



# University prestige, performance evaluation, and promotion: Estimating the employer learning model using personnel datasets☆



Shota Araki<sup>a,b</sup>, Daiji Kawaguchi<sup>b,c,d,\*</sup>, Yuki Onozuka<sup>a,e</sup>

<sup>a</sup> Hitotsubashi University, Japan

<sup>b</sup> RIETI, Japan

<sup>c</sup> The University of Tokyo, Japan

<sup>d</sup> IZA, Germany

<sup>e</sup> University of Western Ontario, Canada

## HIGHLIGHTS

- We estimate the employer learning model incorporating promotion decision.
- We use personnel datasets from two large Japanese manufacturers.
- Alma mater and performance evaluation are crucial variables to estimate the model.
- Employers learn employee's ability quickly.
- Initial expectation errors on ability halve in about 3 to 6 years in both companies.

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## ABSTRACT

Employers rely on educational credentials to form their initial belief about a worker's ability and update the belief by observing the worker's performance on the job. We study the careers of white-collar university graduates, using personnel data from two large Japanese manufacturers. These data contain information about the university from which the worker graduated, as well as the worker's performance evaluations and positions in the promotion ladder. As employees move up the career ladder, performance evaluations become a more important determinant for promotion than educational credentials. Structural estimates suggest that employers learn workers' ability quickly through observing their performance on the job, with expectation errors halving after about 3 to 6 years.

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\* Corresponding author.

E-mail addresses: [araki-shota@rieti.go.jp](mailto:araki-shota@rieti.go.jp) (S. Araki), [kawaguchi@e.u-tokyo.ac.jp](mailto:kawaguchi@e.u-tokyo.ac.jp) (D. Kawaguchi), [yonozuka@uwo.ca](mailto:yonozuka@uwo.ca) (Y. Onozuka).

## 1. Introduction

Hiring a worker from the labor market is a risky endeavor for an employer, because even a careful examination of a resume and several interviews do not entirely reveal the qualifications of a worker that will determine his performance on a specific job. Consequently, employers are both routinely fortunate to have over-performers who surpass prior expectations and doomed by under-performers. Is this generally held perception consistent with real-world personnel data? If so, how long does it take until the employer is convinced that he is fortunate or doomed by a specific employee? These are the questions that we address in this paper. Analysis of personnel data sets from two large manufacturers in Japan suggests that employers indeed learn employees' ability through observing the performance and the learning takes place quickly;

it does not take long before employers are convinced that they are either fortunate or doomed.

The employer learning model postulates the process by which an employer learns about a specific employee's ability as a series of Bayesian updates of the prior distribution of the employee's ability; the employer first forms each worker's prior distribution of ability from educational background, prior labor-market experience, and impressions from interviews, and then the employer subsequently updates the ability distribution by observing his performance on the job. Estimating the speed of this employer's learning process is crucial to shed light on the significance of ex-post employee allocation across jobs that are heterogeneous regarding how the output depends on each employee's productivity. Lazear (2004) develops a model in which the employer sets a high standard for promotion when the employee's productivity is uncertain, because the employer expects a future mean reversion of the employee's productivity. Setting a high standard for promotion results in an ex-post misallocation of employees across jobs, because many eligible employees end up in easy jobs whose outputs are not sensitive to the employee's productivity, while the allocation is an ex-ante optimal allocation. Therefore, the employer's quick learning of each employee's productivity is the key for properly allocating employees across jobs.

Recent literature empirically estimates the employer learning by which the employer determines the prior distribution of a worker's ability based on his schooling and updates the posterior distribution based on his performance on the job. Farber and Gibbons (1996) and Altonji and Pierret (2001) test the model's prediction using the National Longitudinal Survey of Youth 1979 (NLSY79) by regressing earnings on education and the Armed Forces Qualification Test (AFQT) score, allowing for variable slopes depending on the worker's labor-market experience. Altonji and Pierret (2001) find that as a worker accumulates labor-market experience, the return to schooling decreases, while the return to the AFQT score increases. The findings are consistent with the employer learning model under the presumption that the worker's ability, approximated by the AFQT score, determines performance on the job and the employer sequentially updates the posterior distribution of the worker's ability while observing his performance. Lange (2007) recovers the structural estimates of the speed of the employer's learning from the reduced-form estimates and concludes that the initial expectation error on ability halves after three years of labor-market experience. Recent developments of the literature based on the NLSY79 further address whether the learned information about an employee's ability is the current employer's private information or public information that is shared by employers in the labor market to determine the significance of the labor-market friction caused by information asymmetry among employers (Schönberg, 2007; Pinkston, 2009; Kim and Usui, 2012; Kahn, 2013). Furthermore, Mansour (2012) and Light and McGee (2015) examine heterogeneity in the importance of learning across occupations, and Rao (2016) examines the learning through sibling performance.

Although these previous studies bring innovations to the literature, they have several limitations stemming from their use of the NLSY79, which only records workers' earnings, years of schooling, and AFQT score. Researchers thus need to make several critical assumptions to fill the gap between the employer learning model and observable variables. We point to three important limitations resulting from these assumptions.

First, the absence of the employer's performance evaluation on the job requires that the AFQT score correlates with the performance that the employer observes. This is a reasonable assumption to maintain, but it significantly limits the scope of the information that the employer learns from an employee's performance on the job. Recent studies reveal that non-cognitive ability – examples include social skills, motivation and leadership – is a crucial determinant of labor-market success (Heckman et al., 2006). Therefore, the employee's performance on the job can depend on both cognitive and non-cognitive abilities. Since AFQT is a proxy variable for cognitive ability, previous studies implicitly assume

that the employer learns only the employee's cognitive ability, and thus these studies may underestimate the significance of employer learning.

Second, the absence of workers' alma maters compels researchers to compare the wage paths of workers with different years of schooling, assuming that all high-school graduates and college graduates, respectively, have identical amounts of human capital accumulation. The assumption on identical human capital accumulation paths is not innocuous, given the evidence for the heterogeneity of ability development suggested by personnel data regarding performance evaluations (Kahn and Lange, 2014). Moreover, it is widely known that individuals with higher ability tend to attend elite schools (Dale and Krueger, 2002, 2014; Hoekstra, 2009) and that employers are likely to form different expectations about workers' ability based on the prestige level of the university from which the workers graduated. Indeed, using a Chilean administrative data set, Bordón and Braga (2013) report that at the early stage of workers' careers, employers infer workers' ability from the prestige of the universities from which workers graduated, but its importance fades quickly as workers accumulate labor-market experience.<sup>1</sup> Thus, to estimate the speed of learning properly, controlling for the quality of the college from which each employee graduated is critical.

Third, because job rank on the promotion ladder is lacking in the survey data, researchers must use wages as the outcome variable of employer learning. Using wage as the outcome variable requires researchers to impose assumptions on the information structure and the nature of human capital. With the public learning and general human capital assumptions, every firm in a market learns each worker's ability symmetrically and prices workers' abilities equally; each worker's wage reflects his learned productivity. We maintain the public learning assumption, because the promotion decision becomes strategic in an asymmetric learning environment. In an asymmetric learning environment, promoting an employee emits a signal to other employers about who is eligible, depending on the employee's easily observed characteristics, such as educational background; if the current employer promotes an employee whose educational background is not strong, other employers infer that the employee is an eligible worker (Waldman, 1984). Even if we maintain the public learning assumption, firms other than the current employer do not offer wages that are equivalent to the employee's marginal productivity at the current employer, because a part of the employee's human capital can be firm-specific. Using personnel data sets with clear job ranks on a promotion ladder allows us to deviate from the general human capital assumption, because the optimal allocation of employees across jobs within a company does not depend on the nature of human capital to the extent that human capital is general across jobs within a company.

Kahn and Lange's (2014) contribution is the most closely related to our paper. They estimate an employer learning model with a personnel panel data set, but their goal departs from the original motivation of the employer learning model to decompose the increasing wage heterogeneity over careers into the effect of employer learning and the heterogeneous evolution of human capital. Examining the inter-temporal covariance structure of wage and performance evaluation, Kahn and Lange find that current wage is correlated not only with past performance but also with future performance. They interpret the correlation of current wage and future performance evaluation as evidence for heterogeneous human capital accumulation, because workers with high learning ability tend to have high future human capital, resulting in high future performance evaluations, and it is correlated with current wage through current human capital. At the same time, they find that the covariance of current wage and past performance is discontinuously larger than the covariance between current wage and future performance. They interpret this as evidence for employer learning, because

<sup>1</sup> Bordón and Braga (2013) use the test score and the admission cutoff to implement a regression discontinuity analysis. They do not structurally recover the parameters that govern the speed of employer learning.

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