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Does employer learning vary by schooling attainment? The answer depends on how career start dates are defined☆

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HIGHLIGHTS

- We find equal evidence of employer learning for high school and college graduates.
- This refutes a prior study that finds no employer learning for college graduates.
- We attribute the difference in findings to definitions of career start date.

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ABSTRACT

We demonstrate that empirical evidence of employer learning is sensitive to how we define the career start date and, in turn, measure cumulative work experience. Arcidiacono et al. (2010) find evidence of employer learning for high school graduates but not for college graduates, and conclude that high levels of schooling reveal true productivity. We show that their choice of start date—based on nonenrollment at survey interview dates and often triggered by school vacations—systematically overstates experience and biases learning estimates toward zero for college-educated workers. Using career start dates tied to a more systematic definition of school exit, we find that employer learning is equally evident for high school and college graduates.

1. Introduction

The empirically testable model of public employer learning proposed by Farber and Gibbons (1996) and Altonji and Pierret (2001) relies on a simple view of labor market entry: Workers enter the labor market at time $t = 0$ with no labor market experience ($X = 0$), schooling attainment (S) is observed at $t = 0$ and *unchanged* beyond that point, and employers observe performance signals as labor market experience evolves. In short, the employer learning model follows orthodox human capital models (Becker, 1993; Ben-Porath, 1967; Mincer, 1974) in assuming a well-defined, once-and-for all transition from school to employment.

Longitudinal survey data—*e.g.*, the 1979 National Longitudinal Survey of Youth (NLSY79), which is widely used for empirical implementation of the employer learning model[1]—reveal that school-to-work transitions are often less clear-cut than theoretical models assume. Young people interrupt their school enrollment, work while in school, and work both discontinuously and part-time while nonenrolled.[2] Independent of these behaviors, NLSY79 interviews often take place in the summer (especially in early survey rounds), so analysts who allow nonenrollment status at the interview date to trigger the start of the career can inadvertently "start the clock" long before the respondent leaves school or enters the labor market. Given the nature of the data, it is unclear how the career start date should be defined—yet this is potentially a critical decision insofar as it determines which wage observations are included in the analysis, how cumulative labor market experience is measured, and whether schooling attainment continues to increment once the career is deemed to be underway.

In this paper, we ask whether these measurement issues affect the seminal test for employer learning proposed by Altonji and Pierret (2001), hereafter AP, and the extension to that test used by

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[1] NLSY79-based tests of the employer learning model include Farber and Gibbons (1996), Altonji and Pierret (2001), Pinkston (2006), Lange (2007), Schönberg (2007), Arcidiacono et al. (2010), Mansour (2012), and Light and McGee (forthcoming).

[2] Studies documenting these phenomena include Light (1995a, 1995b) and Chuang (1997) on interrupted schooling; Ruhm (1995), Light (2001), Hotz et al. (2002), and Parent (2006) on in-school employment; and Keane and Wolpin (1997), Booth et al. (2002) and Neumark (2002) on early-career employment stability. Michael and Tuma (1984) and Light (1998) focus more generally on school-to-work transitions.

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Arcidiacono et al. (2010), hereafter ABH. The AP test calls for a log-wage model with S, Z, $S \cdot X$, and $Z \cdot X$ among the regressors, where X is labor market experience, S (schooling) is a signal of pre-market productivity observed by employers at $t = 0$, and Z (typically a test score) represents a component of pre-market productivity that employers cannot observe *ex ante*. A negative estimated coefficient for $S \cdot X$ and a positive estimated coefficient for $Z \cdot X$ are evidence that wage determination depends less on initial productivity signals and more on true productivity as employers learn. In an extension to this test, ABH ask whether employer learning differs by workers' schooling attainment. They estimate separate log-wage models for workers with 12 and 16 years of schooling, and find that the estimated $Z \cdot X$ coefficient is positive for the former and zero for the latter. That is, they find evidence of employer learning for high school ($S = 12$) workers only, which they interpret as evidence that college-educated ($S = 16$) workers are able to signal their true pre-market productivity at the outset of their careers.

To learn whether evidence of employer learning is affected by measurement, we conduct both the AP and ABH tests using alternative NLSY79 datasets. First, we work with the exact data used by ABH, whose sample selection rules and definition of career start date are drawn from AP and Lange (2007). Second, we use a preferred version of the data in which the career start date and, in turn, measures of S and X conform closely to the employer learning model. Whereas ABH's career start date is the "year last enrolled" reported by respondents the first time that they are not enrolled at the interview date—which may seem like an innocuous definition of $t = 0$, but in fact corresponds to summer or winter enrollment breaks for those respondents who happen to be interviewed between school terms—we follow Farber and Gibbons (1996), Pinkston (2006) and Schönberg (2007) in pinning our career start date to a well-defined school-to-work transition that is unaffected by the NLSY79 interview schedule. Specifically, we define $t = 0$ as the start of the first nonenrollment spell lasting at least 12 months.[3] ABH define schooling attainment as the *time-varying* value prevailing each time a wage is reported; we define S as the *time-constant* level observed at the start of the career. Because these alternative datasets differ with respect to the measure of X, the measure of S, and the wage observations included, we also use a series of intermediate datasets that hold constant select factors; *e.g.*, we work with a dataset that uses our preferred X and S measures, but contains only those observations that appear in the ABH sample.

By systematically manipulating the data, we demonstrate the following: First, ABH's findings are sensitive to the definition of career start date. Using their data, we reproduce their evidence of employer learning for the $S = 12$ workers but not for the $S = 16$ workers. Using our preferred data, we find that employer learning is equally evident for both schooling groups. Second, ABH's "zero effect" for the $S = 16$ workers can be attributed to their use of career start dates that often precede school exit, and the attendant overstatement of potential experience. This mismeasurement arises for the $S = 16$ workers to a much greater extent than for the $S = 12$ workers because the longer NLSY79 respondents stay in school, the more likely they are to be interviewed during a temporary enrollment break. Third, ABH's (selectively) early career start date does *not* have the advantage of capturing in-school employment experience that is missed by our later start date. Mean levels of *actual* experience are identical when based on the ABH start date and our start date, and it is therefore unsurprising that we find equal evidence of employer learning for $S = 12$ and $S = 16$ workers when we use either start date but substitute a measure of actual experience for potential experience. Fourth, ABH's findings are invariant to whether S is allowed to increment as experience accrues. Use of a time-varying schooling measure is inconsistent with the employer learning model, but the variation in S is not substantial enough to affect the estimates. Fifth, AP's findings—which are based on a pooled sample of workers with schooling levels ranging from 8 to 20—are robust to the definition of career start date. Because mismeasurement of X is concentrated among workers with high schooling levels, it does not drive the estimates when those workers contribute a minor portion of the variation used for identification.

[3] Our findings are invariant to whether we define the cutoff as 6, 12, or 15 months.

2. Employer learning

We begin with a condensed presentation of the AP employer learning model (see also Farber and Gibbons, 1996) to highlight the fact that the career start date ($t = 0$), schooling (S) and cumulative experience (X) are well-defined within the context of the model. After describing in Section 2.2 AP's empirical test for employer learning and ABH's extension, in Section 2.3 we consider how empirical tests of employer learning are likely to be affected by mismeasurement of the career start date, S, and X.

2.1. The Altonji and Pierret employer learning model

The process of public employer learning begins at $t = 0$, when the worker enters the labor market with a productivity level that cannot be directly observed by employers. AP express initial log-productivity as:

$$y_{i0} = rS_i + \alpha_1 q_i + \lambda Z_i + \eta_i$$

where S_i is observed by (all) employers and by the econometrician, q_i is observed by (all) employers but not by the econometrician, Z_i is observed by the econometrician only, and η_i is observed by neither party. It is important to recognize that the econometrician's empirical analogs to S_i and Z_i (typically the highest grade completed and a cognitive test score) must be measured at $t = 0$ and unchanged beyond that point to be consistent with AP's model.

Employers form an expectation of factors that they *cannot* observe (Z_i and η_i) at $t = 0$ on the basis of factors that they *can* observe (S_i and q_i):

$$E(Z_i|S_i, q_i) + \nu_i = \gamma_1 q_i + \gamma_2 S_i + \nu_i$$

$$E(\eta_i|S_i, q_i) + e_i = \alpha_2 S_i + e_i.$$

Employers then use these expressions to form an expectation of initial log-productivity:

$$E(y_{i0}|S_i, q_i) = (r + \lambda\gamma_2 + \alpha_2)S_i + (\lambda\gamma_1 + \alpha_1)q_i,$$

where $\lambda\nu_i + e_i$ represents the initial error in employers' assessments of initial productivity. Over time, firms update their expectations about y_{i0} using observations of the worker's performance history (D_{it})—information that, *by definition*, is unavailable at or before $t = 0$. The model therefore imposes two (related) requirements on the analyst's definition of $t = 0$: the career start date must (i) correspond to the point in the lifecycle when employer learning plausibly begins; and (ii) precede all relevant observations of the worker's performance history.

The AP model assumes that labor markets are competitive and that workers' log-wages equal their expected log-productivity. The log-wage paid by an employer at t is given by:

$$\begin{aligned} w_{it} &= E(y_{it}|S_i, q_i, D_{it}) \\ &= (r + \lambda\gamma_2 + \alpha_2)S_i + (\lambda\gamma_1 + \alpha_1)q_i + H^*(t_{it}) + E(\lambda\nu_i + e_i|D_{it}) + \zeta_{it} \end{aligned} \quad (1)$$

where $H^*(t_{it})$ and ζ_{it} represent additions to log-productivity that occur after $t = 0$ and factors outside the model, all of which are assumed to be orthogonal to S_i, q_i, Z_i, and η_i.