

Training and Jobs Across the Career: An Empirical Investigation

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Abstract

Using the NLSY79 and the 1995 Survey of Employer Provided Training (SEPT), this paper examines the pattern of on-the-job training over the career - a prominent topic in the early human capital literature, but the subject of little empirical investigation. In addition to containing a comprehensive record of formal training, employment experience, and employers, the NLSY79 has data on informal training and positions within firms for some years, allowing one to analyze the relationship of training not just to experience, but to job mobility between and within firms. SEPT contains employee logs of formal and informal training over several days. Informal training declines steeply with position tenure but shows relatively weak results for employer tenure and experience once position tenure is accounted for. Formal training shows inconsistent results between datasets, with a much weaker role of position tenure.

I. Introduction

The human capital model has been a cornerstone of labor economics since it was introduced by Becker and Mincer over fifty years ago (Becker (1962), Becker (1964), Mincer (1962)). The most immediate and perhaps most fundamental application of the model involves treating schooling and on-the-job training as investments in human capital. Viewing these investments over an individual's life cycle, one obtains the now familiar explanation of the generally observed pattern of lifetime earnings, as described by Ben-Porath (1967): "People make most of their investments in themselves when they are young, and to a large extent by foregoing current earnings. Observed earnings are therefore relatively low at early years, and they rise as investment declines and as returns on past investments are realized. The main reason why investment is undertaken mostly by the young is that they have a larger period over which they can receive returns on their investment." Another part of the story is the cost of human capital investment. As an individual's wage increases, the opportunity cost of further investment in human capital rises. In his seminal paper, Ben-Porath develops a formal model that combines these two considerations. Heckman (1976) tests the model with census income data and finds that the point estimates, although estimated imprecisely, make economic sense.

There is a voluminous empirical literature exploring the volume and profitability of educational investments, dating from the same time period as the papers mentioned in the previous paragraph. The empirical analysis of on-the-job training was limited by a lack of data but has grown in the last few decades as new data sources have become available. While there is

now a reasonably extensive empirical literature on the returns to and incidence of training,¹ there are strikingly few papers that examine the life-cycle pattern of training in spite of its prominence in the earlier theoretical literature.

What papers there are mostly pre-date the availability of training data. The earlier literature relies heavily on indirect measures of training that are dependent on an assumed wage-generating mechanism. Mincer (1962) obtains an estimate of on-the-job training by comparing the average wage streams of high school and college graduates and assuming that the rate of return to on-the-job training is the same as the rate of return to schooling. Mincer (1991) obtains indirect estimates of training drawing on the wage profiles estimated by Rosen (1982) using the PSID. (Similarly, Shaw (1984) uses estimates from a wage equation to infer the intensity of investment in occupational human capital.)

Mincer (1991) also obtains a direct estimate of training by drawing on Duncan and Stafford (1980) who use a small scale time use study (the sample size is 375) to estimate the amount of hours that workers of different ages spend in on-the-job training. He finds that his “direct” and “indirect” estimates are close and concludes that “at least 90% of the observed growth in the wage profiles ... is attributable to training on the job!”

¹ Lillard and Tan (1986) examine how training incidence varies among men, women, whites, and blacks using training information in CPS supplement, the National Longitudinal Surveys, and the Employer Opportunities Pilot Project. Lerman, McKernan, and Riegg (1999) examine the incidence and intensity of employer-provided training in the 1997 National Employer Survey, the 1995 Survey of Employer-Provided Training, and the 1995 National Household Education Survey. Also, see Frazis and Loewenstein (2007). More recently, see Almeida and Faria (2014) – especially Table A1 - for a listing of papers estimating the returns to a spell of training in a number of developed and developing countries. .

Mincer's (1991) paper is essentially the end of the literature analyzing the life cycle profile of on-the-job training.² In this paper, we resurrect this literature using more current data sources with extensive measures of on-the-job training.

We use two datasets in our analysis: the National Longitudinal Survey of Youth (NLSY79) and the 1995 Survey of Employer Provided Training (SEPT). Both datasets contain information on the hours that workers spend acquiring formal and informal on-the-job training. The NLSY79 also contains variables describing workers' careers, allowing one to construct measures of actual experience and tenure at a given employer. In addition, it has information on whether individuals have experienced a position change since the last interview, enabling one to calculate position tenure. While the SEPT does not contain information on the total amount of labor market experience, it also has information on employer and position tenure.

It is of interest to determine what happens to the relationship between experience and training once one controls for employer and position tenure. One reasonable hypothesis is that most training occurs when a worker moves to a new position – either at the same employer or at a new employer – as training is required to accomplish the tasks associated with the position.³ While this implies a more discontinuous experience/training profile for individual workers than that of the Ben-Porath model, it need not contradict the basic implication that training declines with experience. At the beginning of their careers, individuals move around quite a bit and receive a lot of training. Over time, mobility falls, which may have the consequence that workers on average need less training. One can think of different positions as corresponding to different levels of human capital. As the career progresses and human capital investment

² For a more detailed summary of the literature than that provided here, see Mincer (1997).

³ This is similar to Shaw's (1984) hypothesis that human capital investment declines as an individual spends time in an occupation and then picks up when the individual moves to a new occupation.

declines, promotion or mobility to a higher position at another employer becomes less frequent. (An interesting question that we are not able to examine here is the extent to which training in earlier positions is valuable in a new position and the extent to which training at an initial employer is useful at a similar job at a new employer.⁴)

In the analysis to follow, we use a two-part model to examine the time pattern of training over workers' careers. Our two-part model allows for distinct incidence and duration effects. In addition, we estimate separate equations for formal and informal training. Furthermore, we include controls for worker heterogeneity. A unique feature of our analysis is the inclusion of a position tenure variable. .

Specifically, we are concerned with the relationship between training and experience, employer tenure, and position tenure. We are interested in the following types of questions. Does training fall over individuals' working lives, as intuition might indicate and as Mincer's findings suggest? To what extent might an observed relationship between training and experience and (employer or position) tenure reflect worker heterogeneity? What happens to the relationship between training and experience and worker tenure when one controls for position tenure?

⁴While Becker originally defined specific training as a human capital investment that raises a worker's productivity only at the employer providing the training, Loewenstein and Spletzer (1999) find that employers and workers believe that little on-the-job training is truly employer-specific. Altonji and Williams (2005) find that the return to employer tenure plays only "a modest role in the determination of wages" and Neal (1995) argues that "the literature on returns to seniority focuses too narrowly on firm-specific factors. Displaced workers who find new jobs in their predisplacement industries earn substantial returns to their predisplacement tenure." A focus on industry instead of the type of job workers are in may be too narrow as well. Kambourov and Manovskii (2009) find substantial return to occupational tenure. However, controlling for occupational tenure, they find that industry and employer tenure both have "relatively little importance in accounting for the wage one receives."

To anticipate some of our results, position tenure is the key variable affecting training. Formal and informal training both fall sharply as position tenure increases. Further, the relationship between training and experience and employer tenure depends on whether one controls for position tenure. Whether or not one controls for position tenure, formal training does not decline with experience (interestingly, before 1987, the duration of formal training falls, but this is offset by an increase in incidence). Informal training falls markedly as experience increases, although this relationship appears to become a little weaker once one controls for position tenure (however, our estimates are not precise enough to be certain about this). Formal training and especially informal training fall with employer tenure, but these effects largely disappear when one controls for position tenure.

II. Data Description

NLSY79. We use the NLSY79 to analyze the timing of formal and informal training throughout an individual's working life. The NLSY79 is a dataset of 12,686 individuals who were aged 14 to 21 in 1979. These individuals were interviewed annually from 1979 to 1994, and every two years since then. The response rate was over 90 percent for each year until 1996, and as of 2000 was 83 percent. We use data from the 1979 through 2010 surveys.⁵

The formal training section of the survey begins with the question, "Since [the date of the last interview], did you attend any training program or any on-the-job training designed to help people find a job, improve job skills, or learn a new job?" Individuals who answer yes to this question are then asked a series of detailed questions about each of their different training spells. In 1988 and thereafter, individuals are asked about the duration of their various training spells in weeks and the average number of hours each week that were spent in training. For each training

⁵ Individuals were not interviewed in 1995. From 1996 on, the survey has been conducted every other year.

spell, we have calculated the number of hours spent in training as the product of the duration in weeks and the average number of hours spent in training during a week. The key training variable used in the empirical work to follow is training occurring in the past year. In calculating this variable, we do not include training occurring more than 52 weeks prior to an individual's interview.

The training questions were changed somewhat in 1988. From 1979-1986, detailed information was obtained only on training spells that lasted longer than one month.⁶ We have used the information contained in the later surveys to impute hours spent in training for training spells in the early surveys that last less than one month. Besides conditioning on the fact that a spell lasts less than one month, our imputations also condition on an individual's age, gender, race, education, and experience.⁷

The focus of our analysis is training whose explicit cost is at least partly paid for by the employer.⁸ Information on who paid for training is available only after 1987; prior to 1987, we include only company training and spells lasting less than one month. (The post 1987 data indicate that company training was generally paid for by the employer. Prior to 1987,

⁶ Training questions were not asked in 1987.

⁷ In the later surveys, individuals were explicitly asked about both the weekly duration of training and the year and month that a training spell began and ended. In the early surveys, individuals were asked about the year and month that a training spell began and ended, but were not explicitly asked about the number of weeks that a training spell lasted. We used the information in the later surveys to impute the number of weeks in the early surveys - our imputation is a quadratic in months, where months is calculated as the difference between the ending and starting month. In both the early and later surveys, individuals were not asked about the number of weeks that a training spell lasted if the training spell was ongoing at the time of the interview. We used the same quadratic in months to impute for number of weeks when training is ongoing at the time of the interview.

⁸ Presumably, some of this cost can be passed on to the worker in the form of a lower wage. Eighty-five percent of the training spells in the NLSY79 are at least partially paid for by the employer. We focus on this training because it would appear to correspond most closely to the on-the-job training concept referred to by Becker and subsequent human capital theorists.

individuals with spells less than one month were not asked about the type of training they received; the post 1987 data indicate that short spells are generally employer-paid).

In investigating the timing of training through individuals' careers, it is important to distinguish between training that took place on the current job and training that took place on other jobs. By comparing the beginning and ending dates of a training spell with the date that the individual started working at his current job, we are able to classify a training spell as occurring on the current job or on a previous job.⁹

Besides providing information on formal training, the NLSY79 has information on informal training in 1996, 1998, and 2000. After being asked about formal training, individuals who have worked at a given employer are asked the following question in the 1996 – 2000 interviews: “Besides the schooling and training programs we've just talked about, during the last 4 weeks while working at [employer name] did you receive any informal on-the-job training from your supervisor, your coworker(s) or both?” Individuals who indicate that they received informal on-the-job training from supervisors are then asked how many weeks and how many hours per week they spent with their supervisor receiving informal training. Similarly, individuals who received informal training from coworkers are asked about the number of weeks and the number of hours per week that they spent receiving informal training from co-workers.

Respondents are next asked whether during the last four weeks they received “any informal on-the-job training by making use of any self-study material or self-instructional packages, such as manuals, workbooks or computer-assisted teaching programs.” As with the

⁹ In cases where the individual holds more than one job simultaneously, we assume that training occurs on the individual's main job.

other types of informal training, individuals indicating that they used self-study material are asked about the number of weeks and the number of hours per week that they engaged in self-study. The questions on self-study continue to the present.¹⁰ For the years 1996 – 2000, we use the responses to the informal training questions to construct estimates of the number of hours individuals spent receiving each of the three types of informal training during the four weeks prior to their interview. Adding up the hours individuals are engaged in the different kinds of informal training, we obtain a measure of the total number of hours of informal training during the four week period prior to an individual’s interview. We annualize by multiplying by 13 for comparability with the formal training data.

We are interested in determining how training evolves over the course of workers’ careers as they gain experience at an employer and in a given position at an employer and as they move among employers and positions. The longitudinal information in the NLSY79 allows us to determine both accumulated labor market experience and workers’ tenure at their current employer at the time of the interview. It also allows us to measure the tenure they eventually achieve at this employer before they move on to another employer, the survey ends, or they attrit from the survey.^{11,12}

¹⁰ We will present some results for self-training in an appendix to a future draft.

¹¹ The survey provides information on all jobs worked at during the time period between the last interview and the current view. A previous employer indicator allows one to link these jobs with jobs that were reported at the last interview, enabling one to construct a tenure profile from the time workers begin working for an employer until the time they move on. In a few cases, the tenure information is inconsistent, often as a result of ambiguities in the previous employer indicator. We delete these jobs from our analysis.

¹² The NLSY79 tenure variable is simply the difference between a worker’s ending and starting date at an employer. In our analysis, we use an adjusted tenure variable, obtained by subtracting out “job gaps” or periods during which an individual does not work at the employer.

In addition to providing information on a worker's tenure at an employer, the NLSY79 also provides information that allows us to determine a worker's tenure in a position from 1996 onward. Specifically, workers are asked whether they have "experienced a promotion, a demotion, or any other type of position change" since the last interview (or since they started working at an employer if the employer is new). Individuals responding that they experienced a position change are then asked when this occurred.¹³ Using this information, we are able to calculate a worker's position tenure. Specifically, for a worker who experienced a position change, tenure in the new position is simply the length of time from the date of the position change to the interview date. And for workers who have not changed positions at their employer, position tenure is equal to position tenure at the time of the previous interview plus the change in employer tenure since the last interview.

SEPT: The 1995 Survey of Employer-Provided Training (SEPT) was conducted by the Bureau of Labor Statistics (BLS) for the Employment Training Administration (ETA) in order to provide nationally representative data on the training practices of employers.¹⁴ A sample of 1,433 establishments for the survey was drawn to represent the universe of private establishments that had fifty or more employees. In addition to collecting data from establishments, randomly selected employees in the responding establishments were interviewed.

An employee questionnaire obtained background information on demographic characteristics as well as questions on employer and position tenure. The specific tenure questions were "How many years have you worked for your current employer?" and "How many

¹³ Individuals experiencing more than one position change are asked about their most recent position change.

¹⁴ A more detailed description of the survey can be found in Frazis, Gittleman, and Joyce (2000).

years have you been in your current job?”¹⁵ As actual labor market experience is not available, in our analysis below, we use potential experience, defined as age – years of education – 6. From the 2,124 potential employee responses (2 employees from each of the 1,062 establishments that responded to the employer survey), 1,074 employee questionnaires were collected.

An employee log captured the number of hours of both formal and informal training. Employees kept a log for 10 calendar-days.¹⁶ Employees reported on any activity in which they were ‘taught a skill or provided with new information to help them do their job better.’ For each learning activity, the following questions were asked: who or what helped them learn the skill or information, how they learned the skill or information, what type of skill or information was learned, and how much time was spent learning this skill or information. Based on answers to the first two of these questions, BLS used an algorithm to classify each activity as formal training, informal training or self-learning.¹⁷ We use the employee log to derive percentage of work time spent in formal and informal training. SEPT contains the standard demographic variables as well as information on education. We also include hours worked during the log period and number of days the log was filled out as variables in our models.

III. Estimation Method

¹⁵ A previous question asks “How many years have you been doing this kind of work?”, so position tenure is unlikely to be confused with occupational tenure.

¹⁶ Interviewers trained the employees on the log by having them recall their activities over the prior three days and then to keep a daily log over the next seven days.

¹⁷ Hours spent doing self-learning are not counted as training.

In both of our datasets, a relatively small proportion of the sample have any training during the reference period. Accordingly, we estimate the effects of our variables of interest on training using a two-part model¹⁸:

$$1) \Pr(T > 0) = F(X\beta)$$

$$\ln T = X\gamma + e \text{ if } T > 0$$

where T denotes hours of training, F is the standard normal distribution, X is a vector of covariates including a constant, β and γ are conformable vectors of covariates, and e is a mean-zero residual. If e is homoscedastic, the expected value of training conditional on X is

$$2) E(T|X) = F(X\beta) \exp(X\gamma)E(\exp(e)).$$

We use the sample mean of $\exp(e)$ (the “smearing” estimator of Duan 1983) to estimate $E(\exp(e))$.¹⁹

All our regressions include indicators for female, black, and Hispanic, and years of education and its square. In the NLSY79 we include indicators for individual calendar year. In addition, we construct a variable “years not employed” which equals age minus years of experience and included it and its square. We use this measure to account for the effect of aging without acquiring experience.

Cross-sectional estimates of the effect of experience and tenure on training are potentially misleading. Workers with a greater attachment to the labor force and hence who acquire more experience will (other things equal) have a greater return to general human capital and would be

¹⁸ There is an extensive literature on two-part models of this type in health economics. See Mullahy (1998) and Manning and Mullahy (1999) for a discussion and consideration of alternatives.

¹⁹ We tested for the presence of heteroscedasticity by regressing estimated $\exp(e)$ on X in each specification. In no case was the regression as a whole significant at the 10 percent level.

expected to get more training. Similarly, workers in a good job match would be expected to both have greater ultimate job tenure and to acquire greater specific capital (Jovanovic 1979).

While there is no straightforward way to correct for this in SEPT, the longitudinal nature of the NLSY79 allows us to correct for heterogeneity of this sort. Accordingly, most of the NLSY79 specifications that we report include the variable years not employed at a given age as a measure of attachment to the labor force. In addition, final employer tenure and final tenure in the position are included as measures of match quality. We will refer to these collectively as “heterogeneity controls”. This approach is similar to that in Abraham and Farber (1987). Further details of the construction of these variables are given below. Pure fixed-effect approaches are not practical in our current application given the non-linearity of the probit function (see Maddala, 1987, for example). In addition, the relatively small number of respondents with multiple training spells (especially within a given employer or position) means that fixed-effects are problematic for the second stage of the estimation.

While it is instructive to estimate the association of training with the measures of labor force attachment and match quality, and to see how these affect the association of training with experience and tenure, such estimates cannot be interpreted causally. Training may itself cause increased tenure and greater attachment to the labor force.²⁰ We do not attempt to estimate a causal effect in this paper.

IV. Results

²⁰ For a short review of the literature on training and turnover, see Frazis and Loewenstein (2007, ch. 5 and ch. 6.3)

We present three sets of estimates. In the first, we include experience and experience squared but not tenure. In the second set of estimates, we include both experience and tenure with the current employer. Our specification with experience and employer tenure includes a quadratic in tenure and experience at the start of the job. Specifically, we include the five terms $[T, T^2, (E - T), (E - T)^2, T(E - T)]$, where E is experience and T is tenure. This formulation is equivalent to one in which E is entered directly, but allows a cleaner interpretation of the effect of tenure as the experience term does not increase one-for-one with tenure. For the third set of estimates, we include position tenure. Analogous to our treatment of experience in our second set of equations, our position tenure specification contains the variable $(T - P)$, where P is position tenure. This variable represents employer tenure at the start of the current position. We use a complete quadratic specification in P , $(T - P)$, and $(E - T)$.that includes pairwise interactions between these variables.

We will refer to the specifications described above as the experience, tenure, and position tenure specifications, respectively. The three specifications correspond to different questions. The experience specification describes how training evolves over the career abstracting from employer or position mobility. The position tenure specification describes both the direct effect of position tenure and, by comparison with the experience specification, how the experience effect is intermediated by position mobility. As we noted above, if mobility falls over the life cycle, even a large degree of intermediation is consistent with the basic Mincer/Ben-Porath model of human capital accumulation. The employer tenure specification shows how experience is intermediated by employer tenure. Employer tenure also picks up the effect of position tenure when position tenure is not available, as in our pre-1987 NLSY79 data.

Experience: Formal training.

NLSY79: For our NLSY79 sample, we exclude the military and poor-white supplementary samples as well as respondents who were enrolled in school since the previous interview.²¹ We only include observations whose current or most recent job since the last interview is in the private sector. All estimates are weighted using the NLSY79 sample weights.

In the NLSY79 we use a measure of actual labor market experience. Our measure of experience includes time spent in the armed forces, although current active duty armed-forces members are excluded from the sample by restricting the sample to current private sector employment. It also excludes experience attained before the first 12-month gap in schooling. For these runs, we include all employer-provided training in the previous year (the training can occur on both the current job and previous jobs).

In the specifications with heterogeneity controls, we include the number of years not employed at age 45 as a measure of labor-force (non)-attachment. (For formal training before 1987, we use years not employed at age 30 instead as a better guide to labor force attachment in the early career.)²² Hereafter we refer to this variable as “labor force nonattachment”. We include labor force nonattachment and its square in all specifications with heterogeneity controls. For the tenure specification we add final tenure with the current employer and its square, and for the position tenure specification we add final position tenure and its square. Where the job is continuing as of the last interview, we impute final tenure (and final position tenure) from a hazard regression whose explanatory variables are the other covariates aside from tenure and the

²¹ For 1979, we exclude respondents enrolled in 1978 or later.

²² Years not employed are imputed for observations where the respondent has dropped out of the sample before the relevant age. Specifically, we predict the proportion of weeks spent employed between the current interview and age 45 (30) from a tobit regression (with limits 0 and 1) on the vector of covariates using a sample with age 45 (30) observed.

calendar year dummies plus a cubic in the start date of the job (these terms are highly significant). The hazard model assumes a log-normal distribution of completed tenures.²³

Unlike the experience specification which includes training at all employers in the previous year, the tenure specification restricts training to that received on the current job. To get a training-per-year measure in cases where tenure is less than a year, we divide training duration by (weeks of tenure/52). In the position tenure specification we restrict the training measure to training acquired in the current position and similarly construct a training-per-year measure.

For all three sets, we estimate models with and without the corresponding heterogeneity controls, though we show training profiles only for specification with heterogeneity controls (except for some specifications run for comparison with SEPT).

Table 1 shows descriptive statistics. We describe results for each variable of interest in turn. Turning to formal training first, we divide the NLSY79 sample period into two parts—1979-86 and 1988-2010--corresponding to the change in the training sequence described earlier.

Table 2 shows the results of joint significance tests on the variables of interest, using both equations in the two part model. Table 3 shows the equivalent results for the heterogeneity controls. Letting X be the variable of interest, note that the null hypothesis being tested is that all the coefficients for variables including X as a factor are equal to zero in both the incidence and the log duration equations. This is not equivalent to the hypothesis that the slope of the function $E(T|X)$ as shown in (2) and (3) is non-zero at any given point, as the incidence and duration coefficients may counteract each other. We show an example of just this situation below.

²³ Abraham and Farber (1987), in an analogous situation, used a gamma distribution, which nests the log-normal. Estimates with the gamma are close to those using the log-normal, and the estimate of the additional parameter in the gamma distribution is small and not significant. Computation of the expected value of completed spells is simpler using the log-normal.

Similarly, note that a test of the null that the slope of the training profile with respect to X —a specific non-linear combination of the coefficients of the two-part model—is zero may have more power than a joint test of the coefficients. We find cases where the null that the slope is zero is rejected while the hypothesis that all variables including X as a factor are zero is not rejected. We focus most of our attention on the slope of $E(T|X)$.

We see from Table 2 that the experience terms are often significant at the 5 percent level for formal training. However, this test is not informative about the shape of the training-experience profile. To show the shape of the profile, we calculate the expected value function (2) at mean values for covariates aside from experience in Chart 1a for formal training for the pre-1987 period and Chart 2a for the post-1987 period.²⁴ For the slope function, we graph the derivative of the log of expected hours of training with respect to experience in Chart 1b and 2b, along with asymptotic 95 percent confidence bounds. (We use the derivative of the log because it has the same sign as the derivative with respect to hours, and is not as non-linear, so the asymptotic confidence interval is likely to be more accurate.)²⁵ As can be seen, the function is quite flat in the pre-1987 time period. The slope is negative and statistically significant in the post-1987 period, but declines at the rate of only a few percent a year. The tenure specification leads to a similarly flat profile for pre-1987 training (not shown). The tenure and position tenure

²⁴ The range of these and all further charts run from the 10th to the 90th percentile of the variable on the x axis.

²⁵ The functions are: $\frac{\partial E(T)}{\partial \text{exper.}} = \exp(X\gamma + \ln m) (F(X\beta)(\gamma_{\text{exper.}} + 2\gamma_{\text{exper. sq. exper.}}) + f(X\beta)(\beta_{\text{exper.}} + 2\beta_{\text{exper. sq. exper.}}))$ where m is $E(\exp(e))$;

$$\frac{\partial \ln E(T)}{\partial \text{exper.}} = (\gamma_{\text{exper.}} + 2\gamma_{\text{exper. sq. exper.}}) + \frac{f(X\beta)}{F(X\beta)} (\beta_{\text{exper.}} + 2\beta_{\text{exper. sq. exper.}})$$

specifications lead to flatter profiles for post-1987 training, though for position tenure some of this appears to be due to the restriction of the sample to respondents with valid position tenure information. We show the profile for the position tenure specification in Chart 3.

SEPT. Turning to results from SEPT, Table 4 shows descriptive statistics from the SEPT sample and Table 5 shows p values analogous to Table 2. Chart 4 shows the association of potential experience with percentage of work time in formal training in the SEPT data. Unlike the NLS79 equivalent, the profile is non-monotonic, with formal training increasing earlier in the career before decreasing after about 22 years. The decrease is not significant. The tenure and position tenure specifications lead to slightly steeper training-experience profiles both early and late in the career, and the late-career decline is statistically significant (as shown in Chart 5 for the position tenure specification).

One can run specifications using the NLSY79 more comparable to those we ran using SEPT by using potential instead of actual experience, omitting the heterogeneity controls, and excluding workers in establishments less than 50 employees from the sample. (This is only practical for the post-1987 data, as prior to 1987 establishment size is only available for 1979 and 1986.) In this case the SEPT-comparable specifications yield results similar to the reported NLSY79 results and fail to reconcile the contrast between the datasets.

Experience: Informal Training.

NLSY79: The training-experience profile for the specification with heterogeneity controls is shown in Chart 6. Training consistently declines with experience and the decline is significant at the 5 percent level for a substantial range of values containing most of the distribution. The tenure and position tenure specifications are similar, at least for higher values

of experience, though somewhat less precisely estimated and consequently with a lesser range of significant values. The position tenure specification is shown in Chart 7.

SEPT: As with formal training, in SEPT informal training follows an inverted U shape as shown in Chart 8, though the slope is never significant. The tenure and position tenure specifications show the same pattern, with a (barely) significantly positive slope (at the 5 percent level) for lower values of potential experience in the position tenure specification shown in Chart 9.

Running a SEPT-comparable specification using NLSY79 data gives the same basic pattern as the NLSY79 in the potential experience specification. However, we may note that that the range of potential experience in our NLSY79 sample is roughly 14 to 22 years. In this range the SEPT experience-training profile has small slopes varying from positive to slightly negative in the SEPT and is compatible with the NLSY79 in the right half of the range. In the position tenure specification the SEPT-comparable potential-experience-training profile is less compatible with SEPT than the original specification, as training shows a sharper decline for low values of (potential) experience.

Tenure: Formal training

NLSY79: Charts 10 and 11 show the tenure-formal training profiles for the pre-1987 and post-1987 time periods, respectively, using the heterogeneity-controlled tenure specification. The profile for the earlier time period exhibits a very large decrease in training with tenure. Note that the scale in Chart 10b is much larger than that in previous charts. Unfortunately position tenure is only available after the change in the formal training measure, so we cannot tell if the large effect is entirely due to the correlation of employer tenure with position tenure or whether

employer tenure has an independent effect early in the career. The post-1987 profile does not decline as rapidly but the rate of decline is still substantial and significant, as shown in Chart 11. Including position tenure in the post-1987 period does surprisingly little to the shape of the profile, though the slope is less precisely estimated, as shown in Chart 12.

SEPT: In dramatic contrast to the NLSY79, formal training increases substantially and significantly with tenure in SEPT, as shown in Charts 13 and 14 (showing the tenure and position tenure specifications, respectively).

For the position tenure specification, using a SEPT-comparable specification in the NLSY79 partially reconciles the results. We show this in Chart 15, as the NLSY79 profile is basically flat rather than decreasing. The change in the NLSY79 profile is only partially due to the exclusion of heterogeneity controls, as the employer size restriction in SEPT appears to be playing a key role: running the specification shown in Chart 15 while restricting the sample to workers in establishments with fewer than 50 employees (rather than 50 or greater) yields a steeply declining tenure-training profile.

Tenure: Informal training

NLSY79: Informal training decreases substantially with employer tenure, as shown in Chart 16. However, once one accounts for position tenure the effect disappears, as shown in Chart 17.

SEPT: Chart 18 shows that informal training decreases with employer tenure, but somewhat less than in the NLSY79 and the decline is not statistically significant. When position tenure is accounted for, in Chart 19, the slope is positive but not statistically significant and

compatible with the NLSY79 estimate. Running SEPT-comparable specifications in the NLSY79 brings the tenure-training profiles still closer to the shape of the SEPT profiles.

Position tenure, formal training.

NLSY79: The position-tenure/training profile shown in Chart 20 indicates that formal training declines with position tenure, but at a relatively slow rate. The slope is never quite significant at the 5 percent level.

SEPT: Chart 21 shows that the position-tenure/formal-training profile is upward sloping at a slow rate. Here also, the slope is not significant anywhere in the distribution. Both the NLSY79 and the SEPT estimates are imprecise enough that they are essentially compatible. Chart 22 shows the profile for the SEPT-comparable NLSY79 estimates. This profile is closer to the SEPT profile for low values of position tenure.

Position tenure, informal training.

NLSY79: Chart 23 shows informal training as a function of position tenure. As can be seen, training decreases dramatically with position tenure. Note that the scale of Chart 23b is increased to accommodate the steep decline in log hours of training.

SEPT: Chart 24 shows the equivalent for SEPT. While not completely consistent in terms of the magnitude of the decline with the NLSY79, the profile shows (by standards of our previous graphs) a relatively steep decline in training with position tenure. (Note that the scale of 24b has been enlarged from that of most of our previous graphs, though not to the extent of 23b.) Running a SEPT-comparable specification with NLSY79 data yields results similar to that shown in Chart 23.

Years not employed. As noted above, we include years-not-employed and its square in our NLSY79 specifications to investigate and control for the effect of aging without acquiring labor market experience. (This is not possible in SEPT because it lacks an actual experience measure.) After correcting for heterogeneity, the slopes of the formal and informal training profiles are generally small in magnitude, seldom significant and not consistently signed across specifications.

Training incidence vs. duration: Much recent literature on the effects of training has concentrated on training incidence measures while ignoring duration of training conditional on incidence, implicitly using incidence as a proxy for quantity of training.²⁶ However, incidence and duration of training do not have the same pattern with respect to career variables, and as a consequence the time path of the total quantity of training does not correspond to the time path of incidence. Charts 25 and 26 show an example of this. As shown in Chart 1, the formal-training/experience profile is quite flat for the pre-1987 measure of training in the NLSY79. This flatness is the result of two factors going in opposite directions. Incidence of training increases with experience (Chart 25), but duration of training conditional on incidence decreases (Chart 26). Many other cases show contrasting shapes of training profiles between incidence and duration.

V. Conclusion

In this paper we use the NLSY79 and SEPT to examine the pattern of on-the-job training over the career, a prominent topic in the early human capital literature but the subject of little empirical investigation. The NLSY79 has a reasonably comprehensive record of formal training,

²⁶ For example, see Dearden, Reed, and Van Reenen (2008), Dostie (2013), and Leuven and Oosterbeek (2009).

employment experience, and employers, as well as data in some years for informal training and positions within firms. SEPT has employee log data on formal and informal training as well as information on employer and position tenure. We are thus able to examine the relationship of training not just to experience, but to job mobility between and within firms.

Results for informal training are roughly consistent between our datasets. Our strongest result is that in both datasets informal training declines steeply with position tenure. This suggests that on-the-job training primarily occurs when necessary to learn the tasks associated with a new position. Interestingly, when one does not control for position tenure, informal training falls sharply with tenure, but this effect disappears once position tenure is accounted for. The results for experience are less consistent, as informal training rises early in the career in SEPT while falling consistently in the NLSY79, though the magnitude of the decline is fairly small. Some of the apparent contradiction may be due to the limited period the informal training questions were asked in the NLSY79, which was well into the career.

Results for formal training are less compatible across datasets. The NLSY79 training profiles are fairly flat with respect to experience, with the exception of a negative slope for post-1987 training in the specification without tenure or position tenure. The equivalent profiles in SEPT follow an inverted U-shape. Formal training decreases with tenure in the NLSY79. Interestingly, in contrast to informal training, there is still a steep decline after correcting for position tenure. The decline in formal training with position tenure is relatively shallow and not statistically significant. In contrast, formal training increases with both tenure and position tenure in SEPT, though not significantly so for position tenure. Part of the discrepancy appears to be due to the fact that smaller establishments are not included in SEPT; surprisingly, the

evidence from the NLSY79 indicates that the absence of heterogeneity controls in SEPT is playing only a small role.

The contrast between formal and informal training in both datasets suggests that they play quite different roles in human capital acquisition. We speculate that formal training is more oriented toward general human capital development while informal training is more associated with developing the immediate tasks required for a new position. In the literature, job mobility and human capital accumulation have often been contrasted as contributors to wage growth (Rubinstein and Weiss, 2006). Our result that workers moving into new positions tend to receive a burst of informal training indicates that they may actually be complements²⁷

The NLSY79 and SEPT95 are fairly unique in providing information on position tenure. Our discussion indicates the usefulness of this information in understanding human capital acquisition in the labor market. The fact that controlling for position tenure severely moderates the negative relationship between informal training and tenure, but has little effect on the relationship between formal training and tenure is quite informative.

From wage profiles we would expect training to decline with experience in the early career. Surprisingly, our results do not provide any evidence that it does. In the early years of the NLSY79, formal training does not fall with experience even when one does not control for tenure, and there is only a small decline in later years. In SEPT, informal training actually increases with low potential experience, and the NLS questions occur too late to provide information about the relationship between informal training and early career experience. This suggests that other factors may play large roles in explaining the early career wage – experience

²⁷In a related vein, Veramendi (2011) develops a model where learning-by-doing is positively associated with job mobility within and between firms.

profile, such as job shopping or learning-by-doing, a form of human capital accumulation about which neither the NLSY79 nor SEPT contains any information.

In future drafts we intend to shed further light on formal training by using the 1997 cohort of the National Longitudinal Surveys. The NLSY97 does not provide any information on informal training. This is unfortunate given that the NLSY79 only provides on informal training for a few years that are fairly late in the career. The reluctance to ask questions about informal training may stem partly from a belief that it is nearly impossible to measure, but our results suggest that it is in fact possible to obtain useful information about workers' informal training. Indeed, we have gotten quite a bit of mileage out of the limited information on informal training that is available.

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Table 1
Descriptive Statistics. NLSY79 (weighted)

Variable	n	Mean	Std. Dev.	Min.	Max.
Any formal training past 12 months (Year<1987)	24,092	0.068	0.252	0	1
Hours of formal training past 12 mo. (Year<1987)	24,092	8.259	79.748	0	4,160
Ln(Formal training) (Tr.>0, Year<1987)	1,373	3.991	0.993	0.527	8.333
Any formal training past 12 months (Year>1987)	72,888	0.122	0.328	0	1
Hours of formal training (Year>1987)	72,888	12.105	110.881	0	8,736
Ln(Formal training) (Tr.>0, Year>1987)	8,014	3.341	1.519	-2.346	9.075
Any formal training with current employer past 12 mo. (Year<1987)	22,586	0.067	0.250	0	1
Hours of formal training with current employer (Year<1987)	22,586	14.208	123.030	0	3,073.86
Ln(Formal training current employer) (Tr.>0, Year<1987)	1,204	4.387	1.218	0.527	8.031
Any formal training in current position past 12 mo.	28,103	0.071	0.257	0	1
Hours of formal training in current position	28,103	7.868	93.415	0	4860.744
Informal training incidence	12,846	0.214	0.410	0	9.075
Hours of informal training (annualized)	12,846	100.694	496.481	0	37,827
Ln(Informal training) (Tr.>0, annualized)	2,623	4.988	1.510	1.872	42.849
Employer tenure	93,004	4.444	5.238	0.019	32.750
Final employer tenure	88,463	10.356	10.456	0.019	42.860
Position tenure	28,103	2.762	2.835	0.003	16.288
Final position tenure	24,492	6.812	6.274	0.008	25.832
Years experience*	96,980	12.202	7.854	0	1
Year=1980	96,980	0.013	0.112	0	1
Year=1981	96,980	0.017	0.130	0	1
Year=1982	96,980	0.026	0.160	0	1
Year=1983	96,980	0.032	0.175	0	1
Year=1984	96,980	0.038	0.192	0	1
Year=1985	96,980	0.043	0.204	0	1
Year=1986	96,980	0.046	0.210	0	1
Year=1988	96,980	0.050	0.217	0	1
Year=1989	96,980	0.051	0.220	0	1
Year=1990	96,980	0.051	0.219	0	1
Year=1991	96,980	0.053	0.225	0	1
Year=1992	96,980	0.053	0.223	0	1
Year=1993	96,980	0.052	0.223	0	1
Year=1994	96,980	0.051	0.220	0	1
Year=1996	96,980	0.053	0.224	0	1
Year=1998	96,980	0.054	0.227	0	1
Year=2000	96,980	0.055	0.227	0	1
Year=2002	96,980	0.054	0.227	0	1
Year=2004	96,980	0.051	0.220	0	1

Table 1 continued

Variable	n	Mean	Std. Dev.	Min.	Max.
Year=2006	96,980	0.050	0.218	0	1
Year=2008	96,980	0.050	0.217	0	1
Year=2010	96,980	0.048	0.214	0	1
Years of education	96,980	12.994	2.278	7	20
Hispanic	96,980	0.061	0.240	0	1

*Includes time in military

**Age - Years experience - Years of education

Table 2
p values, career variable terms, NLSY79

Experience specification
p values, terms including experience

Type of training	Time period		
Formal	1979-86	<.001	<.001
Formal	1988-2010	0.028	0.198
Informal	1996-2000	0.089	0.064
Self	1996-2010	0.028	0.117
Heterogeneity control?		No	Yes

Tenure specification
p values, terms including experience
at start of job

Type of training	Time period		
Formal*	1979-86	<.001	0.022
Formal	1988-2010	0.71	0.482
Informal	1996-2000	0.528	0.259
Self	1996-2010	0.023	0.06
Heterogeneity control?		No	Yes

Position tenure specification
p values, terms including experience
at start of job

Type of training	Time period		
Formal	1996-2010	0.412	0.053
Informal	1996-2000	0.762	0.558
Self	1996-2010	0.043	0.029
Heterogeneity control?		No	Yes

p values, terms including tenure

Type of training	Time period		
Formal	1979-86	<.001	<.001
Formal	1988-2010	<.001	<.001
Informal	1996-2000	<.001	0.002
Self	1996-2010	<.001	0.005
Heterogeneity control?		No	Yes

p values, terms including tenure
at start of position

Type of training	Time period		
Formal	1996-2010	<.001	0.001
Informal	1996-2000	0.101	0.509
Self	1996-2010	<.001	0.025
Heterogeneity control?		No	Yes

p values, terms including position tenure

Type of training			
Formal	1996-2010	<.001	<.001
Informal	1996-2000	<.001	<.001
Self	1996-2010	<.001	<.001
Heterogeneity control?		No	Yes

p values, terms including years not employed

Type of training	Time period		
Formal	1979-86	0.007	0.007
Formal	1988-2010	<.001	0.482
Informal	1996-2000	0.064	0.35
Self	1996-2010	0.117	0.024
Heterogeneity control?		No	Yes

p values, terms including years not employed

Type of training	Time period		
Formal	1979-86	0.321	0.055
Formal	1988-2010	<.001	0.611
Informal	1996-2000	0.011	0.519
Self	1996-2010	0.042	0.154
Heterogeneity control?		No	Yes

p values, terms including years not employed

Type of training	Time period		
Formal	1996-2010	0.027	0.632
Informal	1996-2000	0.324	0.397
Self	1996-2010	0.143	0.252
Heterogeneity control?		No	Yes

Table 3
p values, heterogeneity control terms, NLSY79

Experience specification			Tenure specification			Position tenure specification		
p values, terms including years not employed at age 45			p values, terms including years not employed at age 45			p values, terms including years not employed at age 45		
Type of training	Time period		Type of training	Time period		Type of training	Time period	
Formal*	1979-86	0.021	Formal*	1979-86	0.049			
Formal	1988-2010	<.001	Formal	1988-2010	<.001	Formal	1996-2010	0.070
Informal	1996-2000	0.239	Informal	1996-2000	0.148	Informal	1996-2000	0.183
Self	1996-2010	0.069	Self	1996-2010	0.329	Self	1996-2010	0.606
p values, terms including final tenure			p values, terms including final tenure			p values, terms including final tenure		
Type of training	Time period		Type of training	Time period		Type of training	Time period	
Formal*	1979-86	0.001	Formal*	1979-86	0.001			
Formal	1988-2010	<.001	Formal	1988-2010	<.001	Formal	1996-2010	<.001
Informal	1996-2000	0.233	Informal	1996-2000	0.233	Informal	1996-2000	0.079
Self	1996-2010	0.091	Self	1996-2010	0.091	Self	1996-2010	0.008
p values, terms including final position tenure						p values, terms including final position tenure		
Type of training			Type of training			Type of training		
Formal			Formal			Formal	1996-2010	0.089
Informal			Informal			Informal	1996-2000	0.297
Self			Self			Self	1996-2010	0.099

Table 4
 Descriptive Statistics, Survey of Employer Provided Training
 (weighted)

Variable	n	Mean	Std. Dev.	Min.	Max.
Any formal training	971	0.15	0.36	0	1
Any informal training	971	0.35	0.48	0	1
Ln % time formal training (Tr.>0)	172	-3.20	1.13	-6.68	-0.72
Ln % time inf. training (Tr.>0)	427	-3.30	1.35	-6.74	-0.41
Hours worked in log	971	37.21	21.30	0	123
Usable days in log	971	6.45	3.28	1	10
Black	971	0.10	0.31	0	1
Hispanic	971	0.06	0.24	0	1
Male	971	0.45	0.50	0	1
Years education	971	13.71	2.10	10	18
Years potential experience	971	18.34	10.25	0.1	40
Years employer tenure	971	7.26	7.05	0.02	37
Years position tenure	971	3.92	4.25	0.02	34

Table 5									
p values, SEPT									
Potential experience specification		Tenure specification		Position tenure specification					
p values, terms including pot. experience		p values, terms including pot. experience		p values, terms including experience					
		at start of job		at start of job					
Type of training		Type of training		Type of training					
Formal	0.048	Formal	0.011	Formal	0.029				
Informal	0.327	Informal	0.099	Informal	0.088				
		p values, terms including tenure		p values, terms including tenure					
				at start of position					
		Type of training		Type of training					
		Formal	0.114	Formal	0.102				
		Informal	0.591	Informal	0.004				
				p values, terms including position tenure					
				Type of training					
				Formal	0.182				
				Informal	<.001				

Chart1a
 Hours formal training vs. Yrs. Experience
 NLS79, heterogeneity control, 1979-86, experience specification

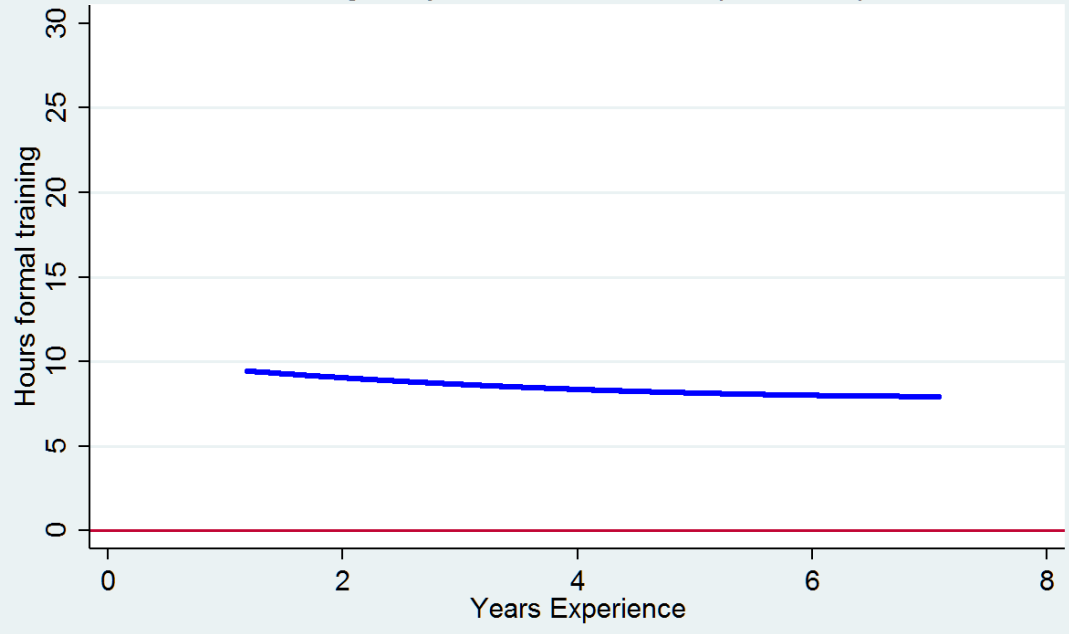
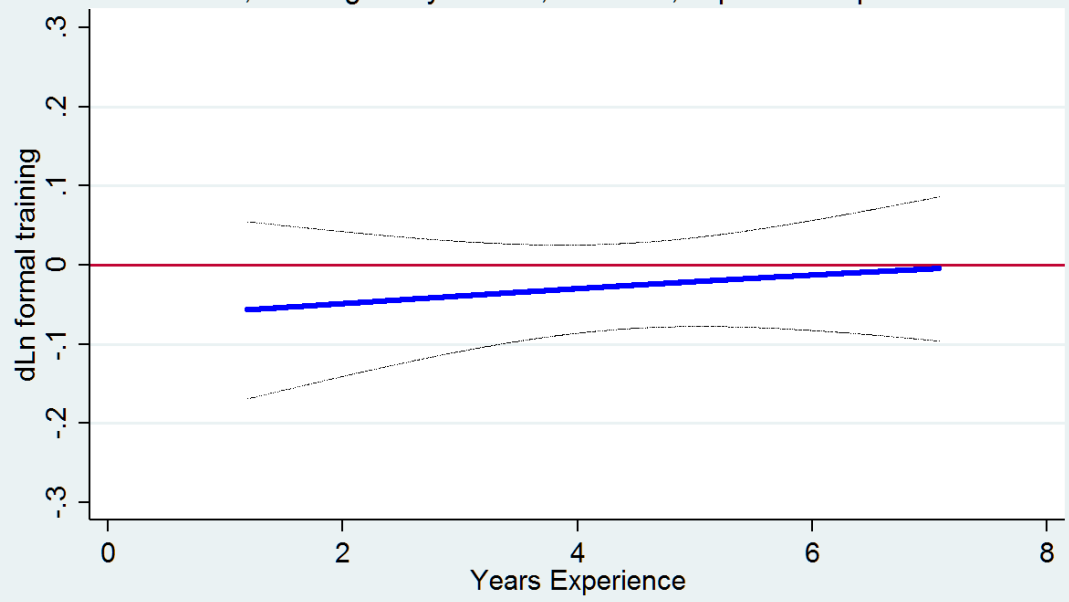


Chart 1b
 dLn formal training/dYrs. Experience
 NLS79, heterogeneity control, 1979-86, experience specification



Outer lines denote 95% confidence interval

Chart 2a
 Hours formal training vs Yrs. Experience
 Heterogeneity control, 1988-2010, experience specification

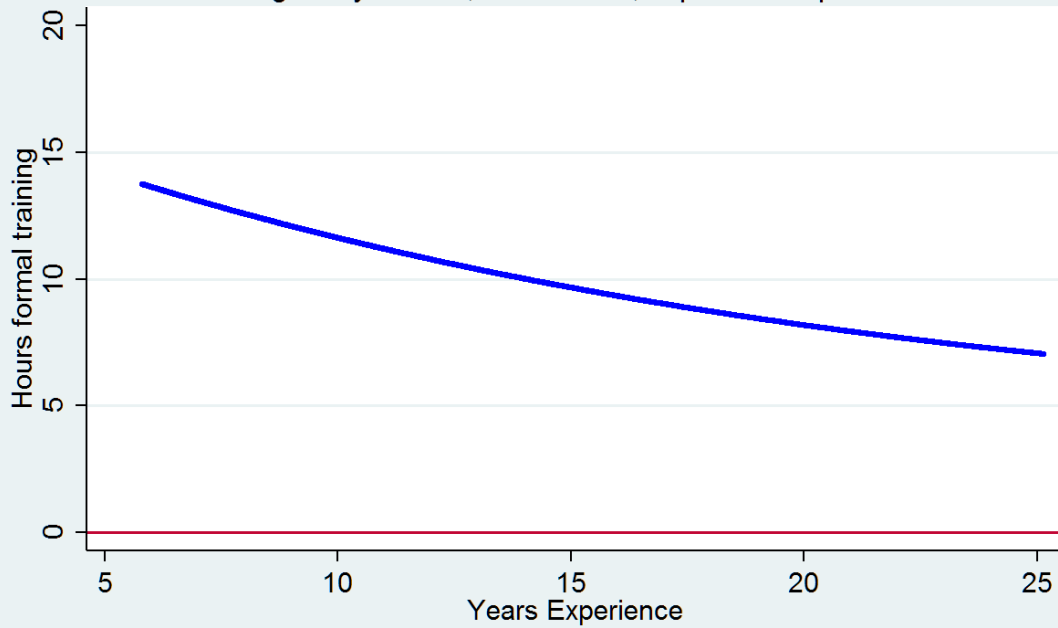
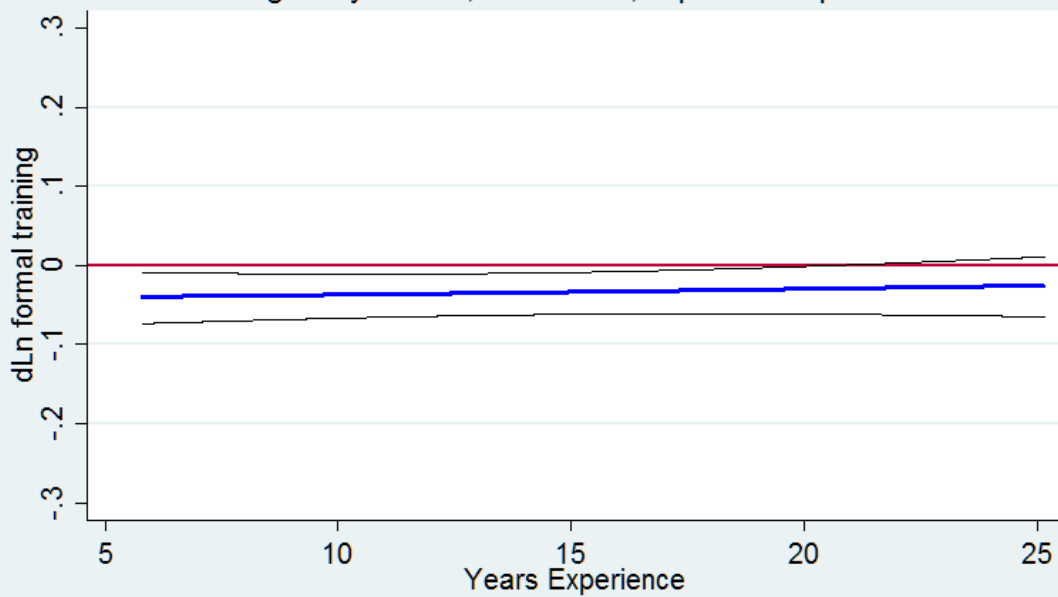


Chart 2b
 dLn formal training/dYrs. Experience
 Heterogeneity control, 1988-2010, experience specification



Outer lines denote 95% confidence interval

Chart 3a
 Hours formal training vs. Yrs. Exp. Job Start
 Heterogeneity control, 1996-2010, position tenure specification

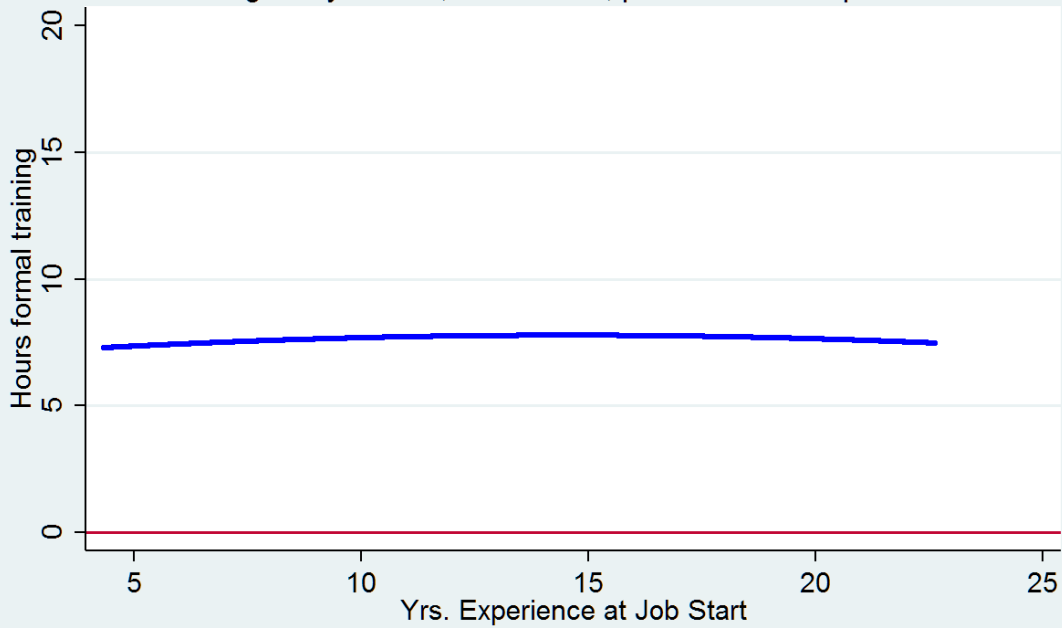
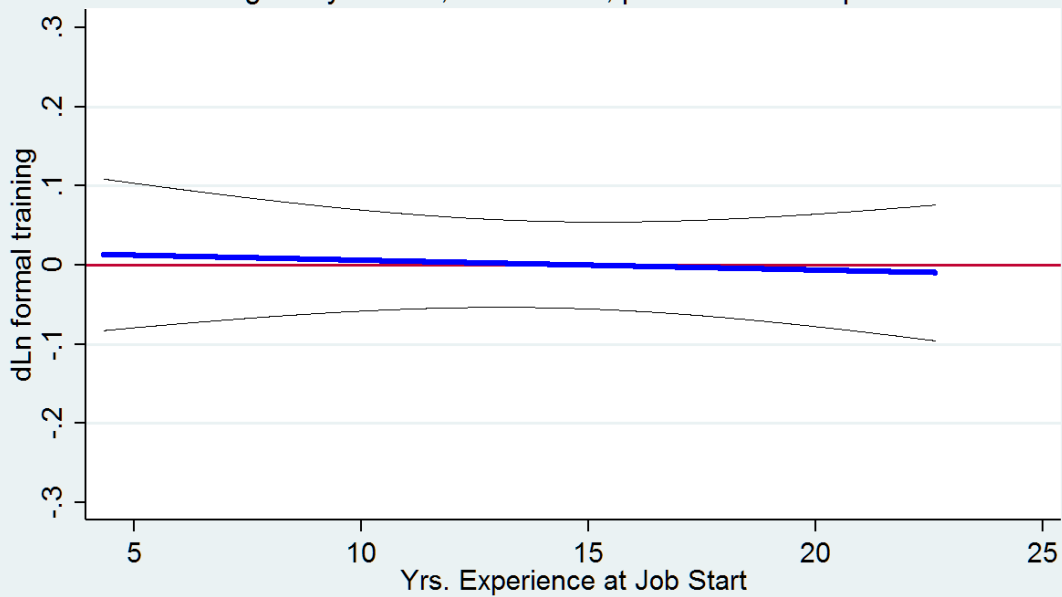


Chart 3b
 dLn formal training/dYears exper. at Job Start
 Heterogeneity control, 1996-2010, position tenure specification



Outer lines denote 95% confidence interval

Chart 4a
 % time in formal training vs. Years pot. experience
 SEPT, potential experience specification

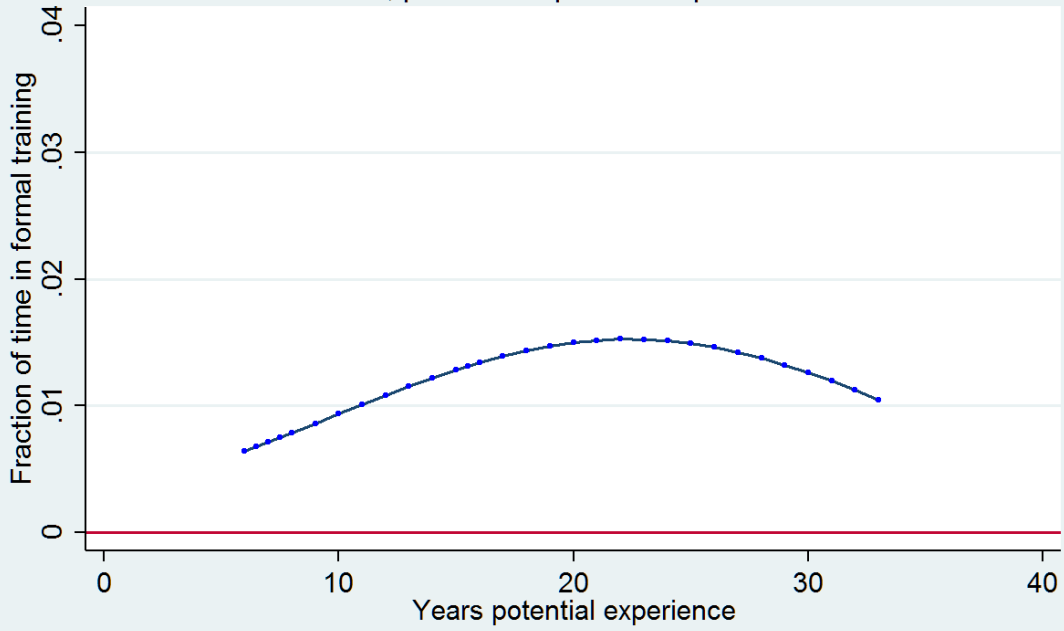


Chart 4b
 dLn formal training/dYrs. potential experience
 SEPT, potential experience specification

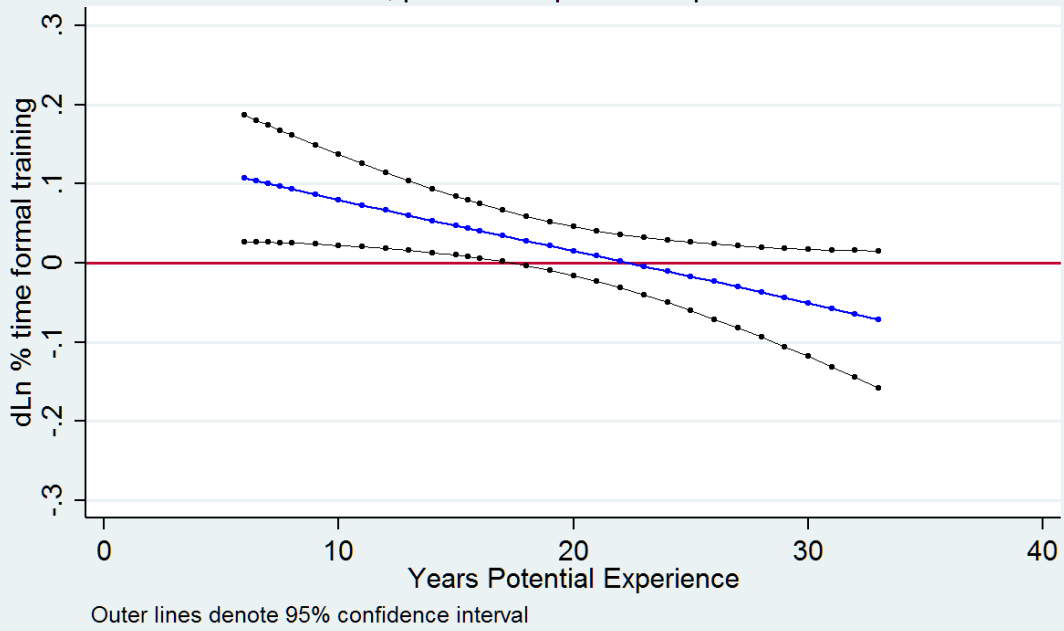


Chart 5a
 % time in formal training vs. Yrs. Pot. Exp. Job Start
 SEPT, position tenure specification

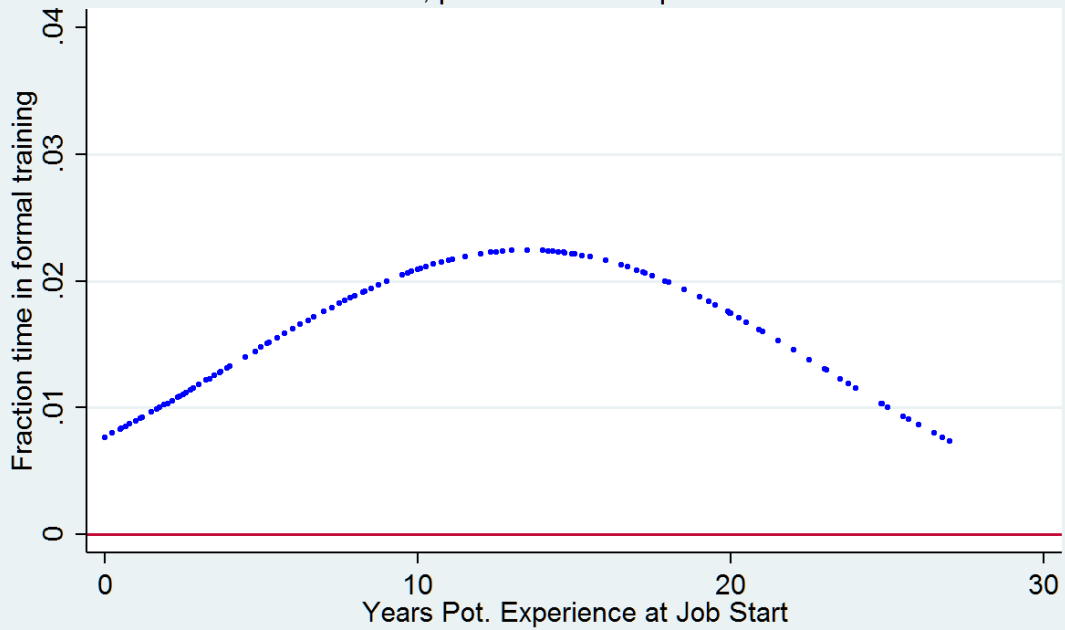


Chart 5b
 dLn % time in formal training/dYrs. Pot. Exp. Job Start
 SEPT, position tenure specification

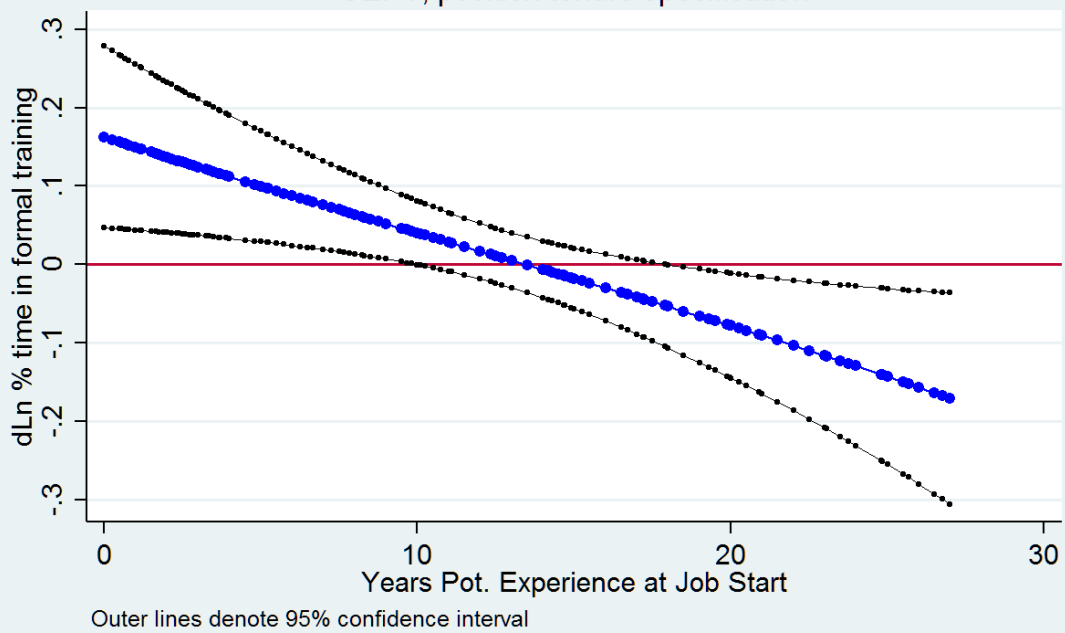


Chart 6a
 Hours informal training vs. Years experience
 NLS79, heterogeneity control, 1996-2000, experience specification

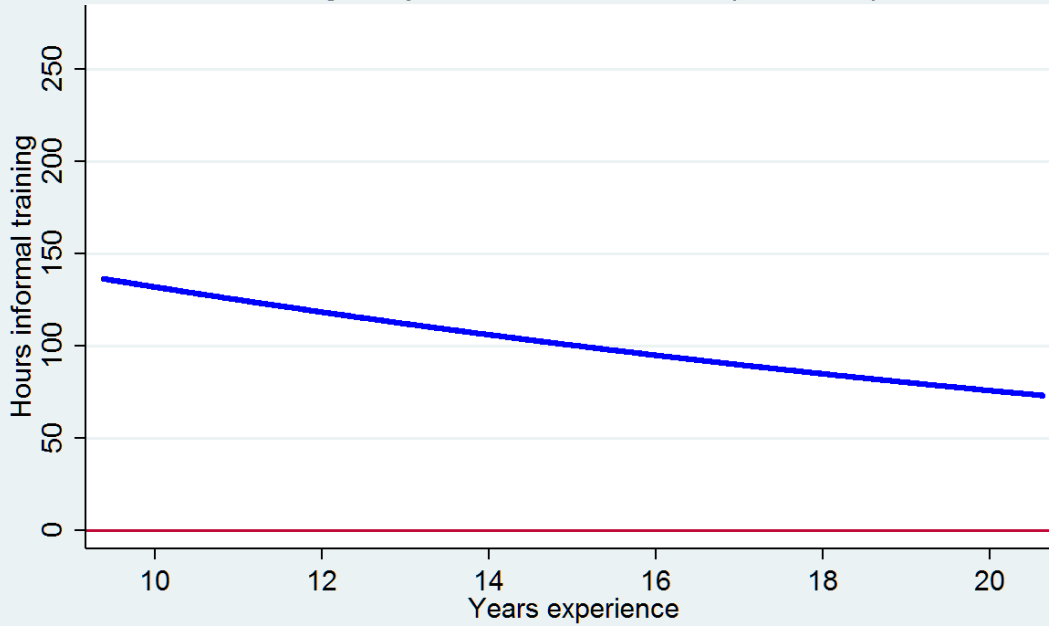
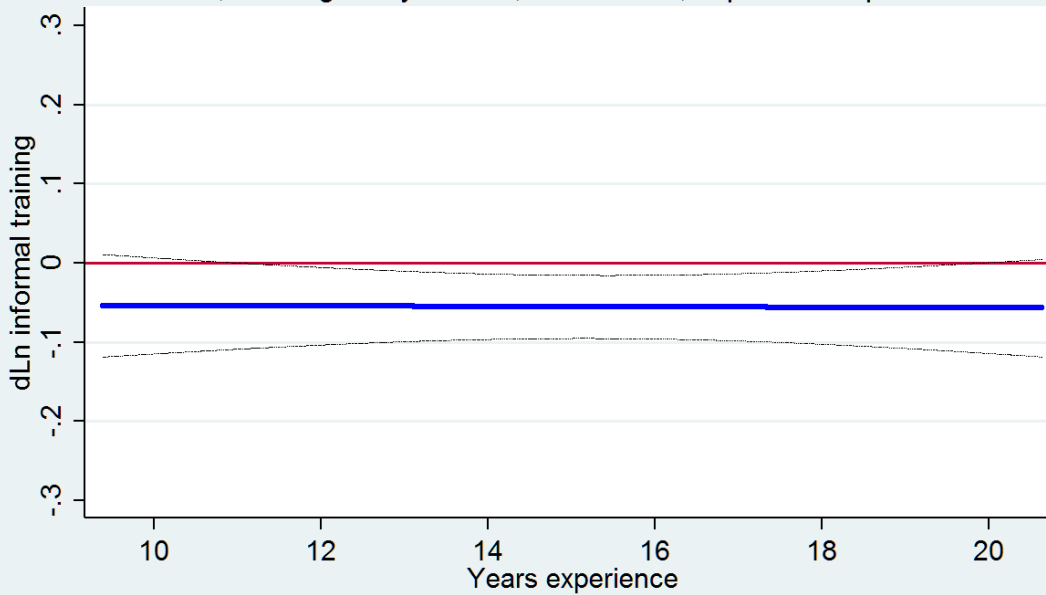


Chart 6b
 dLn informal training/dYears experience
 NLS79, heterogeneity control, 1996-2000, experience specification



Outer lines denote 95% confidence interval

Chart 7a
Hours informal training vs. Yrs. Exp. Job Start

NLS79, heterogeneity control, 1996-2000, position tenure specification

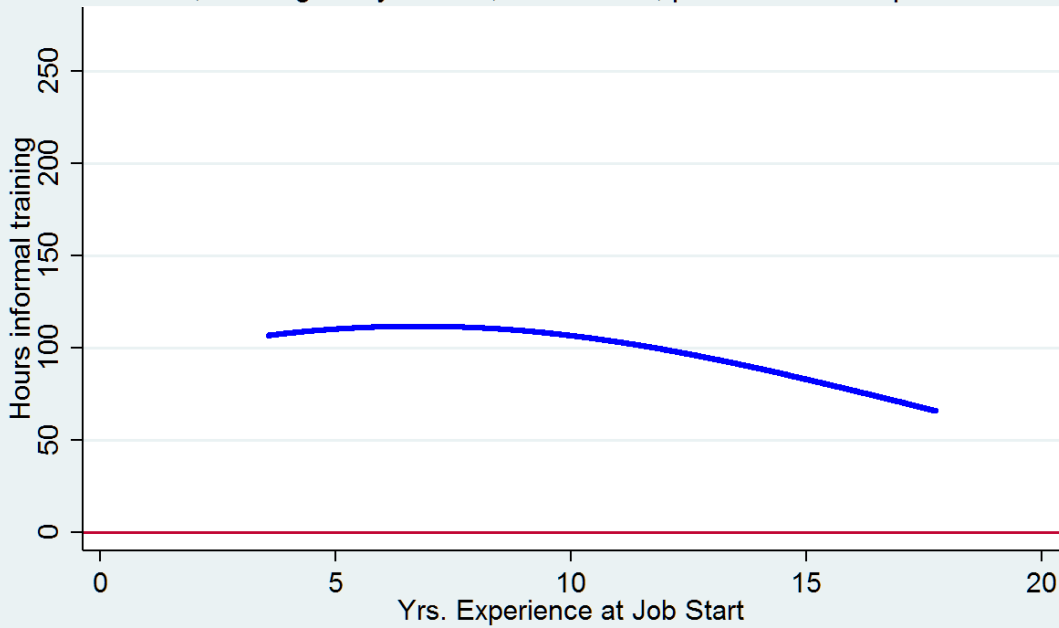
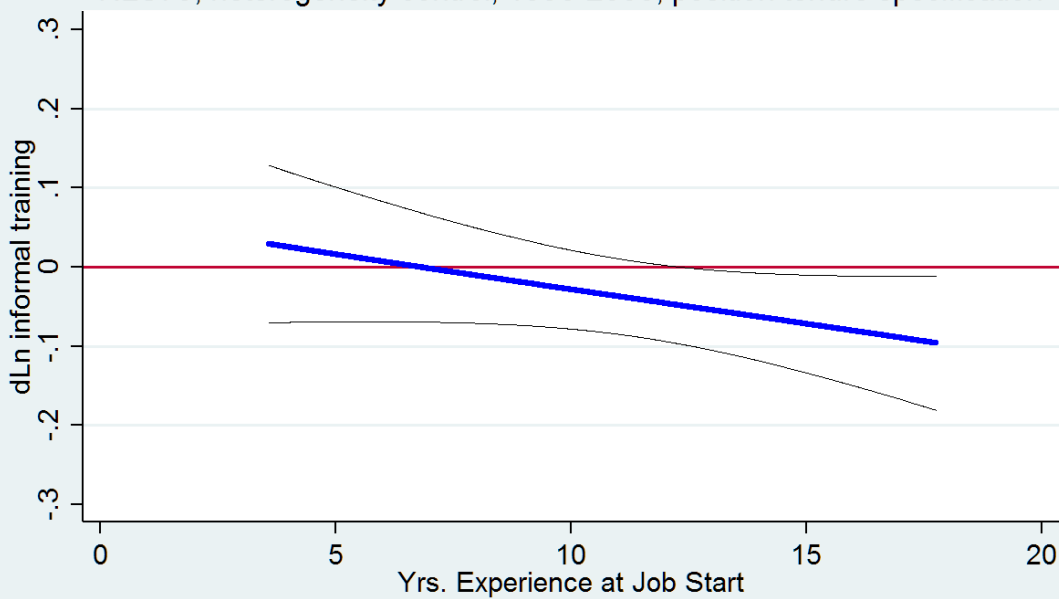


Chart 7b
dLn informal training/dExper. at Job Start

NLS79, heterogeneity control, 1996-2000, position tenure specification



Outer lines denote 95% confidence interval

Chart 8a
 % time informal training vs. Yrs. Pot. Exp.
 SEPT, potential experience specification

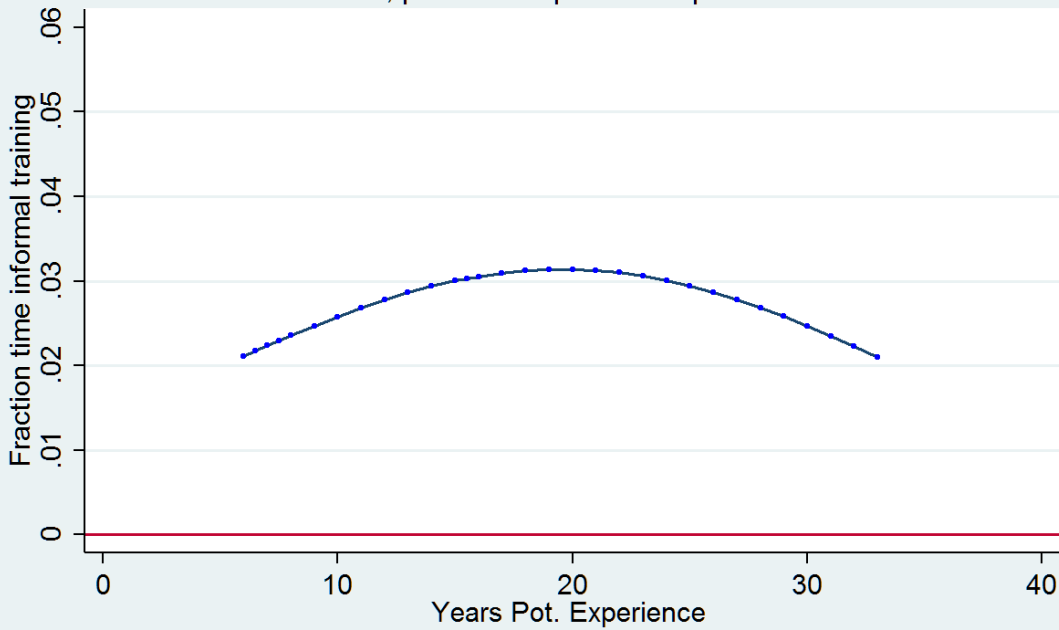
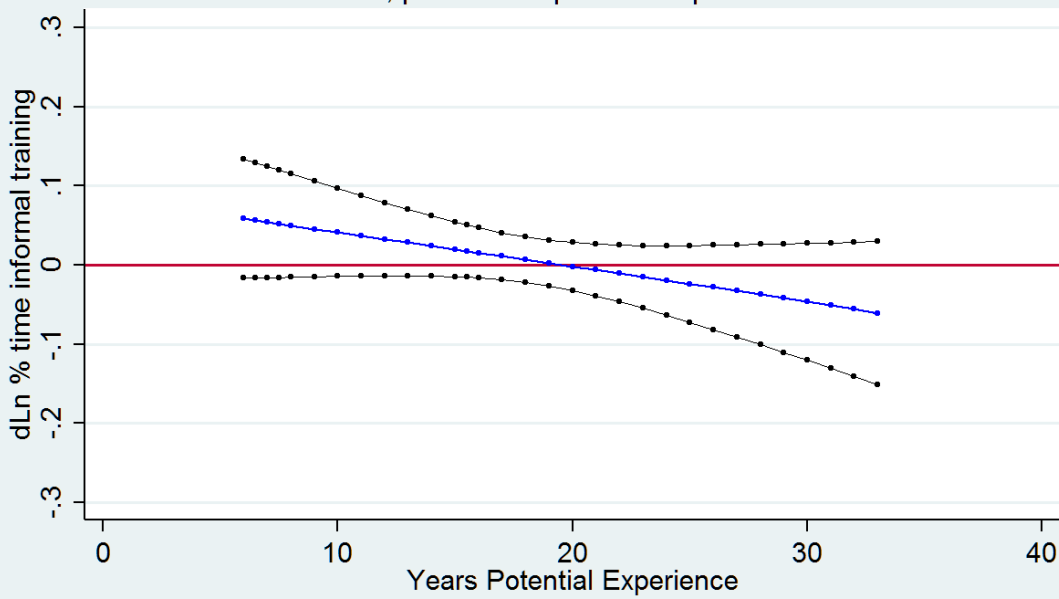


Chart 8b
 dLn informal training/dYrs. potential experience
 SEPT, potential experience specification



Outer lines denote 95% confidence interval

Chart 9a
 % time in informal training vs. Yrs. Pot. Exp. Job Start
 SEPT, potential experience specification

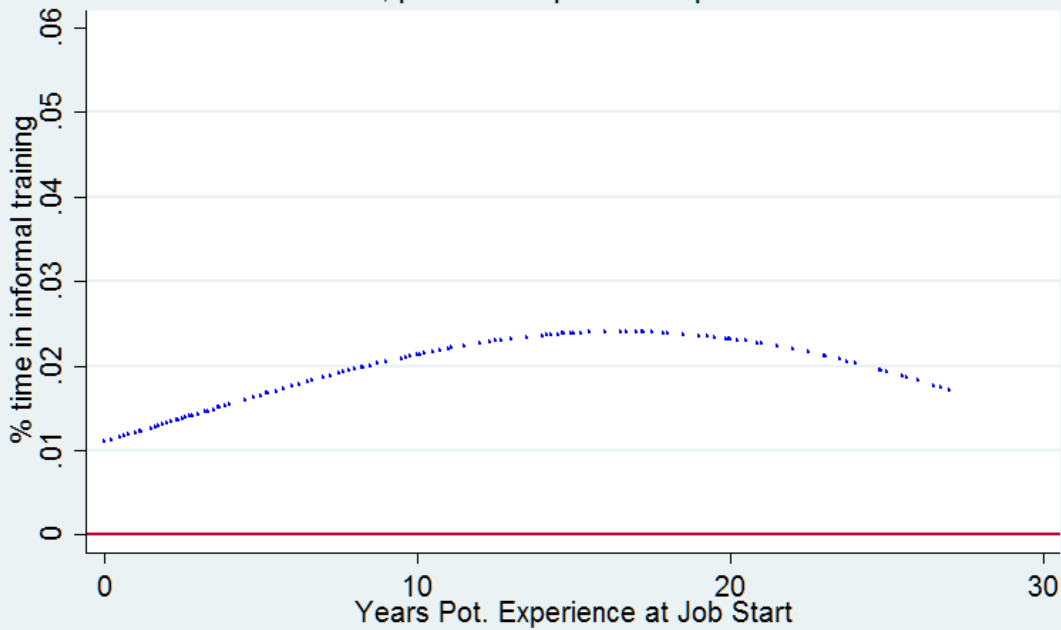
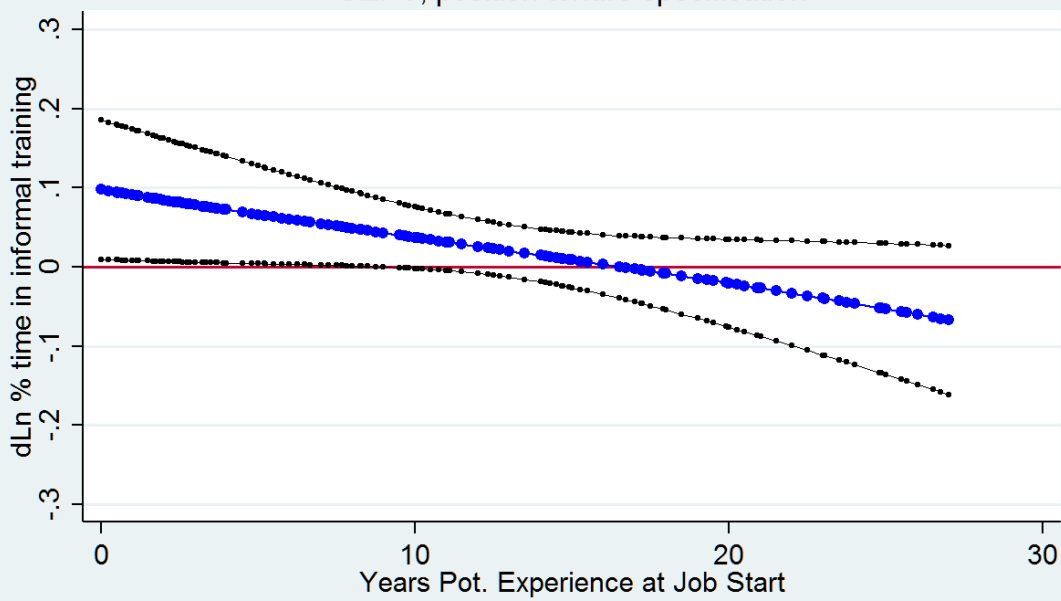


Chart 9b
 dLn % time in informal training/dYrs. Pot. Exp. Job Start
 SEPT, position tenure specification



Outer lines denote 95% confidence interval

Chart 10a
Hours formal training vs. Yrs. Tenure

NLS79, heterogeneity control, 1979-86, tenure specification

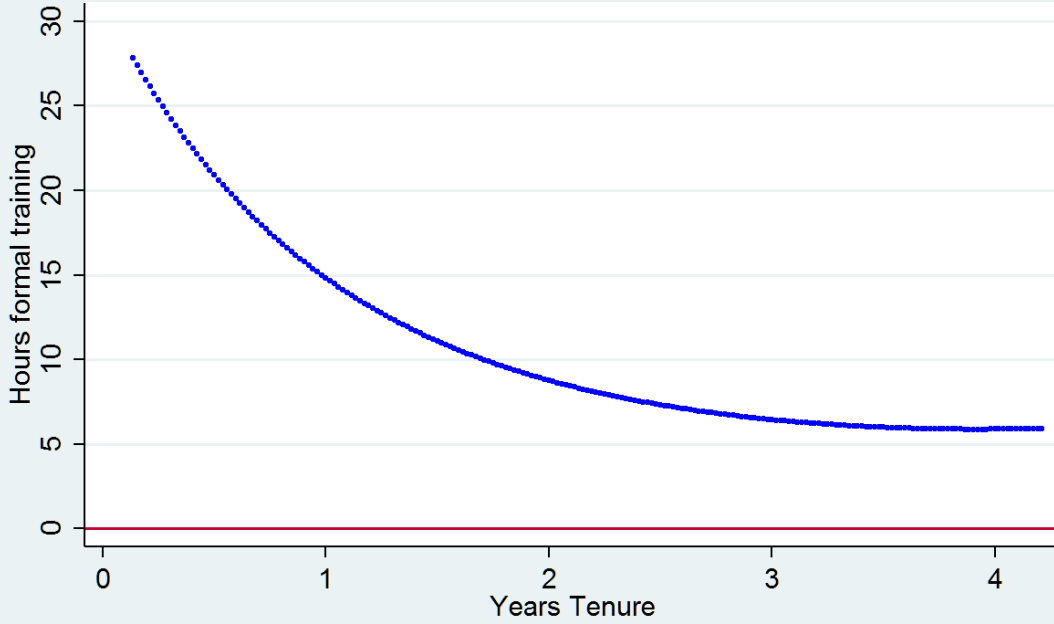
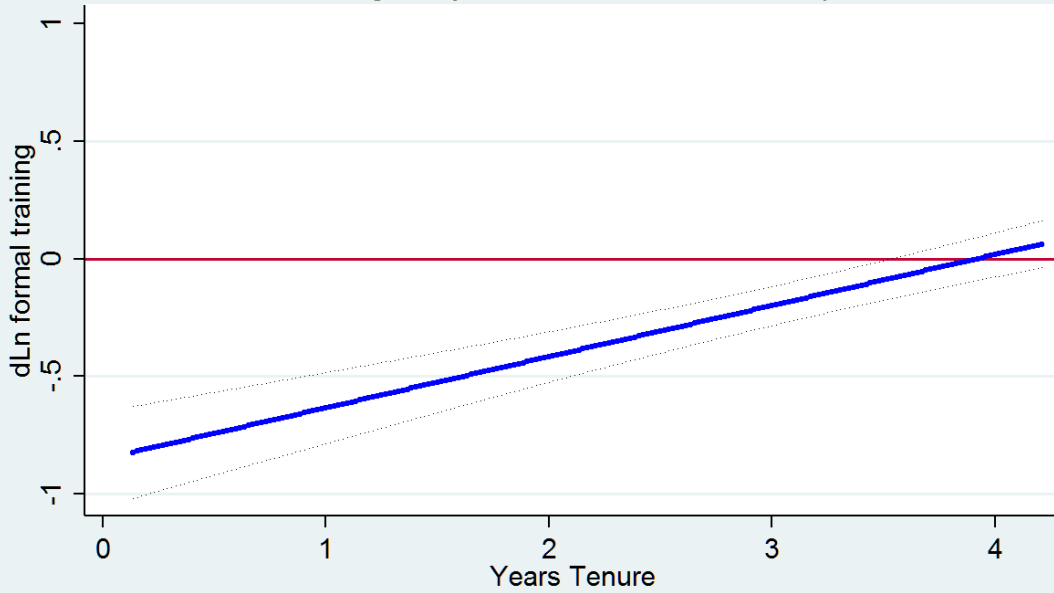


Chart 10b
dLn formal training/dYrs. Tenure

NLS79, heterogeneity control, 1979-86, tenure specification



Outer lines denote 95% confidence interval

Chart 11a
Hours formal training vs. Yrs. Tenure

NLS79, heterogeneity control, 1988-2010, tenure specification

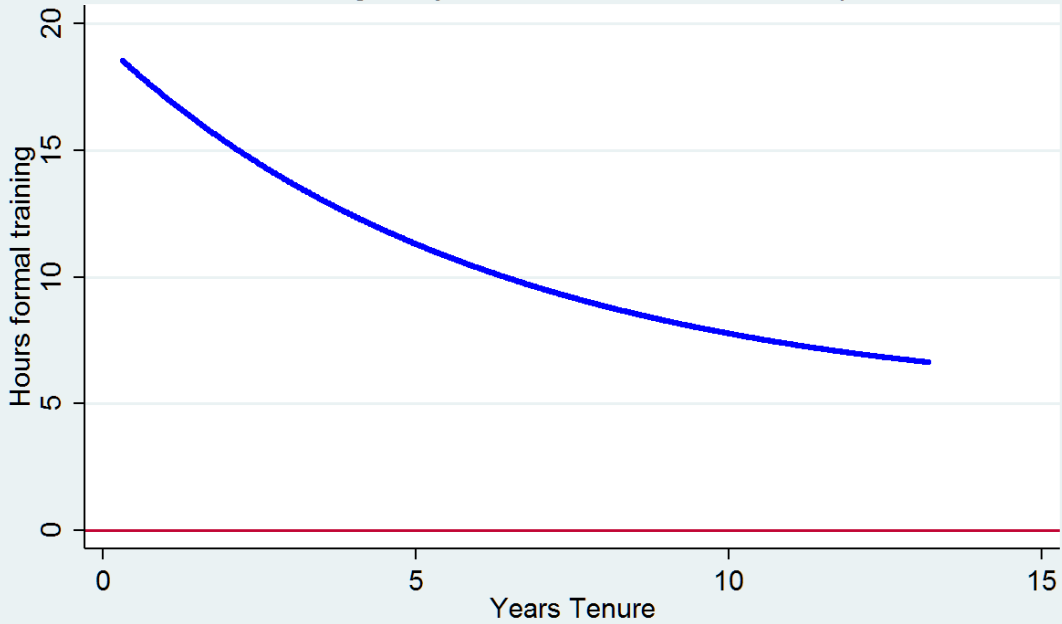
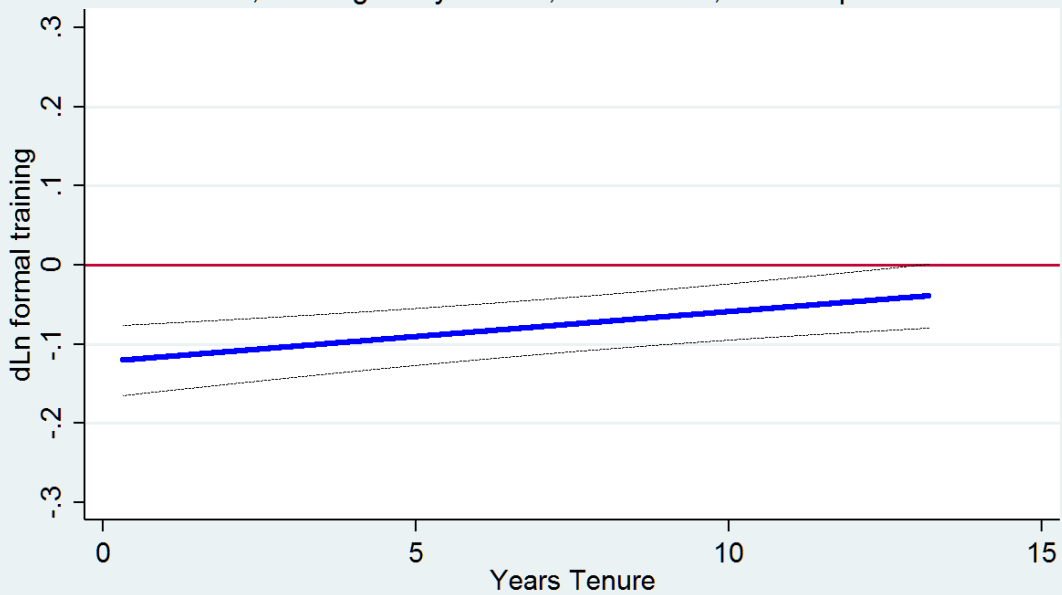


Chart 11b
dLn formal training/dYrs. Tenure

NLS79, heterogeneity control, 1988-2010, tenure specification



Outer lines denote 95% confidence interval

Chart 12a

Hours formal training vs. Yrs. tenure at job start

NLS79, heterogeneity control, 1996-2010, position tenure specification

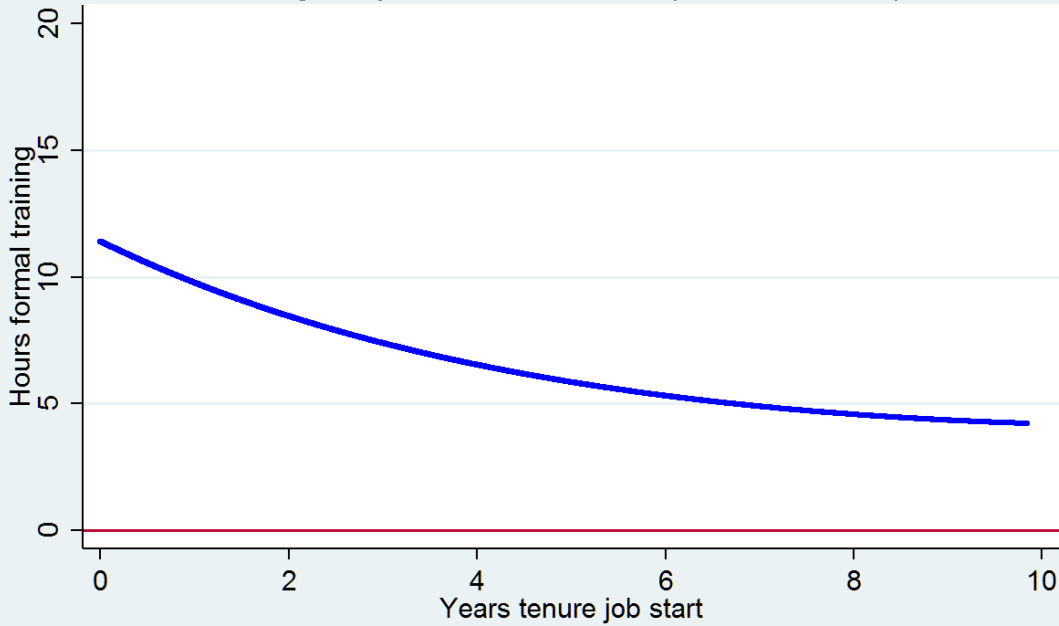
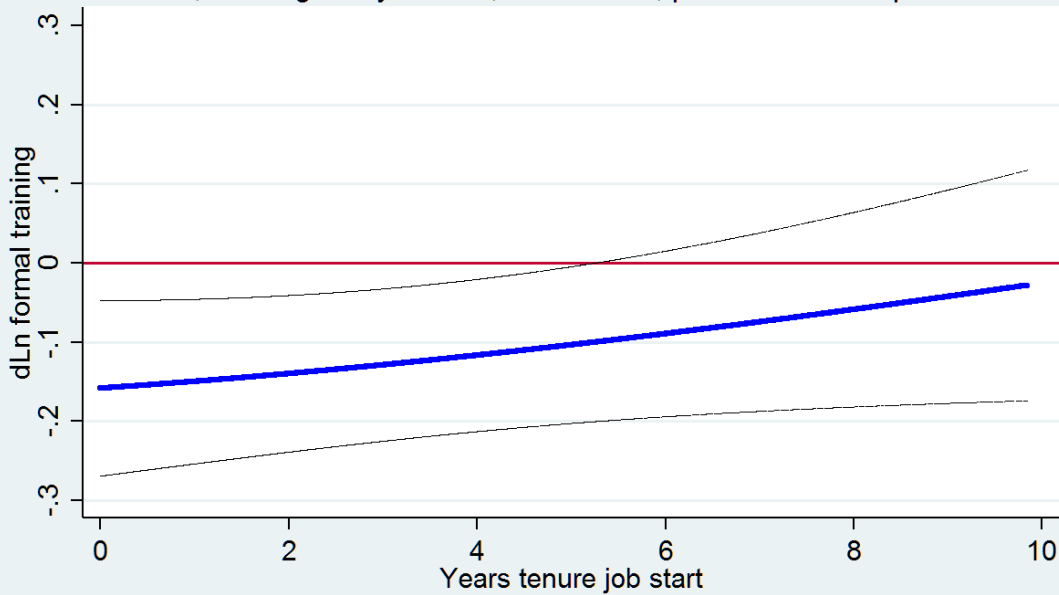


Chart 12b

dLn formal training/dYrs. Ten. Job Start

NLS79, heterogeneity control, 1996-2010, position tenure specification



Outer lines denote 95% confidence interval

Chart 13a
 % time formal training vs. Years tenure
 SEPT, tenure specification

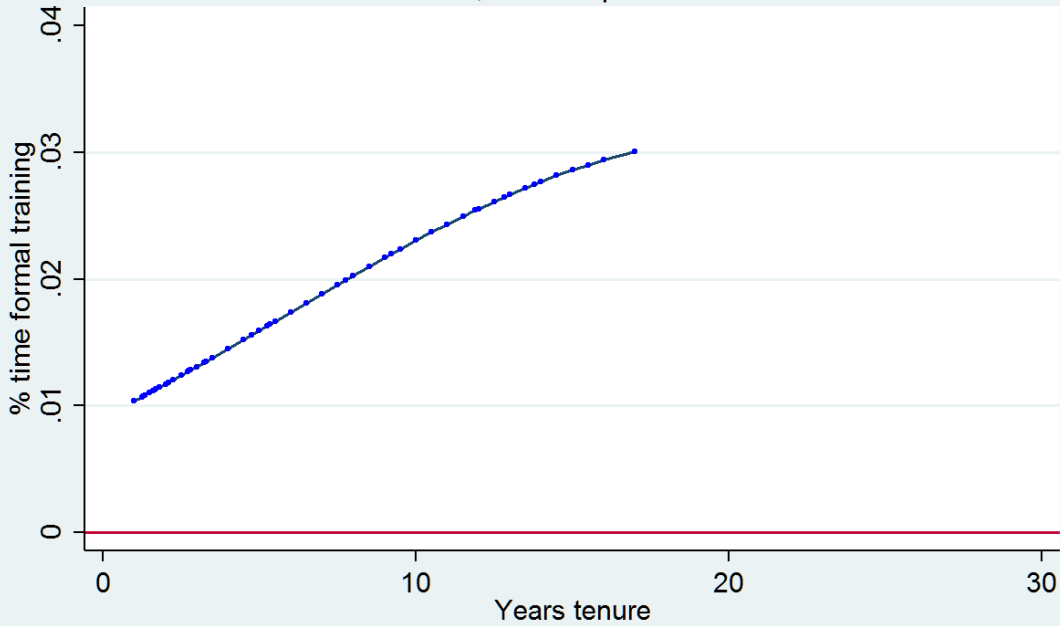
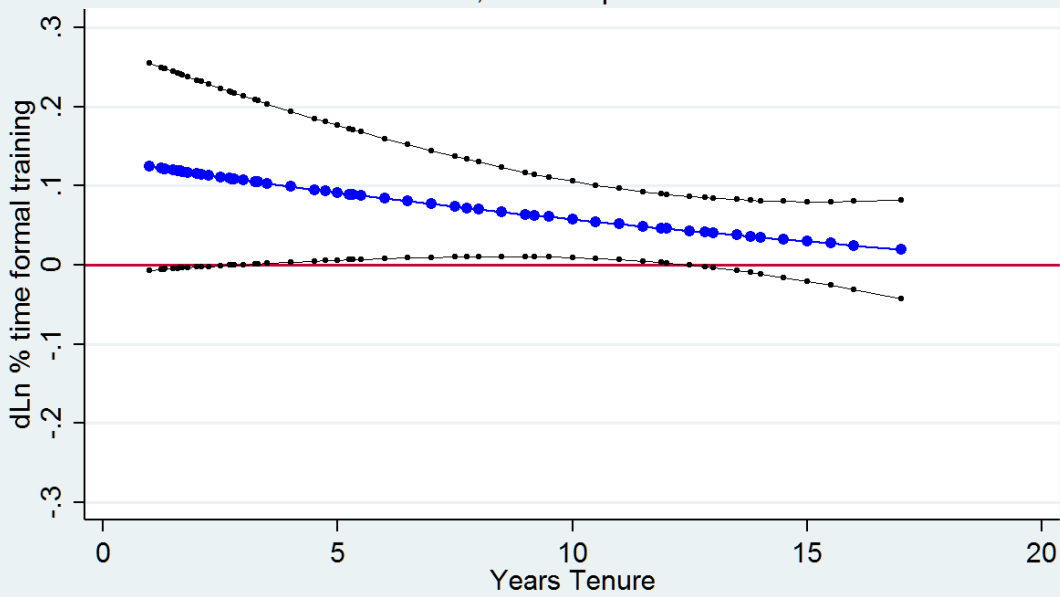


Chart 13b
 dLn formal training/dYrs. Tenure
 SEPT, tenure specification



Outer lines denote 95% confidence interval

Chart 14a
 % time in formal training vs. Years tenure at Pos. start
 SEPT, position tenure specification

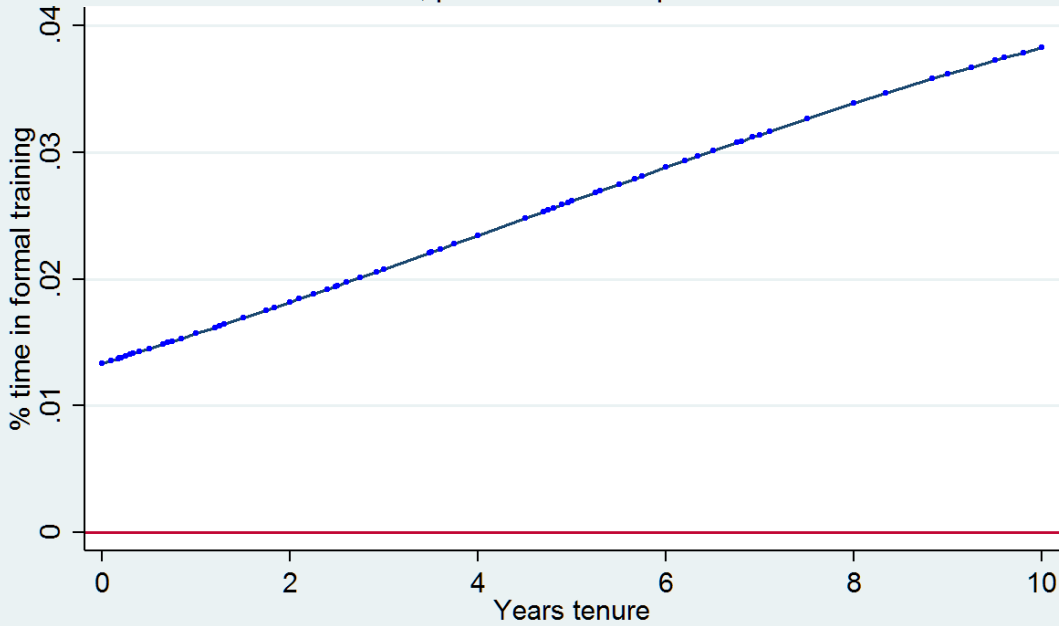
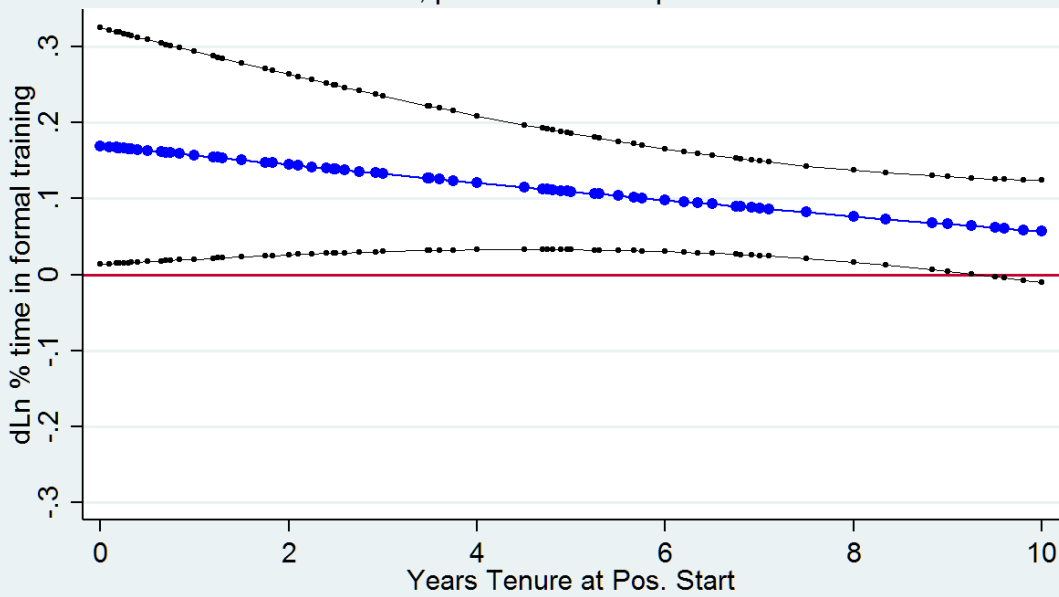


Chart 14b
 dLn % time in formal training/dYrs. Tenure at Pos. Start
 SEPT, position tenure specification



Outer lines denote 95% confidence interval

Chart 15a
 Hours formal training vs. Yrs. Ten. at Pos. Start
 NLS79, 1996-2010, SEPT-compatible position tenure specification

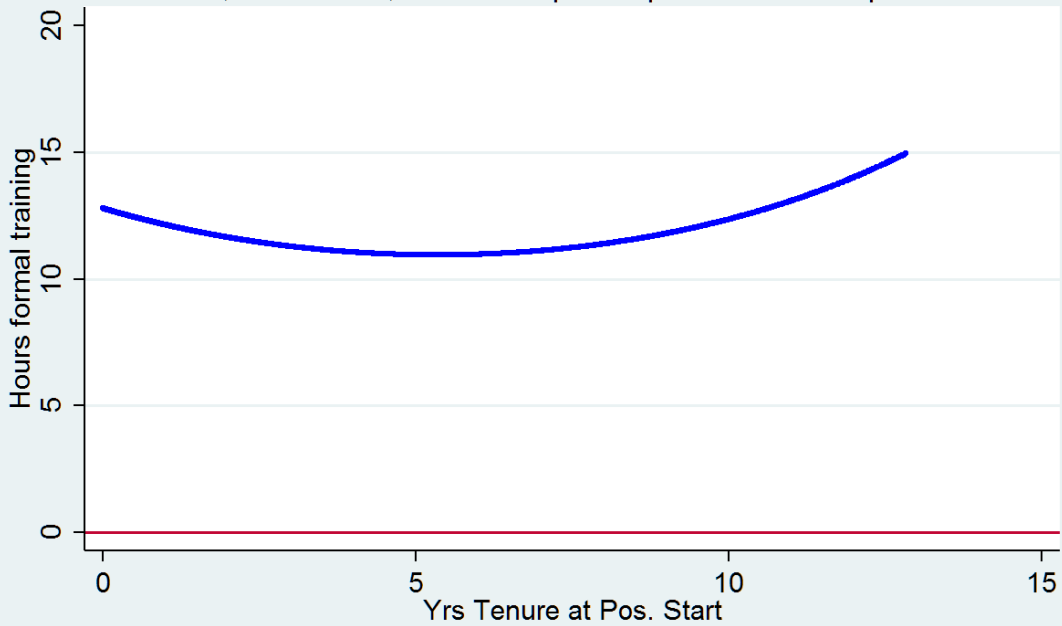
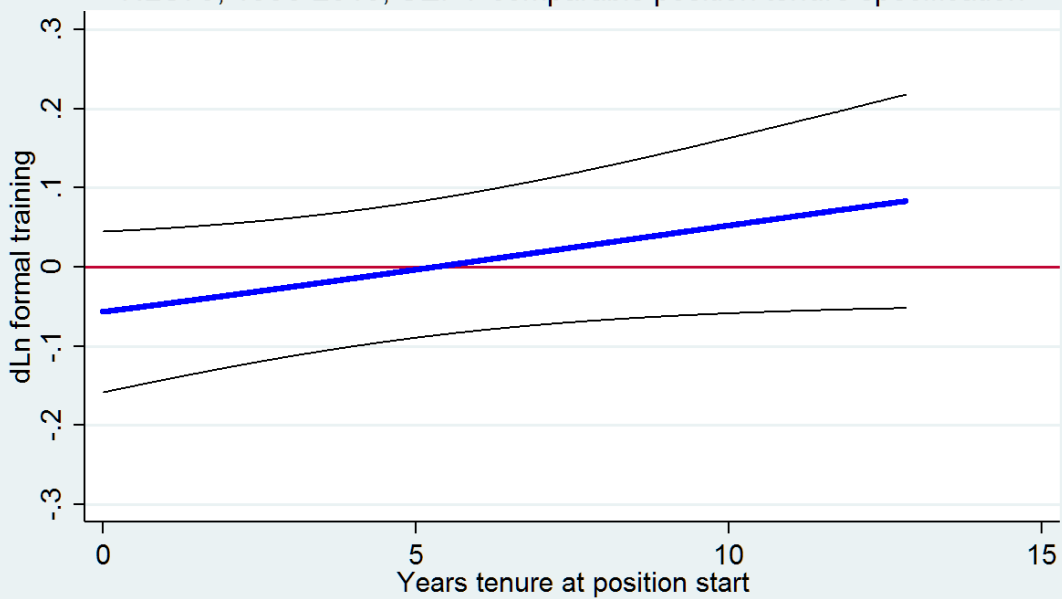


Chart 15b
 dLn formal training/dYrs. tenure at pos. start
 NLS79, 1996-2010, SEPT-comparable position tenure specification



Outer lines denote 95% confidence interval

Chart16a

Hours informal training vs. Years tenure

NLS79, heterogeneity control, 1996-2000, tenure specification

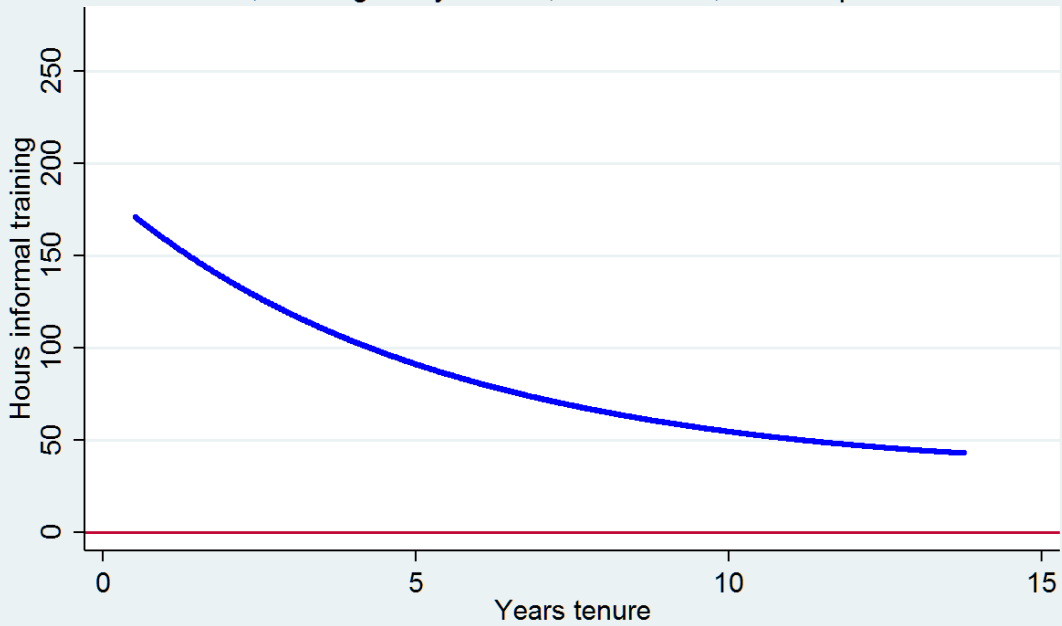
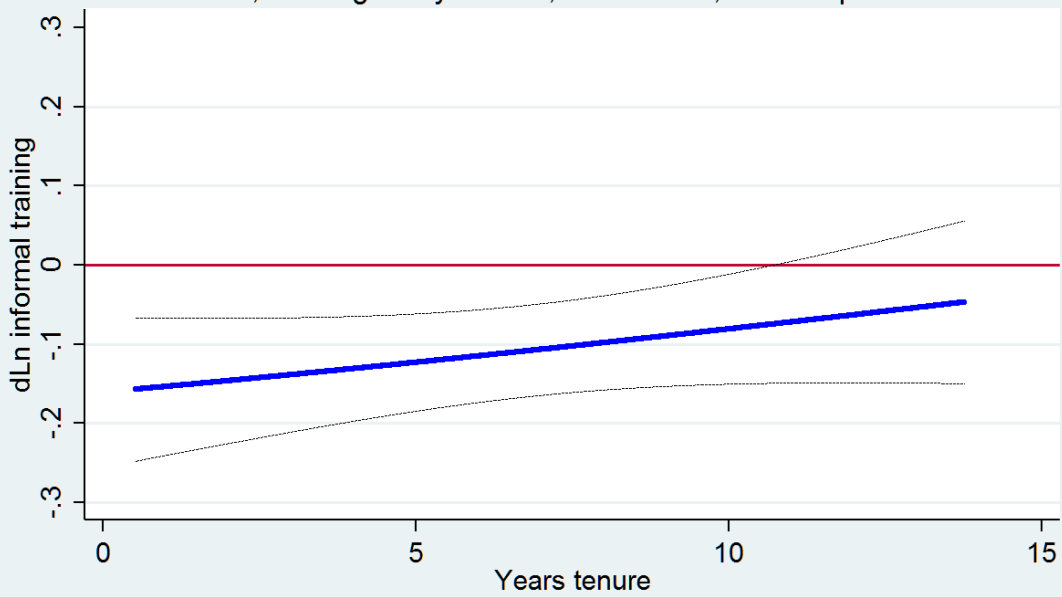


Chart 16b

dLn informal training/dYears tenure

NLS79, heterogeneity control, 1996-2000, tenure specification



Outer lines denote 95% confidence interval

Chart 17a
 Hours informal training vs. Yrs. Ten. at Job Start
 NLS79, heterogeneity control, 1996-2000, position tenure specification

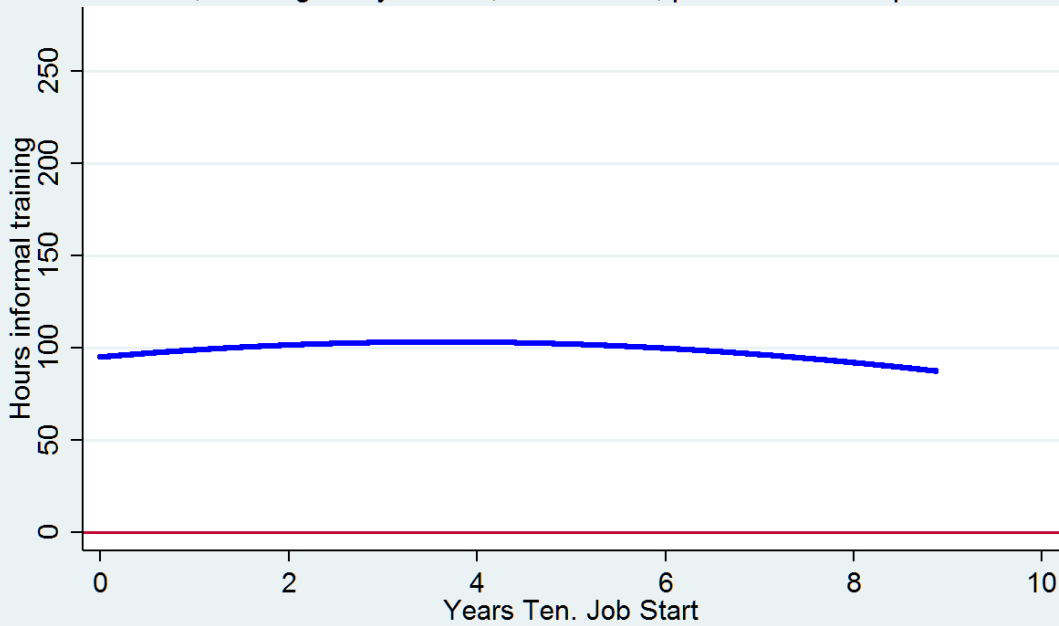
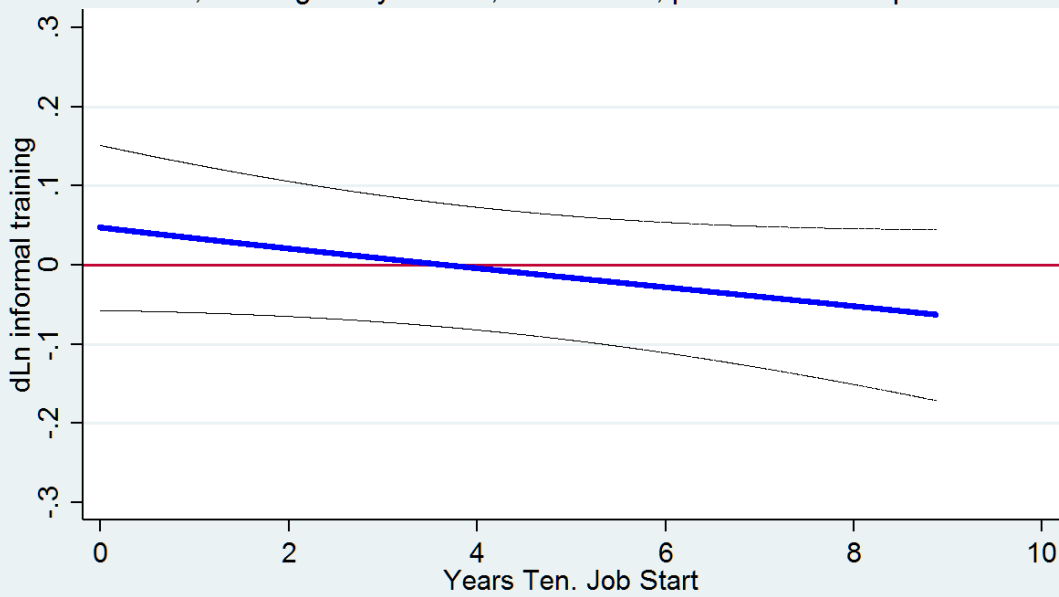


Chart 17b
 dLn informal training/dYrs. Ten. Job Start
 NLS79, heterogeneity control, 1996-2000, position tenure specification



Outer lines denote 95% confidence interval

Chart 18a
 % time informal training vs. Years tenure
 SEPT, tenure specification

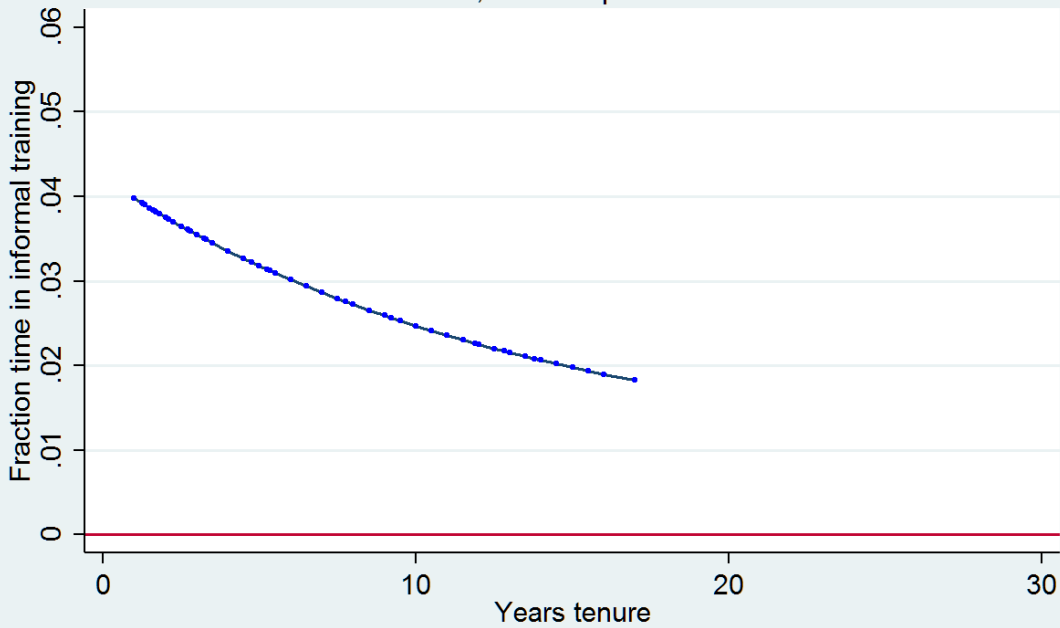


Chart 18b
 dLn informal training/dYrs. Tenure
 SEPT, tenure specification

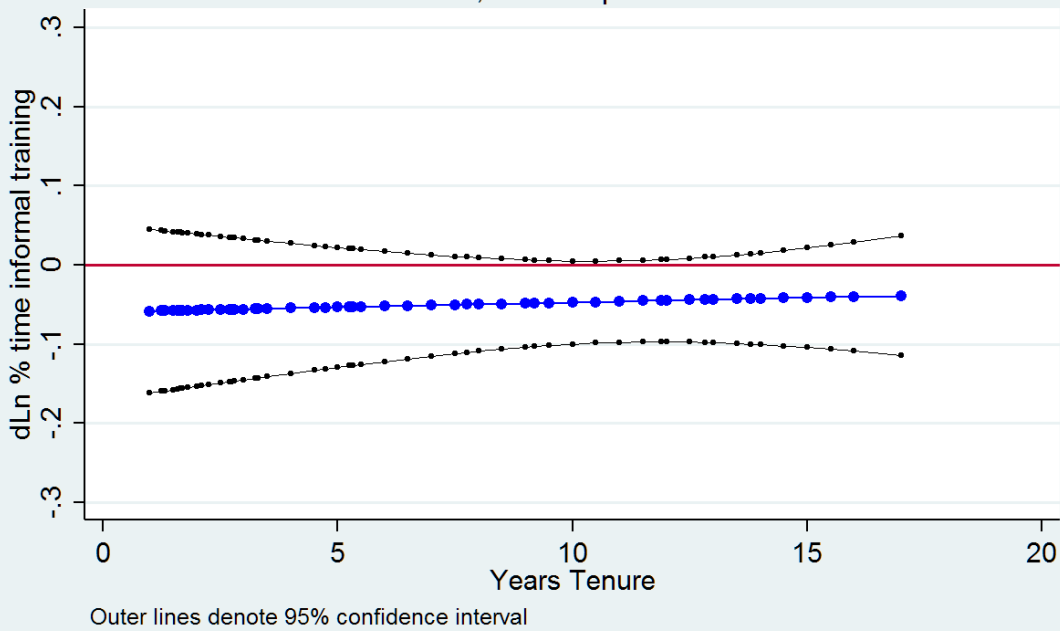


Chart 19a
 % time in informal training vs. Years tenure at pos. start
 SEPT, position tenure specification

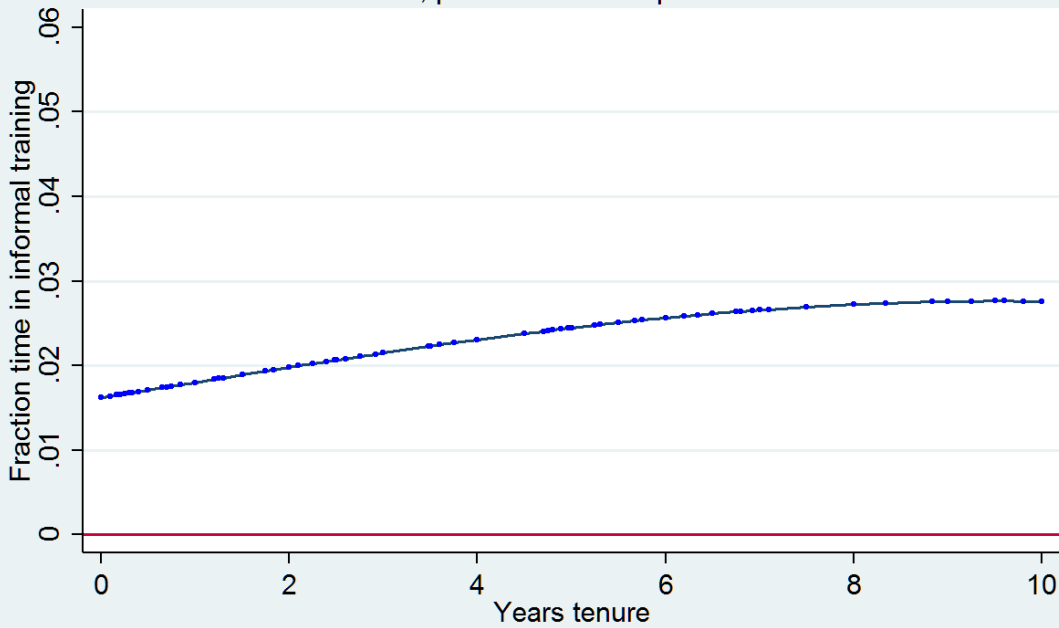
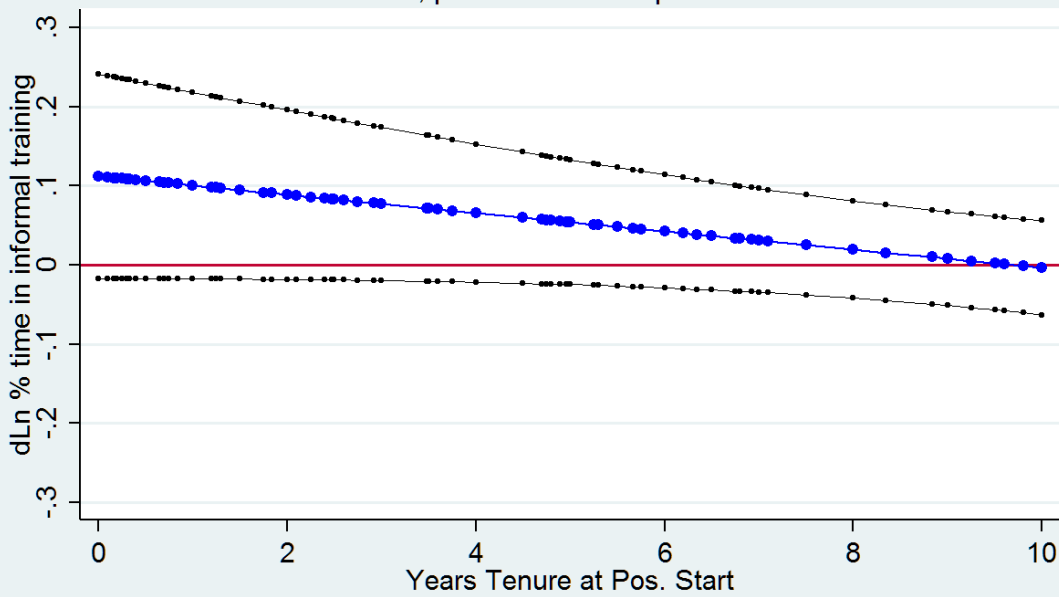


Chart 19b
 dLn % time in informal training/dYrs. Tenure at Pos. Start
 SEPT, position tenure specification



Outer lines denote 95% confidence interval

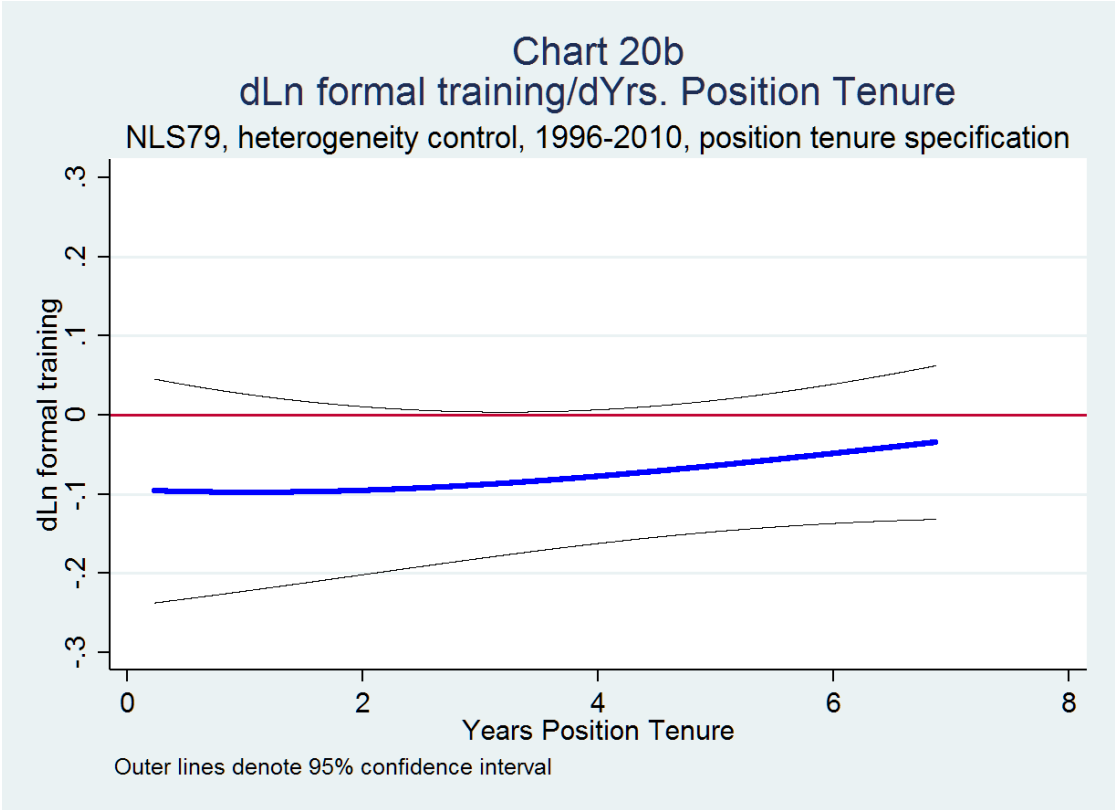
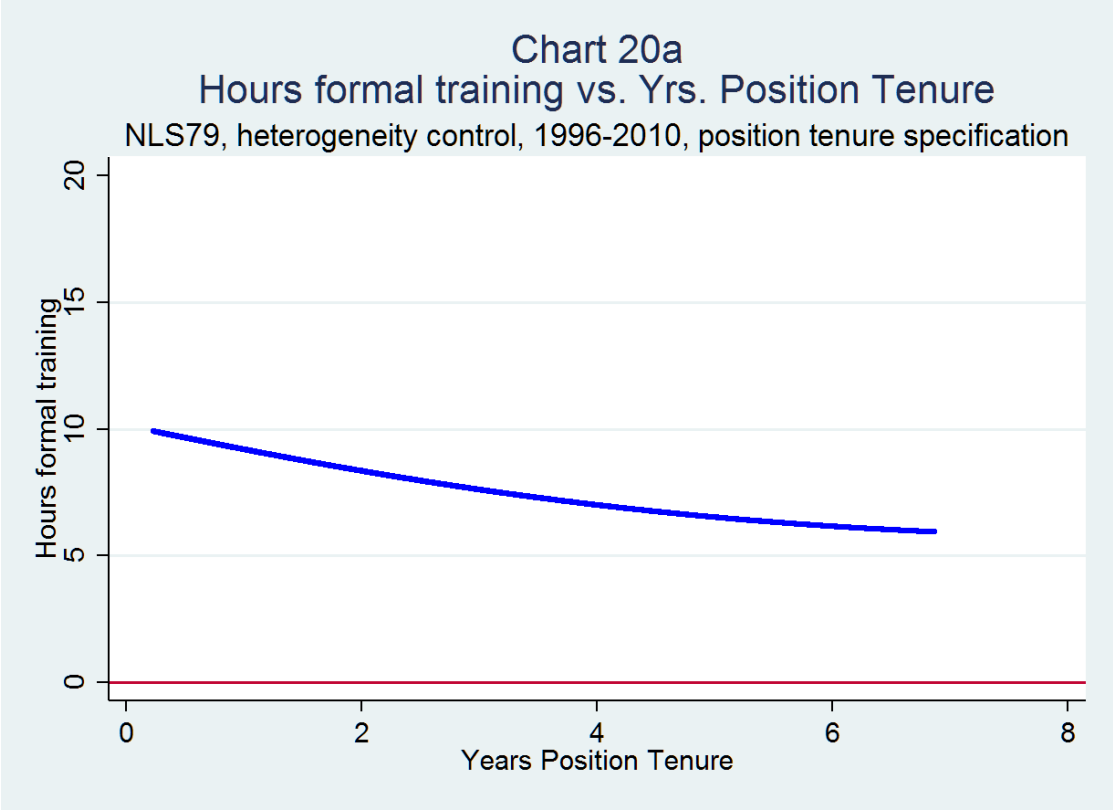


Chart 21a
 % time in formal training vs. Years position tenure
 SEPT, position tenure specification

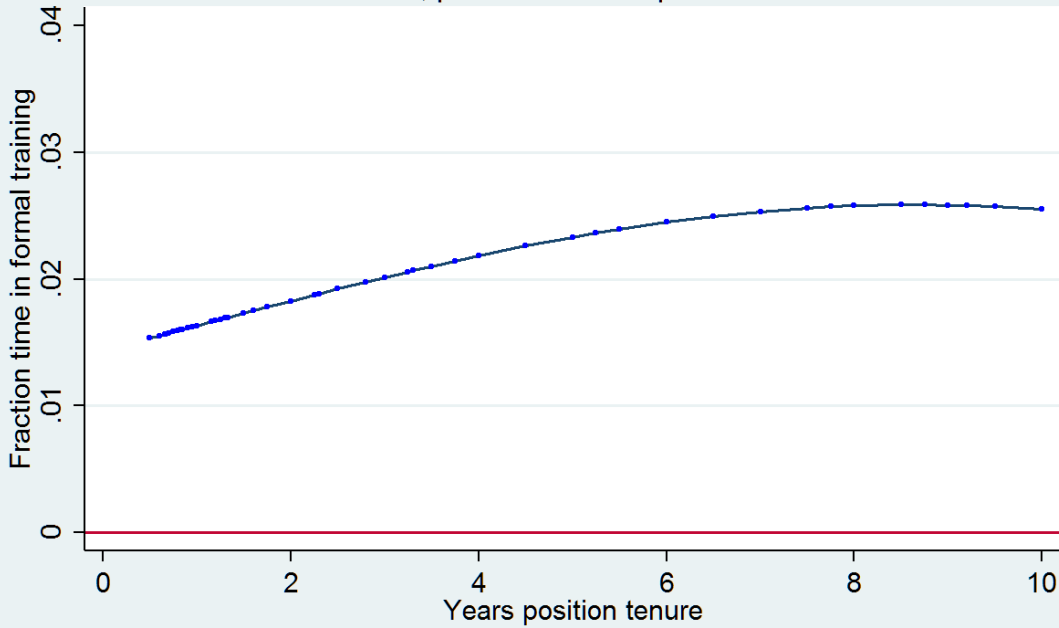
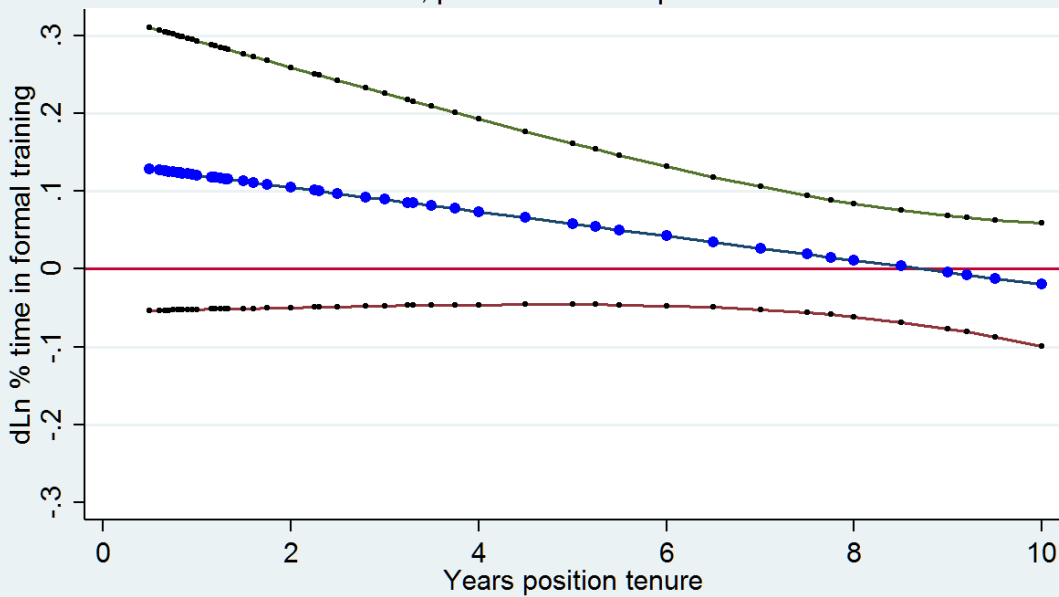


Chart 21b
 dLn % time in formal training/dYrs. position tenure
 SEPT, position tenure specification



Outer lines denote 95% confidence interval

Chart 22a
 Hours formal training vs. Yrs. Position Tenure
 NLS79, 1996-2010, SEPT-comparable position tenure specification

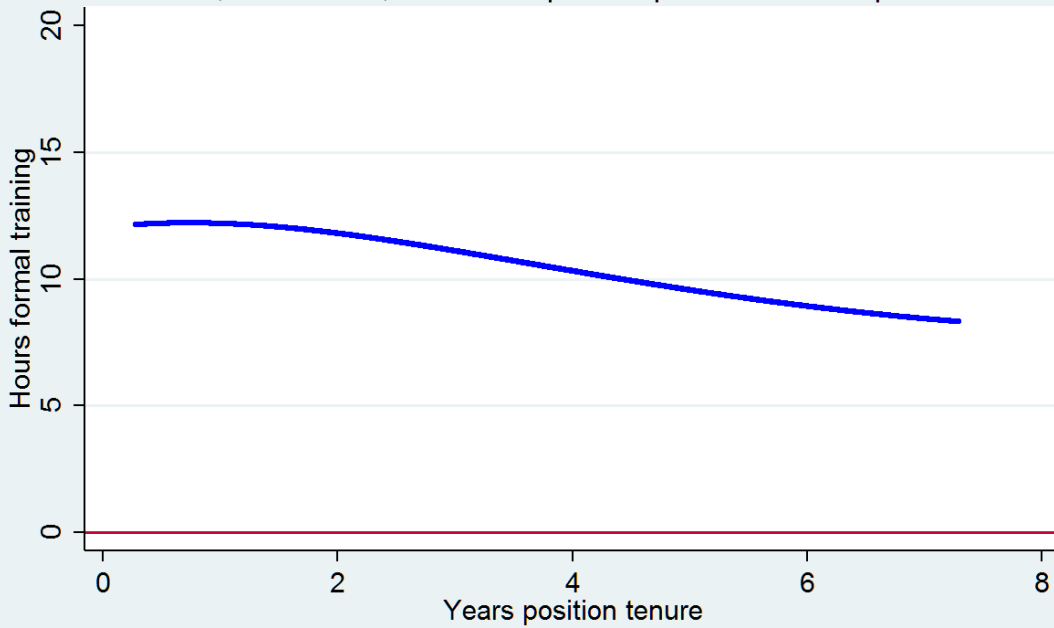
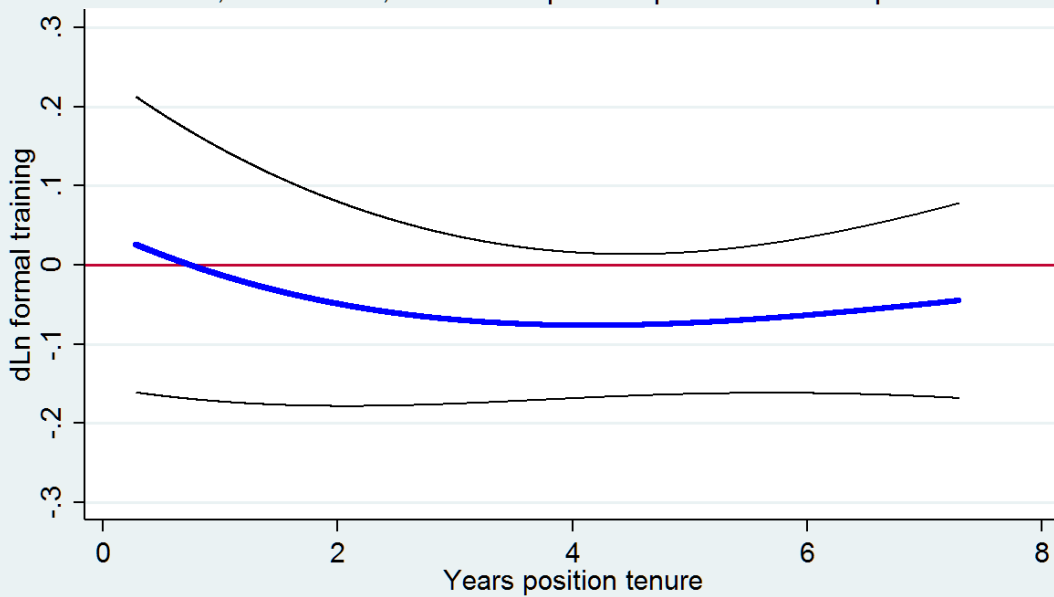


Chart 22b
 $d\ln$ formal training/ d Years position tenure
 NLS79, 1996-2010, SEPT-comparable position tenure specification



Outer lines denote 95% confidence interval

Chart 23a

Hours informal training vs. Yrs. Position Tenure

NLS79, heterogeneity control, 1996-2000, position tenure specification

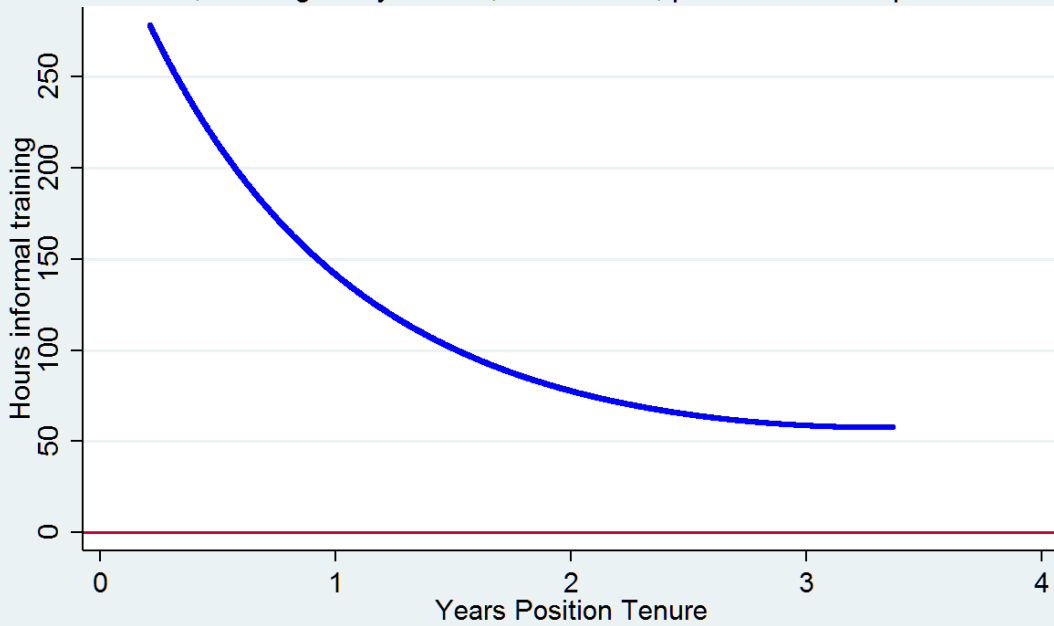
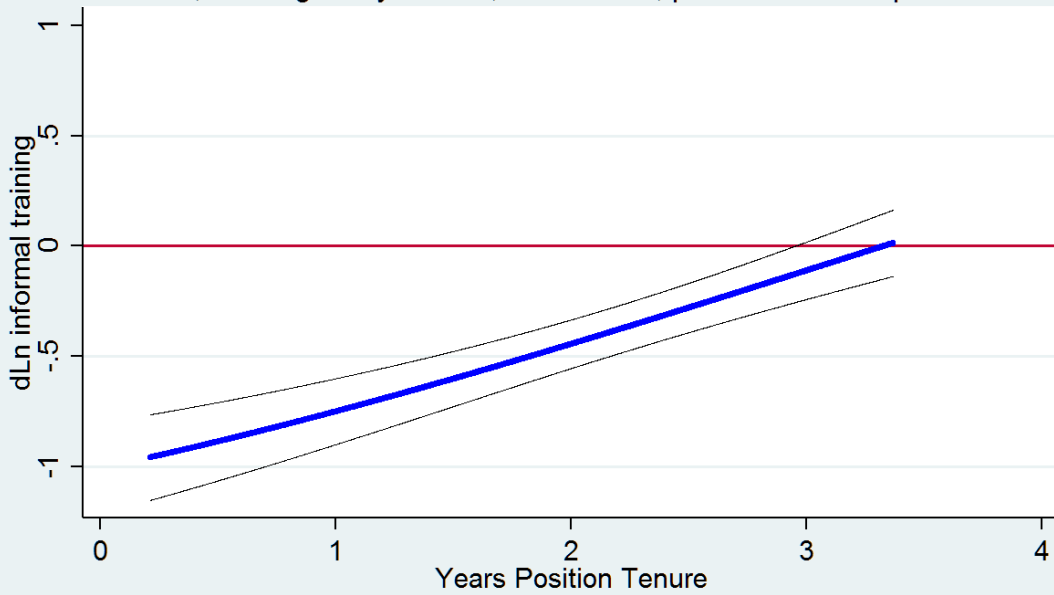


Chart 23b

dLn informal training/dYrs. Position Tenure

NLS79, heterogeneity control, 1996-2000, position tenure specification



Outer line denotes 95% confidence interval

Chart 24a
 % time in informal training vs. Years position tenure
 SEPT, position tenure specification

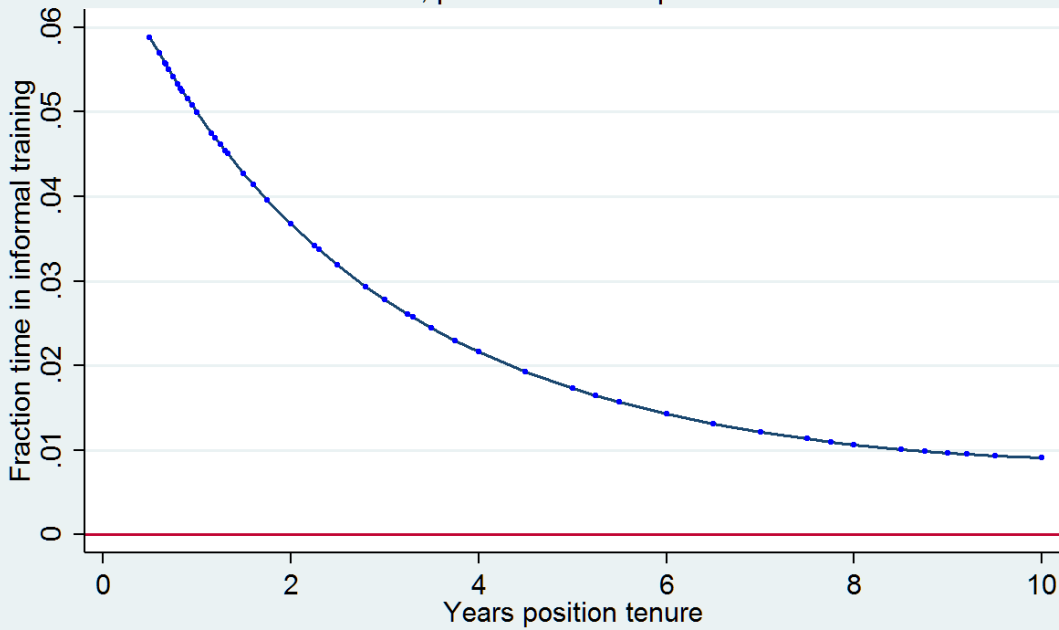


Chart 24b
 dLn % time in informal training/dYrs. position tenure
 SEPT, position tenure specification

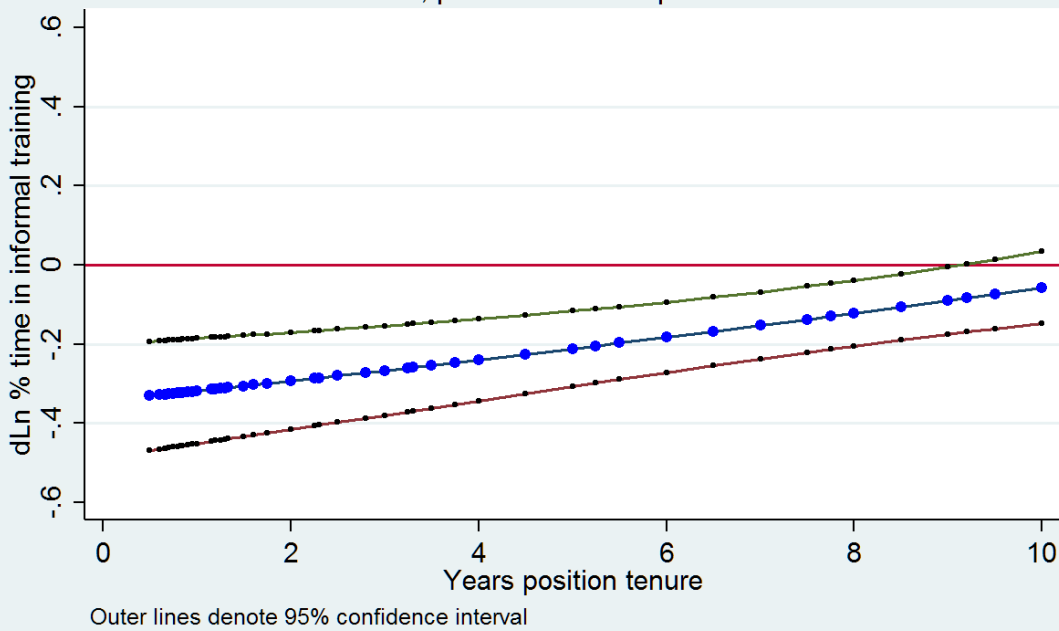


Chart 25a
 Probability of formal training vs Years experience
 NLS79, heterogeneity control, 1979-86, experience specification

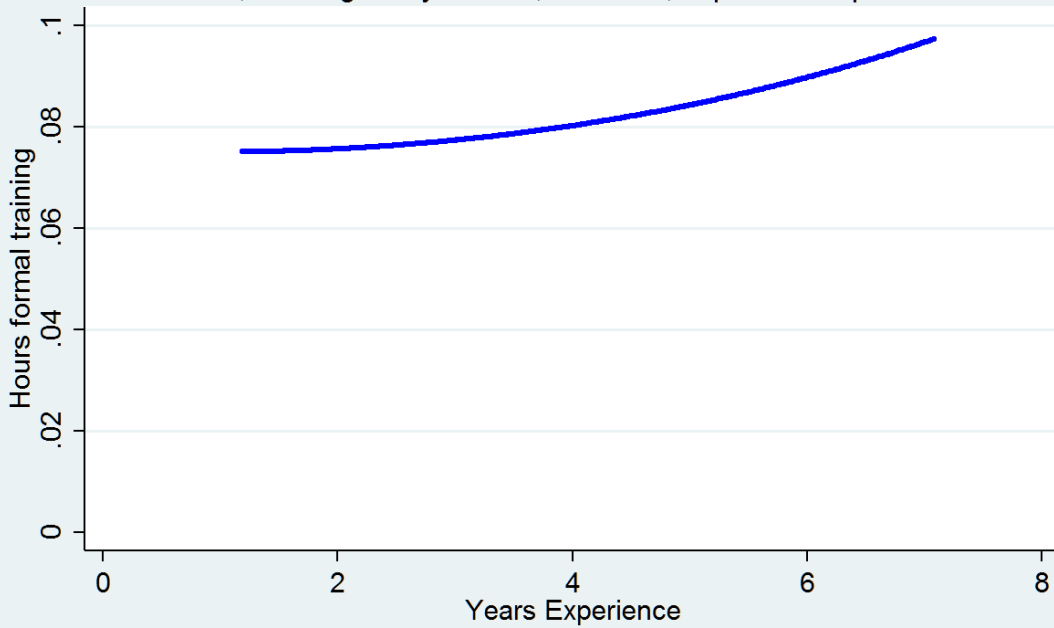
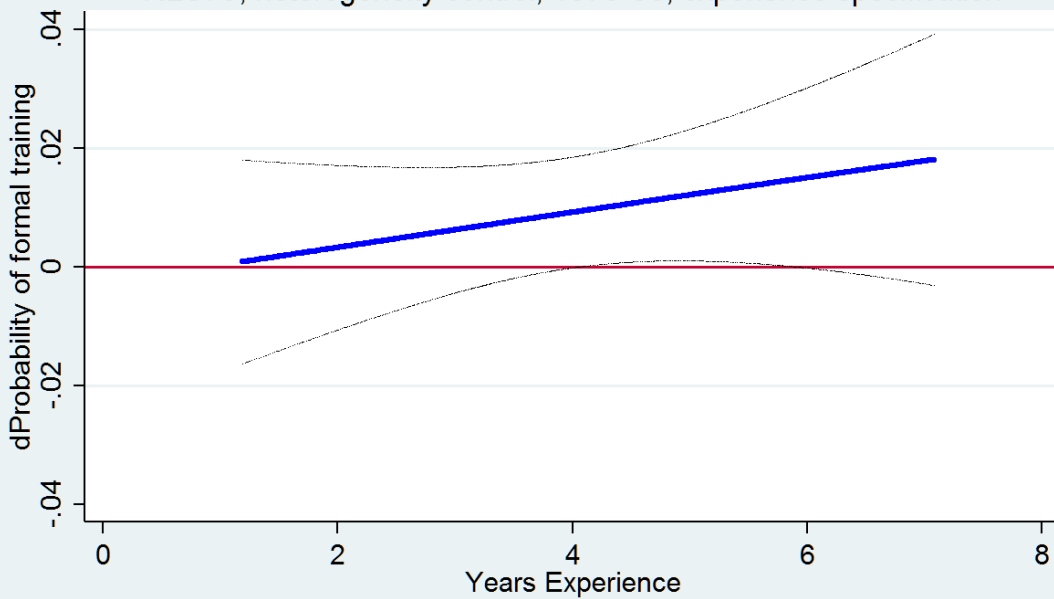


Chart 25b
 dProb. formal training/dYrs. Experience
 NLS79, heterogeneity control, 1979-86, experience specification



Outer lines denote 95% confidence interval

Chart 26a
 Hours formal training vs Years experience, Tr. > 0
 NLS79, heterogeneity control, 1979-86, experience specification

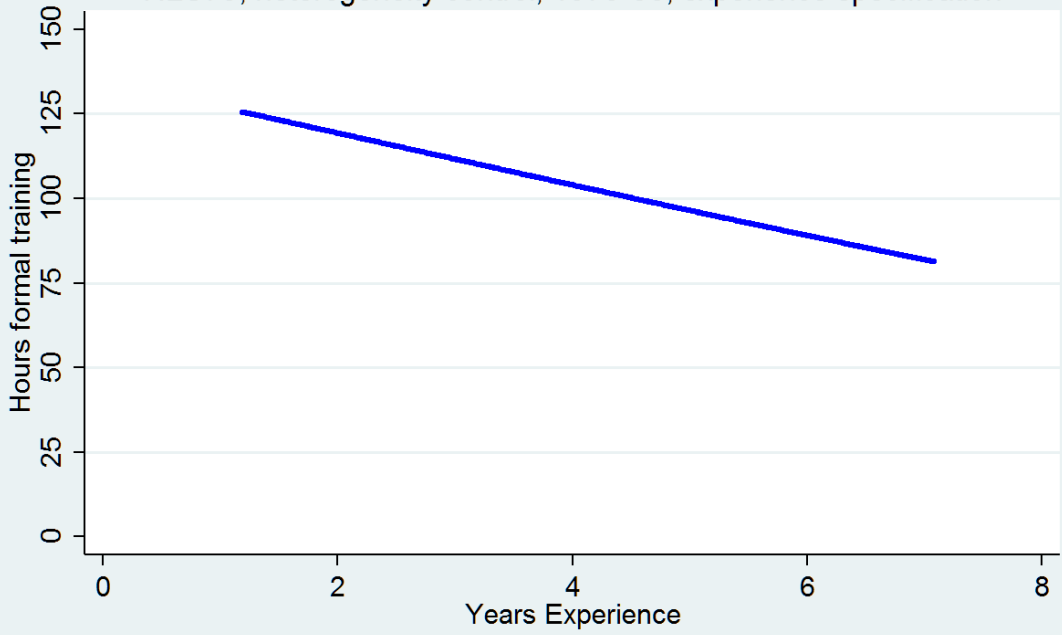
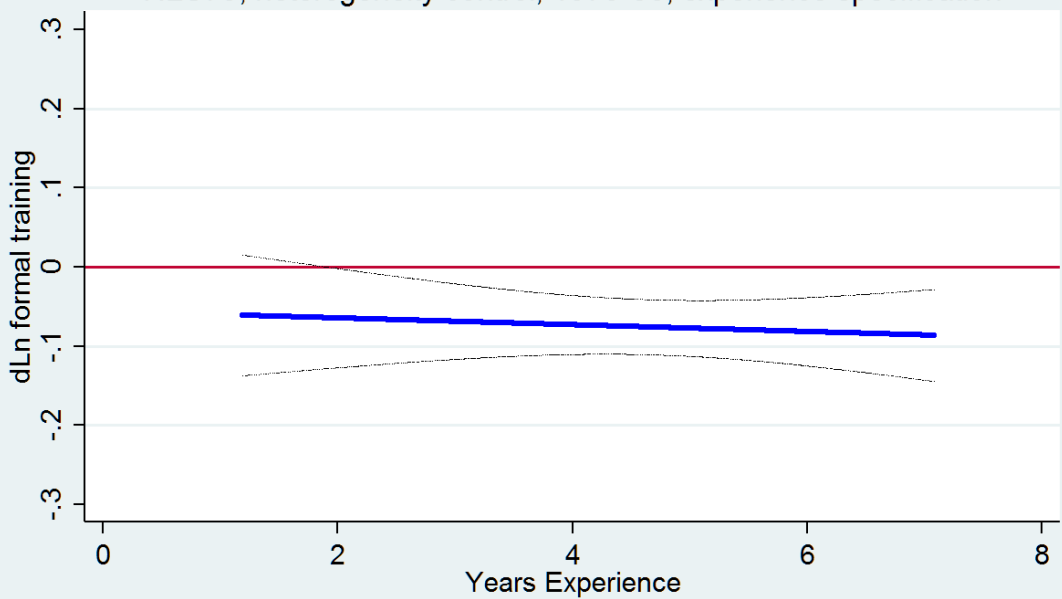


Chart 26b
 dLn formal training/dYrs. Experience, Tr.>0
 NLS79, heterogeneity control, 1979-86, experience specification



Outer lines denote 95% confidence interval