-0.012	-0.012	-0.011	-0.012	-0.011
	(.0001)	(.0001)	(.0001)	(.0001)	(.0001)	(.0001)
Peer demographics	…	-0.002	0.003	0.002	0.002	0.001
		(.001)	(.001)	(.001)	(.001)	(.001)
Peer FE	…	0.026	0.027	0.026	0.026	0.035
		(.001)	(.001)	(.001)	(.001)	(.001)
Worker FE	…	0.011	0.006	0.005	0.007	0.006
		(.0002)	(.0003)	(.0003)	(.0003)	(.0003)
Worker FE *						
Mover	…	…	-0.008	-0.004	-0.008	-0.005
			(.0004)	(.0003)	(.0004)	(.0003)
Firm FE	…	…	0.307	0.410	0.300	0.395
			(.007)	(.005)	(.007)	(.005)
Peer FE	…	…	…	…	0.009	0.041
					(.004)	(.003)
Worker FE-squared	…	…	…	0.005	…	0.005
				(.001)		(.001)
Worker FE squared *						
Mover	…	…	…	-0.005	…	-0.005
				(.001)		(.001)
Firm FE	…	…	…	-0.180	…	-0.171
				(.008)		(.008)
Peer FE	…	…	…	…	…	-0.048
						(.005)
Year controls	Y	Y	Y	Y	Y	Y
Peer controls	N	Y	Y	Y	Y	Y
Young/old controls	Y	Y	Y	Y	Y	Y
R-squared	0.117	0.117	0.119	0.119	0.119	0.119

Notes: All regressions are estimated using lag(FTE employment) weights. All covariates are in changes, except for the Mover dummy variable and worker fixed effects.

Table 5

Regressions of log(FTE Earnings) change, by Sex and Age

	By Sex		By Age		
	Male	**Female**	**20-29**	**30-44**	**45-59**
Firm FE	0.999	0.980	0.910	1.000	1.120
	(.002)	(.004)	(.003)	(.003)	(.005)
Demographics	0.866	0.772	1.006	0.392	0.949
	(.002)	(.002)	(.006)	(.016)	(.021)
Mover	-0.011	-0.013	-0.011	-0.011	-0.017
	(.0002)	(.0002)	(.0003)	(.0002)	(.0003)
Peer demographics	0.000	0.005	-0.019	0.000	0.022
	(.002)	(.002)	(.002)	(.002)	(.003)
Peer FE	0.046	0.026	0.034	0.024	0.034
	(.002)	(.002)	(.002)	(.003)	(.003)
Worker FE	0.017	0.003	0.063	0.008	-0.014
	(.0005)	(.0005)	(.0007)	(.0004)	(.0005)
Worker FE *					
Mover	-0.002	-0.007	0.001	-0.006	-0.015
	(.0007)	(.0006)	(.0010)	(.0005)	(.0006)
Firm FE	0.323	0.398	0.388	0.303	0.485
	(.008)	(.010)	(.010)	(.007)	(.013)
Peer FE	0.030	0.029	0.067	0.016	0.027
	(.006)	(.004)	(.007)	(.005)	(.005)
WFE-squared	-0.005	0.013	0.004	0.016	0.014
	(.001)	(.001)	(.002)	(.001)	(.001)
WFE-squared *					
Mover	-0.009	-0.002	0.032	0.004	-0.001
	(.001)	(.001)	(.003)	(.001)	(.001)
Firm FE	-0.112	-0.276	-0.166	-0.195	-0.246
	(.009)	(.027)	(.038)	(.014)	(.017)
Peer FE	-0.044	-0.054	-0.062	-0.035	-0.043
	(.008)	(.007)	(.018)	(.011)	(.007)
Year dummies	Y	Y	Y	Y	Y
Peer controls	Y	Y	Y	Y	Y
Young/old dummy	Y	Y	Y	Y	Y
R-squared	0.131	0.105	0.139	0.098	0.093

Notes: All regressions are estimated using lag(FTE employment) weights. All covariates are in changes, except for the Mover dummy variable and worker fixed effects.

Table 6

Regressions of log(FTE Earnings) change

	All Observations		Maximum 1 job change		Balanced sample	
	Regression	**Means**	**Regression**	**Means**	**Regression**	**Means**
Log(FTE earnings) change	…	0.0363	…	0.0315	…	0.0233
Firm FE	0.958	0.0016	1.061	0.0006	1.110	-0.0001
	(.001)		(.001)		(.008)	
Demographics	0.811	0.0132	0.735	0.0045	0.835	0.0007
	(.001)		(.003)		(.006)	
Mover	-0.012	0.4732	-0.011	0.1485	-0.015	0.1007
	(.0001)		(.0003)		(.0004)	
Peer demographics	-0.002	0.0018	-0.018	0.0007	-0.062	0.0003
	(.001)		(.003)		(.004)	
Peer FE	0.026	-0.0040	0.025	-0.0065	-0.006	-0.0072
	(.001)		(.002)		(.003)	
Worker FE	0.011	0.0059	0.011	0.0842	0.007	0.1131
	(.0002)		(.0003)		(.0003)	
Year controls	Y	…	Y	…	Y	…
Peer controls	Y	…	Y	…	Y	…
Young/old controls	Y	…	Y	…	Y	…
R-squared	0.117	…	0.066	…	0.063	…
No. Observations	14,506,400		4,804,500		2,806,200	
Total lag(FTE emp)	10,602,400		3,918,600		2,614,400	

Notes: All regressions are estimated using lag(FTE employment) weights. All covariates are in changes, except for the Mover dummy variable and worker fixed effects.

Figure 1

Impacts of Mobility, changing Firm effects and Peer effects on log(FTE earnings)

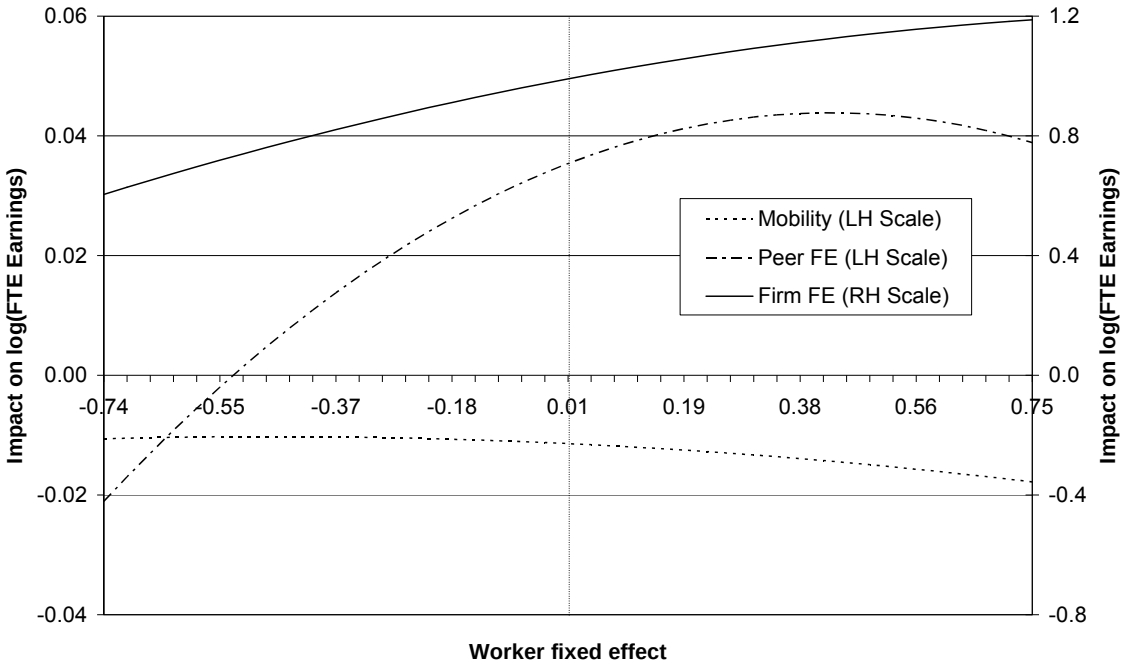


Figure 2

Impacts of Mobility, changing Firm effects and Peer effects, by Sex

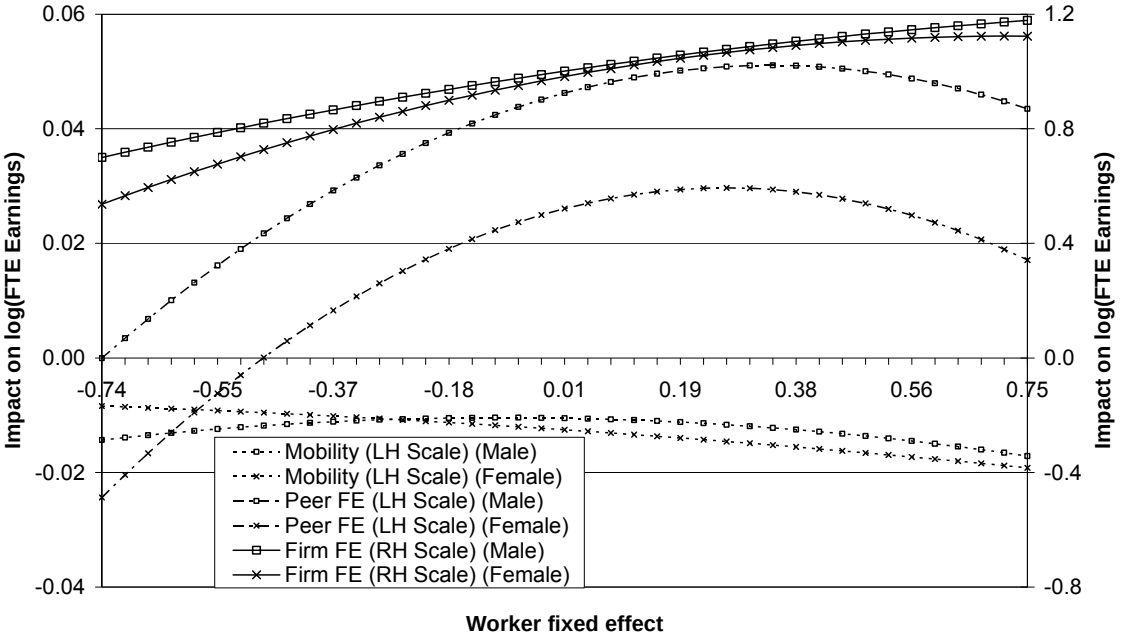
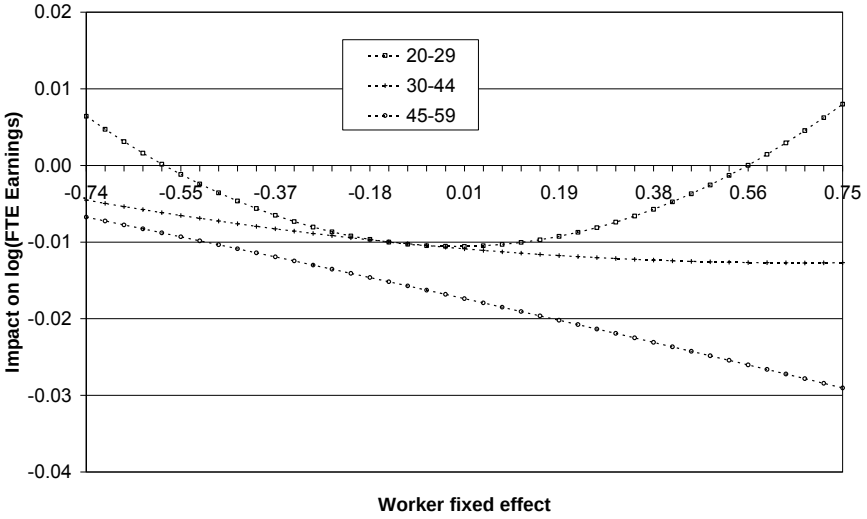


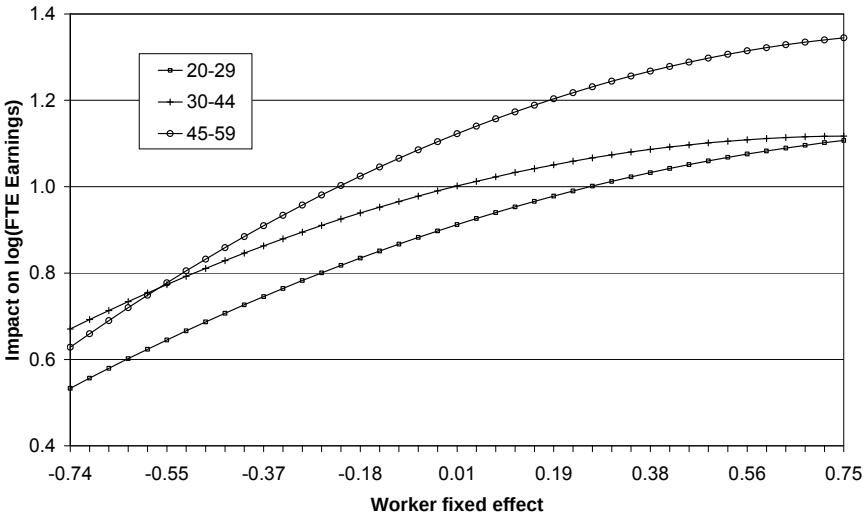
Figure 3

Impacts of Mobility, changing Firm effects and Peer effects, by Age

(a) Mobility



(b) Change in Firm effects



(c) Change in Peer effects

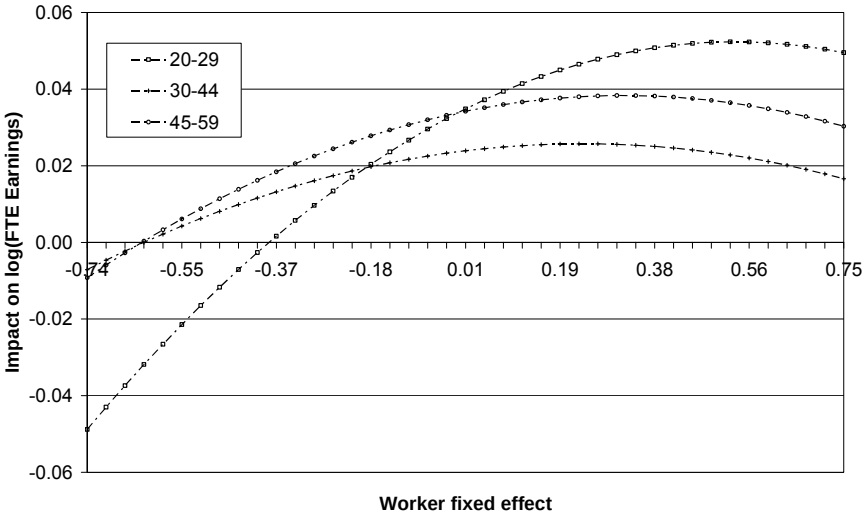
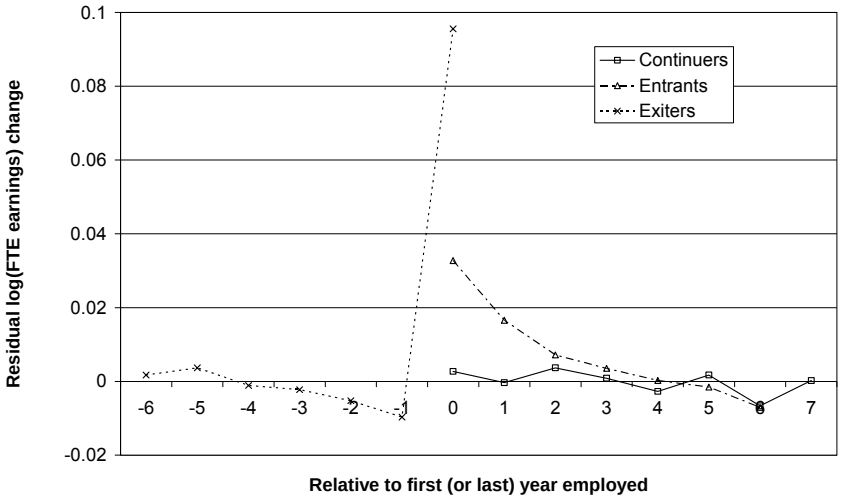


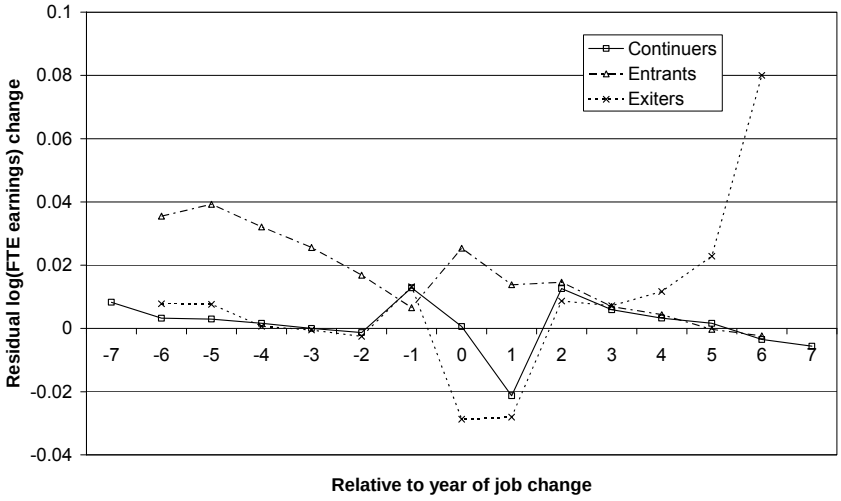
Figure 4

Residual log(FTE earnings) dynamics

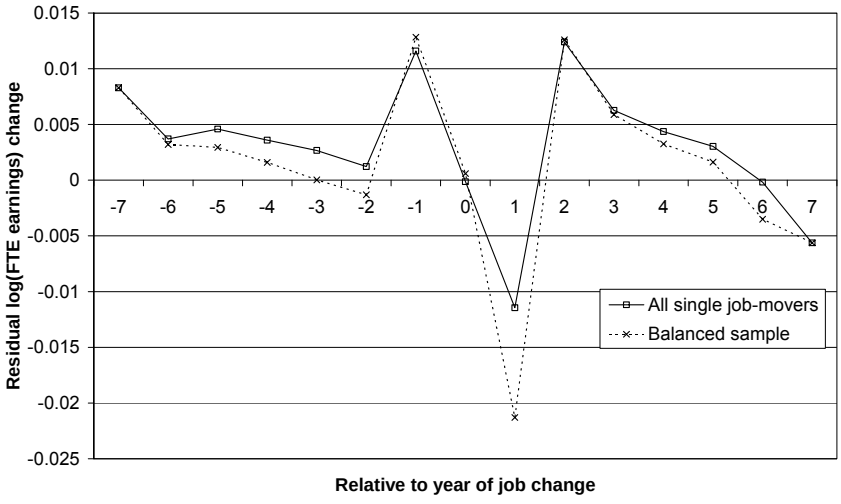
(a) Job-stayers



(b) Job-movers



(c) Job-movers



Appendix table A1

Sample characteristics

	FTE Employment weighted			Lagged FTE Employment weighted
	All years sample	Years 2-9 sample	Balanced sample	Balanced sample
	A: Summary of raw characteristics			
log(FTE Earn)	10.665	10.670	10.684	10.695
lag log(FTE Earn)	10.628[1]	10.628[1]	10.628	10.659
log(FTE Earn) change Δy_{it}	0.056[1]	0.056[1]	0.056	0.036
Female	0.462	0.462	0.463	0.462
Age[2]	38.78	38.89	39.08	39.43
Job mover	…	…	0.487	0.473
	B: Summary of first stage two way fixed effects estimation[3]			
Demographics ($X'_{it}\beta$)	0.000	0.000	0.005	0.015
Time effects (τ_t)	0.000	0.009	0.009	0.009
Worker effects (θ_i)	0.000	-0.003	0.001	0.001
Firm effects (ψ_j)	0.000	-0.001	0.002	0.003
Residual (ε_{it})	0.000	0.000	0.002	-0.002
Peer demographics	0.002	0.002	0.004	0.005
Peer worker effects	0.006	0.003	0.005	0.006
Worker-year Obs	18,377,700	16,553,800	14,506,400	14,506,400
Worker-year FTE	12,614,800	11,375,800	10,862,600	10,602,400

Notes: Based on LEED data from 1999/2000 – 2007/08. Earnings in constant (2008) $-values.
[1] Mean over balanced sample of workers with previous year jobs.
[2] Average age of those aged 18-64 years.
[3] All estimates expressed relative to full sample (column 1) means for each component.

Appendix table A2

Number of Jobs by Mover / Stayer Characteristic

No.	Full sample			Balanced sample					
	FTE weighted			FTE weighted			lag_FTE weighted		
Jobs	Movers	Stayers	Total	Movers	Stayers	Total	Movers	Stayers	Total
1	42.64	99.98	67.98	34.54	99.98	68.13	35.52	99.98	69.48
2	38.58	0.02	21.54	44.06	0.02	21.46	43.89	0.02	20.78
3	12.17	0	6.79	13.89	0	6.76	13.44	0	6.36
4	4.06	0	2.26	4.63	0	2.25	4.41	0	2.09
5	1.43	0	0.8	1.63	0	0.79	1.54	0	0.73
6+	1.12	0	0.62	1.26	0	0.61	1.19	0	0.56
All	100	100	100	100	100	100	100	100	100

Notes: Total FTE employment of the full sample is 12.6 million, the balanced sample is 10.9 million; and lag(FTE) weighted employment of the balanced sample is 10.6 million.

Appendix table A3

Distributions of Movers and Stayers by year

Year	Full sample FTE weighted		Balanced sample FTE weighted		Balanced sample lag(FTE) weighted	
	Movers	Stayers	Movers	Stayers	Movers	Stayers
1	17.60	0	0	0	0	0
2	9.47	10.80	11.53	10.80	11.57	10.82
3	9.67	11.18	11.76	11.18	11.77	11.15
4	9.90	11.74	12.01	11.74	11.96	11.69
5	10.09	12.39	12.22	12.39	12.16	12.35
6	10.47	12.87	12.69	12.87	12.57	12.84
7	10.89	13.19	13.23	13.19	13.20	13.16
8	10.92	13.63	13.29	13.63	13.45	13.71
9	10.99	14.21	13.27	14.21	13.31	14.28
Total	55.8	44.2	48.67	51.33	47.32	52.68

Notes: Total FTE employment of the full sample is 12.6 million, the balanced sample is 10.9 million; and lag(FTE) weighted employment of the balanced sample is 10.6 million.

Appendix table A4

Sample characteristics

		By Worker FE quartile			
	Mean	**Q1**	**Q2**	**Q3**	**Q4**
log(FTE Earn)	10.695	10.272	10.522	10.726	11.237
log(FTE Earn) change	0.036	0.025	0.038	0.044	0.038
Female	0.462	0.726	0.503	0.364	0.267
Age	39.43	42.33	36.96	36.87	41.55
Job stayer	0.527	0.474	0.463	0.522	0.644
Worker-year Obs	14,506,400	4,358,300	3,750,100	3,415,000	2,983,100
Worker-year FTE	10,602,400	2,587,800	2,639,000	2,661,600	2,714,000
			Movers		
log(FTE Earn)	10.586	10.255	10.462	10.648	11.153
log(FTE Earn) change	0.037	0.023	0.041	0.051	0.033
Female	0.488	0.718	0.501	0.371	0.298
Age	36.70	40.65	34.03	33.67	38.94
Worker-year Obs	7,702,700	2,506,100	2,258,300	1,815,500	1,122,800
Worker-year FTE	5,016,600	1,360,600	1,418,400	1,272,400	965,300
			Stayers		
log(FTE Earn)	10.793	10.290	10.592	10.797	11.284
log(FTE Earn) change	0.036	0.028	0.034	0.038	0.040
Female	0.439	0.734	0.505	0.357	0.250
Age	41.89	44.23	40.37	39.76	42.99
Worker-year Obs	6,803,700	1,852,100	1,491,800	1,599,500	1,860,300
Worker-year FTE	5,585,800	1,227,200	1,220,600	1,389,300	1,748,700

Notes: Based on LEED data from 1999/2000 – 2007/08. All means are weighted by lagged FTE employment. Earnings in constant (2008) $-values.

Appendix table A5

Summary of first-stage two-way fixed effects estimation

Sample	Log (Earnings) (y_{it})	Worker sex & age ($X'_{it}\beta$)	Time effects (τ_t)	Worker effects (θ_i)	Firm effects (ψ_j)	Residual (ε_{it})
			Lag(FTE employment) weighted			
Balanced	10.695	0.015	0.009	0.006	0.003	-0.002
			Expressed relative to row 1 means			
Movers	-0.109	-0.029	-0.001	-0.052	-0.017	-0.011
Stayers	0.098	0.026	0.001	0.046	0.015	0.010
			Quartile 1 Worker fixed-effects			
All workers	-0.423	0.049	0.003	-0.430	-0.041	-0.005
Movers	-0.440	0.044	0.002	-0.423	-0.053	-0.010
Stayers	-0.405	0.054	0.004	-0.437	-0.028	0.001
			Quartile 2 Worker fixed-effects			
All workers	-0.173	-0.028	0.002	-0.134	-0.008	-0.005
Movers	-0.233	-0.062	0.001	-0.134	-0.023	-0.015
Stayers	-0.103	0.011	0.003	-0.133	0.009	0.007
			Quartile 3 Worker fixed-effects			
All workers	0.031	-0.043	0.000	0.067	0.006	0.001
Movers	-0.047	-0.090	-0.001	0.064	-0.009	-0.012
Stayers	0.102	0.000	0.001	0.070	0.018	0.012
			Quartile 4 Worker fixed-effects			
All workers	0.542	0.023	-0.005	0.474	0.042	0.008
Movers	0.457	-0.003	-0.008	0.442	0.032	-0.006
Stayers	0.588	0.037	-0.004	0.492	0.047	0.016

Notes: Earnings quartiles are defined based on worker fixed effects.

Appendix table A6

Distributions of first-stage regression estimates by year

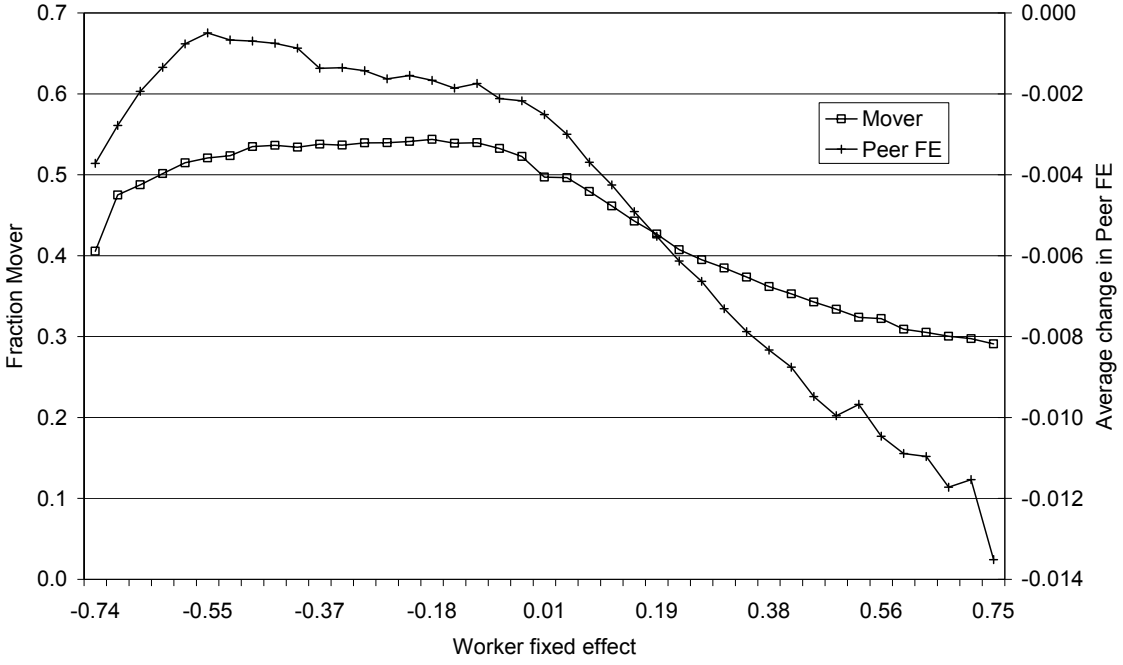
Year	Log (Earnings) (y_{ijt})	Worker sex & age ($X'_{it}\beta$)	Time effects (τ_t)	Worker effects (θ_i)	Firm effects (ψ_j)	Residual (ε_{ijt})	Fraction Female	Average Age	No. of Workers	Total FTE Emp'ment
All years	10.665	10.665	0.000	0.000	0.000	0.000	0.462	37.41	18,377,700[(1)]	12,614,800[(1)]
				Relative to full sample average:						
1999/2000	10.614	-0.002	-0.080	0.026	0.006	0.000	0.462	36.58	1,823,900	1,239,100
2000/01	10.612	-0.001	-0.078	0.022	0.005	0.000	0.462	36.85	1,863,300	1,268,600
2001/02	10.627	0.001	-0.055	0.014	0.003	0.000	0.462	37.19	1,910,000	1,304,100
2002/03	10.634	0.002	-0.040	0.007	0.000	0.000	0.462	37.38	1,971,700	1,351,700
2003/04	10.661	0.002	-0.004	0.000	-0.002	0.000	0.462	37.50	2,038,200	1,401,100
2004/05	10.676	0.000	0.020	-0.005	-0.002	0.000	0.461	37.54	2,112,300	1,454,200
2005/06	10.689	-0.001	0.040	-0.011	-0.002	0.000	0.462	37.64	2,176,400	1,501,500
2006/07	10.703	0.000	0.058	-0.016	-0.002	0.000	0.463	37.79	2,219,100	1,528,800
2007/08	10.736	0.000	0.098	-0.024	-0.003	0.000	0.463	37.91	2,262,800	1,565,700
				1999/2000 – 2007/08 Change:						
	0.122	0.002	0.179	-0.050	-0.008	0.000	0.001	1.33	24.1%	26.4%

Notes: Based on LEED data from 1999/2000 – 2007/08. Earnings in constant (2008) $-values. Analysis weighted by contemporaneous FTE employment.
(1) Total worker-year observations, and annual FTE employment over the period.

Appendix figure A1

Job mobility and changes in Firm and Peer effects across workers

(a) Job mobility and average change in Peer fixed effects



(b) Average changes in Firm and Peer fixed effects