Job changes and the return to skills and tenure

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December 27, 2016

Preliminary version — comments welcome!

All identifying information about returns to seniority comes from loss of tenure in job changes, but these transitions have differing characteristics. This paper uses a short panel representative of the U.S. college-educated population to estimate these returns, incorporating information about the characteristics of job changes. When job changes are treated as equivalent, the estimated returns to tenure are in line with previous estimates. However, when tenure is interacted with the type of transition, I find that loss of tenure has a large wage cost when an individual changes both employer and type of job, but average wage change is indistinguishable from zero when only the employer changes. These results imply that overall returns to tenure represent mainly the accumulation of skills that are matched to the current position and that tenure with an employer in itself has minimal return. Transitions to a different type of job cause a deterioration in the skill match and corresponding wage loss.

On average, wages rise with employee seniority. That relationship may help to reveal important features of the labor market, yet it has been troublesome for economists in various ways. One view has been that the relationship is evidence of employer-specific factors such as firm-specific human capital or deferred compensation (Hutchens, 1989). However, there has been recurring suspicion that much of the wage increase associated with tenure is an artifact of unobserved heterogeneity or failure to control appropriately for secular wage trends (e.g., Altonji and Shakotko 1987; Topel, 1991; Altonji and Williams, 2005; Buchinsky, Fougère, Kramarz and Tchernis, 2010). Another line of thought is that studies have confused employer effects with industry or occupation effects (Neal, 1995; Parent, 2000; Kambourov and Manovskii, 2009). The relationship between tenure and earnings has also played an important role in efforts to test for asymmetric employer learning (Schönberg, 2007; Pinkston, 2009).

This paper combines two ideas to provide insight into why wages rise with tenure. First, separately identifying the effects of experience and tenure relies on job changes; if nobody ever changed jobs, experience and tenure would be perfectly correlated and their effects could not be separately identified. Tenure effects therefore can only be identified via the loss of tenure in job transitions. Therefore I focus attention on these transitions. Second, a hard distinction between firm-specific and general human capital can be misleading (Lazear, 2009), so change in job content is a key feature of job transitions and is potentially as important, or more important, than change of employer.

A newly available longitudinal linkage between the 2010 and 2013 rounds of the National Survey of College Graduates (NSCG) allows me to focus on job transitions. The data make it possible to distinguish among three types of transitions: different job with the same employer (SE-DJ), similar job with a different employer (DE-SJ), or different employer and different type of job (DE-DJ). These three job-to-job transition types are identified directly by NSCG respondents who reported a job change between October 2010 and February 2013.

I first estimate the relationship between earnings change and change in tenure when different types transitions are not distinguished. Results indicate that tenure loss has effects in line with previous estimates for both men and women. However, when tenure is interacted with the type of transition, DE-DJ transitions result in large losses, but losing tenure through a SE-DJ or DE-SJ transition

results in far smaller and statistically insignificant losses. The contrast between DE-SJ and DE-DJ transitions implies, first, that returns to employer tenure are minimal, since changing employer without changing type of job incurs essentially no wage penalty associated with loss of tenure. Second, given that returns to employer tenure are small, the results are consistent with returns to tenure representing mainly returns to human capital that accumulates on the job, but is not as well-matched with different positions. Deferred compensation models, for example, Lazear (1979), imply the same losses in DE-SJ and DE-DJ transitions. (SE-DJ transitions are not really comparable because of the internal economics of employers, such as career ladders.)

These results are complementary to and, to a large extent, reinforce those of Kambourov and Manovskii (2009), who found that returns to occupational tenure in their PSID sample are far larger than returns to employer or industry tenure. The data and methodology here offer several advantages. First, the complementary approach taken here is to concentrate on job transitions coded according to respondents' own assessments of whether their jobs have changed. Recorded occupation, in contrast, is based on the coding of short job descriptions provided by respondents.[1] Second, although drawn from a narrower population (college graduates), the NSCG sample is substantially larger than the PSID, and thus allows separate estimation for men and women. Although the results do not differ qualitatively between men and women, for the most part job changes have larger effects for women. Third, I am able to distinguish, to some extent, between voluntary and involuntary transitions.

As a whole, the results are consistent with the predictions of Lazear's skill-weights perspective. They suggest that returns to employer tenure are minimal and that overall returns to tenure represent mainly the accumulation of skills that are matched to the current position. Transitions to a similar type of job cause little deterioration in this match, while transitions to a different type of job cause more substantial disruption of the skill match.

The next section develops a simple theoretical model of job transitions. Sec-

[1]Much of Kambourov and Manovskii's paper is devoted to difficulties with occupational coding. Their detailed analysis mitigates, but probably does not eliminate these. Occupations are also coded in NSCG data. Section 2 compares direct reports and occupational coding.

tion 2 describes the NSCG sample and addresses several issues regarding the key variables. The empirical approach is described in section 3, followed by discussion of the results in section 4.

1 What does economic theory say about job transitions and tenure?

1.1 Skills

Deferring for the moment the issue of deferred compensation, there is no reason why tenure itself should affect wages. Instead, economists believe (hope?) that tenure is statistically related to processes that affect a worker's productivity inside a specific workplace. Taken literally, a Mincer equation augmented with tenure (as used by most of the papers cited above) imposes very strong restrictions on those processes: it implies that when job changes take place the worker retains her accumulated returns to experience, but immediately loses all of her accumulated returns to tenure, whatever those may represent. In other words, the within-employer processes start over. This restrictive view is consistent with interpreting returns to tenure as returns to firm-specific human capital or loss of deferred compensation.

Lazear (2009) has made a persuasive case that little human capital is truly firm-specific. Instead, individuals hold portfolios of skills, each of which is valuable to a subset of employers. Because of on-the-job skill investments, the match between skills and skill needs improves over time, so an individual's portfolio is generally most valuable to her current employer. Lazear's insights suggest a different perspective on the roles of experience and tenure in the evolution of an individual's earnings. In a general way it says that there is no clear line between returns to experience and returns to tenure. But since tenure is a correlate of skill accumulation, at least some of the apparent returns to tenure will be associated with the nature of the work, rather than the employer. Switching employer *and* type of job should result in larger losses than switching employer only. Lazear's approach therefore implies that the earnings losses associated with

loss of tenure will depend on how well matched an individual's skill portfolio is to the requirements of the new job.

The remainder of this section develops a simple model in the spirit of Lazear's to illustrate how different types of job transitions result in different consequences from loss of tenure. The key points illustrated by the model are intuitive. First, even though tenure falls to zero, voluntary job transitions do not generally occur if they involve a pay cut (holding constant non-wage features of jobs).

Second, if returns to tenure represent the improving match between an individual's portfolio of skills and the skill requirements for her job, then DE-DJ transitions result in the greatest disruption of the skill match, so a more negative association between change in tenure and change in wage should be observed in these transitions. The two effects reinforce one another if DE-DJ transitions are involuntary; this is where wage losses associated with lost tenure should be largest.

The model is intended only to illustrate the ideas mentioned above and, therefore, abstracts from non-wage features of jobs and from the notational complications of finite lifetimes. Suppose that each worker has a portfolio of skills described by the vector $S \in \mathcal{R}^n$. Each individual skill might or might not be of use to any particular firm. For each job (position) a firm's production technology determines a target vector of skills, $J \in \mathcal{R}^n$, and a norm $|\cdots|$ on $\mathcal{R}^n$, which it uses to evaluate a worker's skill gap (skill deficiencies) relative to J: $G = |J - \min(S, J)|$, where the minimum is taken element-wise.[2]

I assume that no two jobs are exactly alike: $|J' - \min(J, J')| > 0$ for any pair of jobs. This means that an individual whose skills are ideal for her job, J, will have a larger skill gap if she switches to a different job, J'.

I define match quality as decreasing function of the skill gap, $m(G)$. Employees and firms invest idiosyncratically (in Lazear's terminology) to increase $m(G)$

[2]This specification assumes that the employer places zero value on over-qualification ($S_i > J_i$). The purpose is to capture in a simple way the idea that employers design positions with particular qualifications in mind. Of course, employers do often value skills beyond their normal expectation for a position, but the language implies some asymmetry between under- and over-qualification, which this assumption characterizes sharply.

through explicit training or learning by doing. Therefore, $\Delta m > 0$ in each period; m increases with tenure (time subscripts will not be needed).[3] To highlight key points, I assume that jobs differ from the worker's point of view only in match quality and, therefore, wages.

The market for skill portfolios is bilaterally thin in the following two ways. First, the expected cost of finding a new employee with match quality better than m is $c(m) > 0$ with $c'(m) > 0$. I assume that $c(m)$ rises quickly enough that employers will often choose to hire workers with skill deficiencies: $m < m(0)$. Second, for employed workers, new job opportunities arrive with probability α_1. The arrival probability for unemployed workers is α_2. Each opportunity is characterized by a random realization of J and, therefore, m (how directed search modifies the conclusions is discussed below). These thin-market assumptions imply that, although skill investments themselves are not specific, they generate match quality that *is* specific and that there are switching costs on both sides of the employment relationship.

Switching costs and specificity of match quality imply that there are rents from match quality that must be shared (MacLeod and Malcomson, 1993). I assume that the sharing is determined via an unspecified bargaining process that results in a wage function, $w(m)$, that is increasing in match quality (decreasing in skill distance). Thus wages increase with tenure since it was assumed above that m increases with tenure, but the effect of increasing m implicitly combines the effects are normally thought of as stemming from experience and tenure.

Workers' utility flow is an increasing function of the wage and normalized to be $w(m)$. The flow of utility received when not employed is u_0. The utility flows are discounted by a factor $\beta < 1$. Finally, exogenous separations (i.e., other than job-to-job moves) arrive with probability λ each period.

Although the assumptions above define only part of an equilibrium model of the labor market, they nevertheless have useful and intuitive empirical implications. Let $V(m)$ be the value for an employed worker of a current or new opportunity with match quality m, and let V_u denote the value of unemployment.

[3]This does not rule out the possibility that employees invest with an eye toward the market value of their skill portfolio, only that they do not entirely ignore match quality.

Then

$$V(m) = w(m) + \alpha_1\beta \int_{-\infty}^{\infty} \max\big\{V(m+\Delta m), V(\mu)\big\}\, dF(\mu) \\ + +\lambda\beta V_u + (1-\alpha_1-\lambda)\beta V(m+\Delta m) \tag{1}$$

Since $w(m)$ is monotonic, $V'(m) > 0$. Therefore, an employed worker's reservation match quality is $\mu > m + \Delta m$ (the new job would begin next period), and equation (1) can be written as

$$V(m) = w(m) + \alpha_1\beta \int_{m+\Delta m}^{\infty} V(\mu)\, dF(\mu) + \lambda\beta V_u \\ + (1 - \alpha_1[1 - F(m+\Delta m)] - \lambda)\beta V(m+\Delta m)$$

The second term now highlights that an employed worker thus accepts a new job only at a higher wage. To overturn this implication, the new job would have to be superior on some other dimension (not modeled). The empirical implication is that loss of tenure is associated with *increasing* wages in voluntary job changes.

Turning to decisions made by an unemployed worker,

$$V_u = u_0 + \alpha_2\beta \int_{-\infty}^{\infty} \max\left\{V(\mu), V_u\right\}\, dF(\mu) \tag{2}$$

Since $V'(\mu) > 0$, this individual has a reservation match quality m^* so that equation (2) can be written as

$$V_u = u_0 + \alpha_2\beta F(m^*)V_u + \alpha_2\beta \int_{m^*}^{\infty} V(\mu)\, dF(\mu)$$

Suppose m_0 was the match quality on the worker's previous job. Since the worker was willing to hold that job, it must be the case that $V(m_0) > V_u$, so $m^* < m_0$.[4] Therefore, the expected wage on jobs acquired from unemployment is lower than the average wage in voluntary job-to-job transitions. Since this argument does not involve u_0, it also applies to an employed worker, who knows she is facing an exogenous separation for some reason.

[4]Even if the worker was initially indifferent between the job and unemployment, the asusmption that skill investments take place results in $V(m_0) > V_u$ after only a short time.

If the worker is lucky enough to find a job similar to or better than her old one ($m \geq m_0 > m^*$), her wage will not be lower and may even be higher than on her previous job. Incorporating directed job search (i.e., if the worker can bias her sampling of jobs towards higher m) would amplify this effect.

Reality, of course, differs from the preceding theoretical description in various ways that are relevant when these ideas are brought to the data. First, NSCG respondents were asked to distinguish similar and different jobs. Therefore, when interpreting the empirical results it makes sense to interpret "similar" to mean $m \approx m_0$. "Different" jobs may be better or worse in terms of earnings: a promotion to management vs. a lower-skill job following displacement. The empirical analysis that follows suggests that the skill match generally deteriorates more when respondents judge that they have moved to a "different type" of job, but that is an average across heterogeneous outcomes. Second, many workers switch jobs for reasons beyond termination or higher pay, including, in particular, different non-wage characteristics, such as looking a new job that fits better with family responsibilities.

1.2 Deferred compensation

The assertion that there is nothing about tenure itself that should affect wages is less clearly defensible with respect to models of deferred compensation. Lazear's (1979) model of back-loaded compensation, for example, directly revolves around an employee's time with a firm. If estimated returns to tenure in some way represent deferred compensation, it is important to recognize that there is a complicated selection process behind job changes similar to that described in the previous section, which affects whether an individual will appear to have lost earnings when her employer tenure drops to zero. Consider first what happens in a move directly to a new job. Holding non-wage features constant, an individual will not agree to move to a new firm if the expected present value of earnings at the new firm is not at least as high as it is at her current employer. Therefore, we would not generally expect a drop in current earnings as implied by the augmented Mincer equation.

On the other hand, if the individual is displaced, removing the option of re-

maining with an incumbent employer reduces her reservation wage, so it is possible that earnings will be lower at a new job. But a key feature of deferred compensation as an explanation for returns to tenure is that it is linked specifically to the employer, so there should be no difference between the the consequences of losing tenure in DE-SJ and in DE-DJ transitions.

The overall message of this section is that the earnings consequences of changing jobs and losing accumulated tenure depend on the circumstances of the transition.

2 Data

2.1 Sample definition

The samples for the 2010 and 2013 National Survey of College Graduates were designed to be representative of the college-educated segment of the U.S. population. Overall, the 2010 and 2013 surveys include, respectively, 77,188 and 104,599 respondents with at least a bachelor's degree. A subset of 37,654 respondents from the 2010 NSCG were surveyed again in 2013.[5]

Because the focus of this paper is job transitions, the dependent variable used throughout is the change in the log of current annual salary per hour on the respondent's principal job between the 2010 and 2013 reference weeks. The salary question explicitly excludes other forms of compensation, including any kind of variable pay.[6] Excluding those who were not working full time (at least 35 usual hours per week) during both reference weeks restricts the sample to 20,852 respondents.

[5] Prior to the 2013 survey, the NSCG was strictly cross-sectional. Starting with the 2010 and 2013 surveys the NSCG has employed a rotating-panel design.

[6] Hourly earnings in the Current Population Survey outgoing rotation groups, hourly rate of pay in the National Longitudinal Survey of Youth, and hourly pay in the PSID share this limitation. There is a separate question about total earnings during the previous calendar year, but there is no way using these data to ensure that all earnings derive from the principal job.

I exclude individuals who were self-employed, in active military service, or public school elementary or secondary teachers in either year because the research question is irrelevant to them.[7] Respondents who indicated that they had retired from a previous position between the surveys were excluded, but those who indicated that retirement took place before the 2010 survey were included. In other words, cases where there was a transition from a pre-retirement job to a post-retirement job are excluded. Finally, a small number of respondents who received a degree between surveys or who were enrolled in a degree program at the time of the 2013 survey were dropped.[8] A small number of additional individuals were excluded if their full-time salary was below 52 times the federal minimum wage times their weekly hours. These exclusions reduce the sample size to 13,686, comprising 5,156 women and 8,530 men.

2.2 Job transitions

In 2013, respondents who indicated they were working during the reference weeks for the 2010 and 2013 surveys were asked whether they were working for (1) the "same employer *and* in same type of job," (2) "same employer *but* in different type of job," (3) "different employer *but* in same type of job," or (4) "different employer *and* in different type of job (the emphasis on "and" or "but" is in the questionnaire). As mentioned earlier, answers (1)–(4) are denoted as SE-SJ, SE-DJ, DE-SJ, and DE-DJ, respectively. The numbers of different transition types are reported in table 1.

Respondents' reports of having a different employer are almost certainly reliable, but it is less clear whether "different type of job" is sufficiently reliable to be usable. The NSCG includes a series of questions about 13 work activities (e.g., "accounting, finance, contracts", "computer programming, systems or application development," or "teaching"), which allow a partial assessment (partial because the list of activities is not exhaustive and the activities are broadly defined). Respondents were asked to indicate for each whether they typically spent

[7] For public school teachers, the relationship between salary and tenure is contractually determined by the nearly ubiquitous "steps and lanes" system.

[8] Including the former with dummy variables for degrees attained changes the results only slightly.

Table 1: Number of transitions

	Women			Men		
	Total	Termination	Promotion	Total	Termination	Promotion
No change	4128	0	0	6943	0	0
SE-DJ	336	42	232	410	36	310
DE-SJ	440	114	222	844	247	479
DE-DJ	252	68	126	333	115	155

Notes: Terminations include all individuals who listed termination as a reason for job change. Promotions include all individuals who listed promotion/raise as a reason except those who also listed termination.

Table 2: Main work activity matches between 2010 and 2013 (percent)

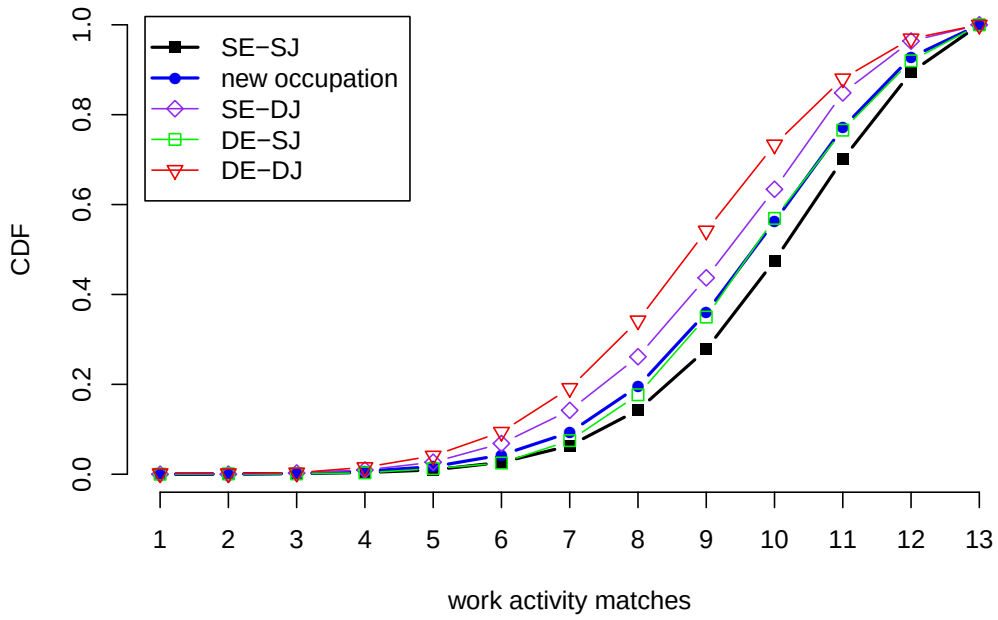
	Self reports				
	unchanged	SE-DJ	DE-SJ	DE-DJ	New occ.
Primary	56.9	35.0	51.2	27.5	48.1
Secondary	29.3	18.8	24.2	16.1	24.2

at least 10 percent of their time on each activity (yes or no). They were also asked to indicate the two that used the most time.

Figure 1 shows the empirical CDF of matches on these 13 work-activity questions between survey rounds by type of transition and change in occupational coding (discussed below). The figure indicates that the distribution of number of matches is consistently shifted to the left for respondents who experienced SE-DJ and DE-DJ transitions compared to individuals who indicated no job change or DE-SJ transitions. Table 2 shows that those who experienced SE-DJ or DE-DJ transitions were also far less likely to have matches on their two most important activities. Thus "different type of job" clearly reflects greater change in the task composition of the job than does "same type of job."

Occupational coding is an alternative way to measure change in job content. It is arguably inferior, however, at least for the NSCG data. Only about two-thirds

Figure 1: CDF of work-activity matches by transition type



of those who report "different type of job" are coded in different occupations, while about one-third of those who report "same type of job" are coded in different occupations. Most telling, perhaps, 31 percent of those who responded that they were in the same job with the same employer were coded as changing occupations. Part of the reason for the first discrepancy may be that the occupational coding scheme is unique to the NSCG and somewhat coarse outside academic and science occupations. For instance, only three management-related occupations are separately identified, but 23 different kinds of post-secondary educators. On the other hand, coarse occupational coding is unlikely to explain why a third of SE-SJ and DE-SJ individuals are coded in different occupations in 2010 and 2013. Figure 1 indicates that changes in occupational coding are less consistent with changes in work activities than are the self-reported transitions. The point is reinforced by table 2, which shows that nearly as many individuals coded with a new occupation indicate no change in their primary and secondary activities as those who said they continued to work in the "same type of job."

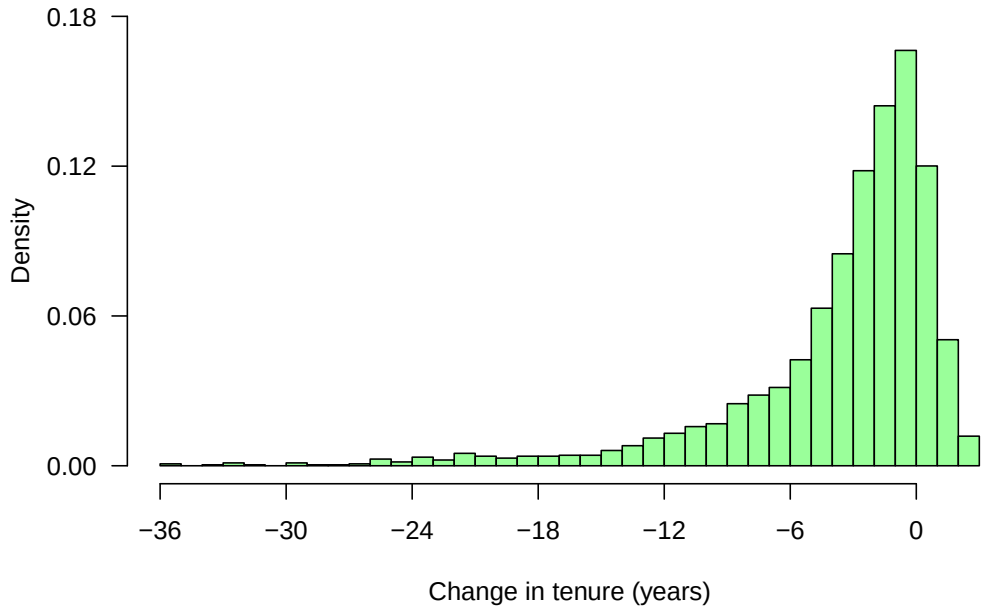
The question about job changes is followed by a series of yes/no questions about reasons for the job and/or employer change. These overlap: an individual can indicate, for example, that a transition happened both for location reasons and because of a termination. The two used below are "pay, promotion opportunities" and "laid off or job terminated." These two are of particular interest because they clearly identify subsets of voluntary and involuntary transitions. The frequency of these reasons by transition type is shown in table 1.

2.3 Tenure variable

Employed respondents were asked for the start date (month and year) of their current principal job, from which I calculate tenure at the reference weeks of the two surveys (October 1, 2010 and Feburary 1, 2013). The distribution of tenure change for job changers is shown in figure 2. Change in tenure for non-changers is 28 months.

In the overall context of the questionnaire it is clear that "principal job" refers to the combination of employer and position, but less clear from the question itself taken out of context. It appears that a minority of respondents reported

Figure 2: Distribution of tenure change, job changers



when they the started with their current employer, rather than the start of their current position. The extent of confusion between employer and position start dates can be assessed by examining the 1,752 individuals in the regression samples who reported a within-employer (SE-DJ) job change. Among these, 294 report an increase in tenure of 28 months, exactly the length of the interval between surveys. However, only two of the 294 report that their 2013 principal job started during October 2010, the only circumstance in which the change in position tenure could be 28 months.[9]

The emphasis in this paper is on between-employer transitions. There the con-

[9]The cluster of 294 people at 28 months is the only significant spike in the distribution of change in tenure for SE-DJ transitions (the next largest is 19 people). There are also 40 individuals with change in tenure greater than 28 months, but these are not necessarily errors because a secondary job in 2010 could have become a principal job in 2013.

fusion between employer and position start date among a minority of respondents generally causes the change in position tenure variable to be biased downwards (to larger negative numbers in most cases) since position and employer tenure on the 2013 job can differ little for job changers. That is, most of the change in measured tenure comes from the loss of the tenure at the 2010 job, which is overstated, not from the tenure accrued at the 2013 job. The econometric consequences are discussed later. Apart from this confusion, there is little evidence of error in the start dates. In particular, the start dates for individuals reporting DE-SJ and DE-DJ transitions appear to be quite consistent with 28 months between reference weeks: only 37 are before October 2010, and none is earlier than February 2010. Among those who did not change jobs, there were no start date discrepancies between the two surveys larger than three months.[10] A small number of individuals with obviously problematic start dates (e.g., the start date for the 2013 job earlier than that of the 2010 job) were excluded.

3 Empirical strategy

The usual approach to estimating returns to tenure is based on the standard Mincer model augmented with tenure variables:

$$S_{it} = \beta_0 + \beta_1 X_{it} + \beta_3 PT_{it} + \beta_4 ET_{it} + \zeta_i + \theta_{ip} + \eta_{ie} + \varepsilon_{it} \tag{3}$$

where S_{it} is the log wage, X_{it} is potential experience PT_{it} is position tenure in years, ET_{it} is employer tenure, ζ_i is an individual fixed effect, θ_{ip} is a position fixed effect, and η_{ie} is an employer fixed effect. To clarify the central points I omit higher-order terms and additional controls.

The empirical strategy used here is first-difference estimation taking into account the constraints implied by different transition types and allowing tenure effects to differ by transition type. With tenure measured in years, differencing

[10] This is intended as indirect evidence about measurement error for those who changed positions. The tenure of non-changers has no bearing on the regression results.

equation (3) over a two-year interval produces[11]

$$\Delta S_{it} = \beta_1 \Delta X_{it} + \beta_3 \Delta PT_{it} + \beta_4 \Delta ET_{it} + \Delta\theta_{ip} + \Delta\eta_{ie} + \Delta\varepsilon_{it} \tag{4}$$

I subsequently suppress t subscripts because there is only one difference, between the 2010 and 2013 surveys. Assuming for the moment that changing to a "similar" job means no loss of position tenure so that $\Delta PT = 2$, equation (4) specializes as shown in table 3 for the different transition types.

Table 3: Augmented Mincer equation for different transition types

same job:	$\Delta S_i = 2\beta_1$	$+2\beta_3$	$+2\beta_4$	$+0$	$+0$	$+\Delta\varepsilon_i$
SE-DJ:	$\Delta S_i = 2\beta_1$	$+\beta_3 \Delta PT_i$	$+2\beta_4$	$+\Delta\theta_{ip}$	$+0$	$+\Delta\varepsilon_i$
DE-SJ:	$\Delta S_i = 2\beta_1$	$+2\beta_3$	$+\beta_4 \Delta ET_i$	$+0$	$+\Delta\eta_{ie}$	$+\Delta\varepsilon_i$
DE-DJ:	$\Delta S_i = 2\beta_1$	$+\beta_3 \Delta PT_i$	$+\beta_4 \Delta ET_i$	$+\Delta\theta_{ip}$	$+\Delta\eta_{ie}$	$+\Delta\varepsilon_i$

The equation for non-changers makes obvious that they provide no way to separately identify the effects of experience and tenure. The usual endogeneity concern in estimating returns to tenure is that tenure is likely correlated with match-specific components of the error term: an individual may have high tenure exactly because θ_{ip} and/or η_{ie} is high. Differencing removes that concern, but there may be a different unobserved selection process for each transition type so that the match-specific components of the error terms, $\Delta\theta_{ip}$ and $\Delta\eta_{ie}$, may be correlated with transition type. I assume, therefore, that

$$\Delta\theta_{ip} + \Delta\eta_{ie} = \mu_x + u_i \tag{5}$$

where μ_x is the mean change in the match-specific components for transition type x (μ_x and u_i are identically zero if there is no transition). The remaining error term components, $\Delta\varepsilon_i$ and u_i, are assumed uncorrelated with the regressors. The basic specification classifies transitions as $x \in \{SEDJ, DESJ, DEDJ\}$.[12]

[11] Differencing over a year simplifies presentation; the actual interval between the surveys was two years and four months.

[12] I also consider $x \in \{SEDJ, DESJ, DEDJ\} \times \{T, P, OR\}$, where *T, P,* and *OR* denote termination, promotion/raise, and other reason, but in this case I interact the tenure variables only with *SEDJ*, *DESJ*, and *DEDJ*. Instead table 6 shows separate estimates for promotions and terminations.

A drawback of the NSCG data is that employer start date is not recorded, so it is necessary to assume that $\Delta ET_i = \Delta PT_i$. Ignoring the misreporting issue discussed in the previous section, this will be exactly correct when the individual held only one position with the 2010 employer. It will be most incorrect for individuals with long employer tenure who moved to a new position with that employer shortly before the 2010 survey and changed employers before the next survey. Since employer tenure must be at least as long than position tenure, the sign of the resulting bias can be easily determined, as discussed below.

The equations in table 4 impose assumption (5) and $\Delta ET_i = \Delta PT_i$ and collect terms.

Table 4: Augmented Mincer equation for different transition types

same job:	$\Delta S_i = 2(\beta_1 + \beta_3 + \beta_4)$	$+0$	$+\Delta\varepsilon_i$
SE-DJ:	$\Delta S_i = 2(\beta_1 + \beta_4) + \mu_{\text{SEDJ}}$	$+\beta_3 \Delta PT_i$	$+u_i + \Delta\varepsilon_i$
DE-SJ:	$\Delta S_i = 2(\beta_1 + \beta_3) + \mu_{\text{DESJ}}$	$+\beta_4 \Delta PT_i$	$+u_i + \Delta\varepsilon_i$
DE-DJ:	$\Delta S_i = 2\beta_1 + \mu_{\text{DEDJ}}$	$+(\beta_3 + \beta_4)\Delta PT_i$	$+u_i + \Delta\varepsilon_i$

I interact the right-hand sides of the equations in table 4 with transition-type dummies to get an equation to estimate:

$$\begin{aligned}\Delta S_i = {} & 2(\beta_1 + \beta_3 + \beta_4) \\ & + \big(2(\beta_1 + \beta_4) + \mu_{\text{SEDJ}}\big) SEDJ_i + \gamma_3 SEDJ_i\, \Delta PT_i \\ & + \big(2(\beta_1 + \beta_3) + \mu_{\text{DESJ}}\big) DESJ_i + \beta_4 DESJ_i\, \Delta PT_i \\ & + \big(2\beta_1 + \mu_{\text{DEDJ}}\big) DEDJ_i + (\beta_3 + \beta_4) DEDJ_i\, \Delta PT_i \\ & + u_i + \Delta\varepsilon_i.\end{aligned} \tag{6}$$

Equation (6) has been re-parameterized in one place: in the SE-DJ component β_4 has been changed to γ_4, acknowledging the possibility that a "different type of job" with the same employer results in a smaller wage penalty on average than when switching to a new employer; must such transitions are probably promotions.

There are several things to note about equation (6). First, changes in earnings *levels* associated with the different transition types are incorporated in the coefficients on the transition dummies. A wage penalty for loss of tenure—a positive coefficient on one of the ΔPT terms—is the penalty relative to the average wage change for that type of transition. Second, the effect of lost employer tenure is captured by the coefficient on $DESJ_i \Delta PT_i$. Third, under the assumption that $\Delta PT_i = \Delta ET_i$ is a good approximation, β_3 can be identified by comparing the ΔPT terms for DE-SJ and DE-DJ transitions. Since employer tenure must be at least as long as position tenure, substituting ΔPT for ΔET biases the estimates of $\beta_3 + \beta_4$ and β_4 upwards.[13]

The augmented Mincer model used to estimate returns to tenure typically includes quadratic tenure terms. I follow that lead, which complicates equation (6). The key point, however, remains: the interactions with $DESJ_i$ capture the effect of loss of employer tenure. The interactions with $DEDJ_i$ capture both effects.

When a quadratic potential experience term is added to equation (3), equation (6) gains a linear potential experience term. However, because the change in tenure is generally not the time between survey weeks except in the no-change case, when a quadratic in tenure is added to (3), the extra terms in (6) involve interactions with $(PT^2_{i,2013} - PT^2_{i,2010})$. Lastly, note that if a common linear wage trend were added to equation (3), its effect would be incorporated into the intercept term.

4 Results

Columns 1 and 4 of table 5 estimate a version of the empirical model that distinguishes transition types only via intercept shifts. The result is that the estimated effects of losing tenure are modest.[14] (Without dummies for transition types in columns 1 and 4, tenure has a small *negative* effect.)

[13] Since this kind of error is concentrated in tenure on the 2010 job (which is more likely to include a position change), it will be mitigated somewhat if the relationship between tenure and earnings is concave.

[14] Recall that ΔPT is generally negative in transitions, so a positive coefficient corresponds to a loss of earnings.

Estimates of equation (6) (including quadratic terms) are presented in columns 2 and 5. (Parallel regressions that replace respondents' direct report of "different type of job" with change in occupation are shown in the appendix.) There are three important features of these regressions. First, the estimated effects for DE-SJ transitions do not approach statistical significance and the point estimates are small: for a job held for five years the loss is essentially zero for men and only 3 percent for women. Since these estimates include both the effect of loss of employer tenure (β_4) and the effect of loss of position tenure when moving to a similar job (γ_3), they imply that both are minimal.

Second, the earnings penalty from tenure loss is highest by a wide margin in DE-DJ transitions, and is far larger than suggested by columns 1 and 4. Leaving a job held for five years in a DE-DJ transition costs men about 12 percent of salary and women 17 percent. The fact that earnings losses associated with tenure loss are highly concentrated in DE-DJ transitions and are much smaller or nearly absent for DE-SJ moves, strongly suggests that the effects in the DE-DJ case are mainly due deterioration of the match between skills and position.

There is a statistically significant effect of loss of tenure in SE-DJ transitions for men, but, as mentioned earlier, the internal economics of firms (career ladders, for example) complicate interpretation of results for SE-DJ transitions. It is notable, however, that the tenure effect is small enough that main effect of an SE-DJ transition is larger than the loss from losing eight years of position tenure.

The third important feature of the regressions in columns 2 and 5 is the sign and economically important differences in the main effects of SE-DJ, DE-SJ, and DE-DJ transitions. These incorporate the effects of the means of changes in match-specific effects, $\Delta\theta_{ip}$ and $\Delta\eta_{ie}$. The signs (all positive) imply that, on average, transitions result in pay increases.[15]

Columns 3 and 6 employ the finer classification of transition types to allow for more flexibility in capturing unobserved selection processes. The same conclusion about change in tenure emerges; in fact, the change in tenure effects are

[15]Note that equation (6) says that the estimated coefficients understate the change in match-specific components because they capture the change in pay between an old job in October 2010 and a brand new (zero tenure) job in February 2013 relative to the average change for non-changers who accumulate 28 months of tenure.

Table 5: Earnings effects of tenure lost from job changes

	Men			Women		
potential experience	−0.0025****	−0.0027****	−0.0025****	−0.0019****	−0.0022****	−0.0020****
	(0.0003)	(0.0003)	(0.0003)	(0.0003)	(0.0003)	(0.0003)
ΔPT	0.0079****			0.0132****		
	(0.0020)			(0.0027)		
$PT_{13}^2 - PT_{10}^2$	−0.0002**			−0.0002***		
	(0.0001)			(0.0001)		
SEDJ (same employer, different job type)	0.0818****	0.0637****	0.0193	0.1261****	0.0750****	0.0472
	(0.0153)	(0.0165)	(0.0238)	(0.0189)	(0.0187)	(0.0322)
DESJ (different employer, same job type)	0.1050****	0.0794****	0.0046	0.1248****	0.0918****	0.0087
	(0.0132)	(0.0130)	(0.0266)	(0.0186)	(0.0197)	(0.0331)
DEDJ (different employer, different job type)	0.0742****	0.0950****	−0.0446	0.1498****	0.1678****	0.0396
	(0.0212)	(0.0255)	(0.0381)	(0.0247)	(0.0301)	(0.0508)
SEDJ×ΔPT		0.0087**	0.0096**		0.0038	0.0041
		(0.0043)	(0.0043)		(0.0049)	(0.0046)
SEDJ×$(PT_{13}^2 - PT_{10}^2)$		−0.0003*	−0.0003*		0.0000	−0.0000
		(0.0002)	(0.0002)		(0.0002)	(0.0002)
DESJ ×ΔPT		−0.0014	−0.0004		0.0054	0.0025
		(0.0040)	(0.0038)		(0.0073)	(0.0071)
DESJ ×$(PT_{13}^2 - PT_{10}^2)$		0.0003	0.0001		0.0001	0.0001
		(0.0002)	(0.0002)		(0.0004)	(0.0003)
DEDJ ×ΔPT		0.0281**	0.0235**		0.0395*	0.0344*
		(0.0124)	(0.0116)		(0.0232)	(0.0180)
DEDJ ×$(PT_{13}^2 - PT_{10}^2)$		−0.0009	−0.0008		−0.0011	−0.0010
		(0.0006)	(0.0006)		(0.0016)	(0.0012)
promotion×SEDJ			0.0595**			0.0541*
			(0.0234)			(0.0308)
termination×SEDJ			0.0094			−0.0940***
			(0.0414)			(0.0350)
promotion×DESJ			0.1285****			0.1470****
			(0.0260)			(0.0334)
termination×DESJ			−0.0226			−0.0170
			(0.0268)			(0.0373)
promotion×DEDJ			0.2271****			0.2213****
			(0.0413)			(0.0488)
termination×DEDJ			0.0048			−0.0314
			(0.0449)			(0.0499)
$\bar{R}^2$	0.0316	0.0329	0.0492	0.0431	0.0467	0.0713
N	8530	8530	8530	5156	5156	5156

Notes: Significance levesl: *** = 0.01, ** = 0.05, * = 0.1. Heteroskedasticity-robust standard errors in parentheses. PT = position tenure. Dependent variable is change in log salary.

surprisingly similar to those in columns 2 and 5. The main effects for transition types in columns 3 and 6 are of some interest in their own right. The largest effects are for transitions involving promotions/raises. Surprisingly, the main effects of transitions involving terminations are not much different than the other types of transitions.

It might at first seem counterintuitive that there could be a penalty for loss of tenure when changing jobs for promotion or a raise, but that neglects the immediate effects of DE-SJ and DE-DJ transitions shown in table 5, which capture the change in match-specific fixed effects ($\Delta\theta_{ip}+\Delta\eta_{ie}$). For DE-DJ×promotion transitions these coefficients (0.2280 for men and 0.2215 for women) outweigh more than a decade of lost tenure. In other words, the estimates say that longer-tenure workers get raises, but these tend to be smaller percentages than shorter-tenure workers. (If the veteran worker gets a promotion to management, she gets the same salary as the hot-shot two-year employee.) This is a sharp contrast with what happens in DE-DJ×termination transitions. Here short-tenure workers more or less break even, so the penalties associated with loss of longer tenure are not offset.

Table 6 focuses on the transitions associated with terminations and promotions/raises, excluding changers who don't mention termination or promotion/raise as a reason. Those who mention both termination and promotion (144 individuals) are counted as being terminated since the transition was involuntary, regardless of the desirability of the new job. Cell sizes for transitions are much smaller for these regressions, so estimates are imprecise, but the point estimates suggest some nuance in the distinction between termination and promotion. Tenure loss in a DE-SJ is costly for men if the transition is the result of termination, but not if it is the result of promotion. In the latter case, tenure loss in DE-DJ transitions is inconsequential.

For women, the earlier pattern repeats for both termination and promotion: small cost for tenure loss in DE-SJ transitions, large cost in DE-DJ transitions, though the estimates are imprecise.[16]

[16]Testing whether the linear and quadratic tenure terms in DE-DJ transitions are jointly significant yields p-values of 0.06 for terminations (column 3) and 0.24 for promotions (column 4).

Table 6: Earnings effects of tenure lost from job changes, termination and promotion

	Men		Women	
	Termination	Promotion	Termination	Promotion
potential experience	-0.0024^{****}	-0.0025^{****}	-0.0017^{****}	-0.0021^{****}
	(0.0003)	(0.0003)	(0.0003)	(0.0003)
SEDJ (same employer, different job type)	0.0232	0.0839^{****}	−0.0614	0.1003^{****}
	(0.0745)	(0.0197)	(0.0532)	(0.0218)
SEDJ$\times\Delta PT$	0.0052	0.0103^{*}	−0.0026	0.0035
	(0.0231)	(0.0056)	(0.0102)	(0.0065)
SEDJ$\times(PT_{13}^2 - PT_{10}^2)$	−0.0003	−0.0003	0.0002	−0.0000
	(0.0010)	(0.0002)	(0.0003)	(0.0003)
DESJ (different employer, same job type)	0.0382^{*}	0.1226^{****}	0.0236	0.1706^{****}
	(0.0230)	(0.0168)	(0.0437)	(0.0247)
DESJ $\times\Delta PT$	0.0148^{**}	−0.0080	0.0026	0.0105
	(0.0064)	(0.0078)	(0.0152)	(0.0141)
DESJ $\times(PT_{13}^2 - PT_{10}^2)$	−0.0003	0.0004	0.0001	−0.0004
	(0.0002)	(0.0005)	(0.0009)	(0.0011)
DEDJ (different employer, different job type)	0.0714	0.1509^{****}	0.1056^{*}	0.2481^{****}
	(0.0452)	(0.0390)	(0.0551)	(0.0356)
DEDJ $\times\Delta PT$	0.0434^{**}	0.0022	0.0457^{*}	0.0292
	(0.0181)	(0.0201)	(0.0272)	(0.0210)
DEDJ $\times(PT_{13}^2 - PT_{10}^2)$	-0.0014^{*}	−0.0001	−0.0012	−0.0011
	(0.0008)	(0.0011)	(0.0017)	(0.0013)
$\bar{R}^2$	0.0170	0.0469	0.0134	0.0744
N	7341	7887	4352	4708

Notes: Significance levesl: $^{***} = 0.01$, $^{**} = 0.05$, $^{*} = 0.1$. Heteroskedasticity-robust standard errors in parentheses. PT = position tenure. Dependent variable is change in log salary. Individuals who indicated their transition occurred for both reasons are treated as terminations.

5 Conclusion

This paper is based on the observation that identifying information about returns to seniority comes from loss of tenure in job changes and estimates these returns with a focus on the characteristics of job changes: Did they involve a new employer? Did the content of the job change? When job-to-job transitions are treated as equivalent, the estimated returns to tenure are very modest. However, when tenure is interacted with the type of transition, I find that loss of tenure returns is large only when an individual changes both employer and type of job.

I infer from these results that returns to employer tenure are minimal and that overall returns to tenure mainly represent the accumulation of skills that are matched to the current position. Transitions to a different type of job cause a deterioration in this match, making long-tenure workers more equivalent to short-tenure workers.

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Appendix

Table A-1: Earnings effects of tenure loss, using occupation coding

	Men	Women
potential experience	-0.0027^{****}	-0.0022^{****}
	(0.0003)	(0.0003)
SEDO (same employer, different occ.)	0.0129^{**}	0.0340^{****}
	(0.0056)	(0.0068)
SEDO$\times\Delta PT$	-0.0014	0.0014
	(0.0024)	(0.0031)
SEDO$\times(PT_{13}^2 - PT_{10}^2)$	-0.0001	-0.0003^{**}
	(0.0001)	(0.0001)
DESO (different employer, same occ.)	0.0956^{****}	0.1109^{****}
	(0.0191)	(0.0277)
DESO $\times\Delta PT$	0.0036	0.0080
	(0.0059)	(0.0086)
DESO $\times(PT_{13}^2 - PT_{10}^2)$	0.0001	0.0000
	(0.0003)	(0.0003)
DEDO (different employer, different occ.)	0.0754^{****}	0.1403^{****}
	(0.0152)	(0.0197)
DEDO $\times\Delta PT$	0.0075	0.0368^{***}
	(0.0059)	(0.0122)
DEDO $\times(PT_{13}^2 - PT_{10}^2)$	-0.0000	-0.0014
	(0.0002)	(0.0009)
$\bar{R}^2$	0.0303	0.0454
N	8530	5156

Notes: Heteroskedasticity-robust standard errors in parentheses. PT = position tenure.