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Abstract
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Keywords
general training, turnover, tuition assistance

Cover Page Footnote
Colleen Flaherty Manchester is Assistant Professor in the Carlson School of Management at the University of Minnesota. For information regarding the data and/or computer programs utilized for this study, please address correspondence to the author at cmanch@umn.edu.

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GENERAL HUMAN CAPITAL AND EMPLOYEE MOBILITY: HOW TUITION REIMBURSEMENT INCREASES RETENTION THROUGH SORTING AND PARTICIPATION

COLLEEN FLAHERTY MANCHESTER*

Using administrative data from a large establishment that implemented a tuition reimbursement program, the author examines the relative importance of two channels by which these employer-sponsored general training programs increase employee retention. The first channel operates through the type of workers that sort into firms with tuition reimbursement programs versus firms without a program. The second channel is the direct effect on retention due to employees participating in the program. In this setting, the author finds that 80% of the program's overall effect on retention comes through sorting. The author also exploits information on degree major to evaluate potential mechanisms outside standard human capital theory for how participation in general training increases retention.

The potential disconnect between standard human capital theory and training practices often serves to motivate research on the provision of general skills training by firms. Becker's (1962) seminal work on human capital includes the prediction that a firm will not invest in the general human capital of its workers because transferability of the acquired skills prevents the firm from capturing the return on its investment due to the poaching of trained workers by outside employers. Counter to this prediction, empirical evidence is available of firms providing general training and bearing at least part of the cost (see, for example, Barron, Berger, and Black 1999; Loewenstein and Spletzer 1999a, 1999b). Despite this evidence, Becker's theory of human capital remains the dominant framework for conceptualizing provision of general training in part because of uncertainty as to whether the training identified in past studies was in fact general. Tuition reimbursement programs, a firm-sponsored benefit that reimburses employees for the financial cost of coursework, represent an opportunity to glean insight into the potential limitations of standard human capital theory

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because curriculum development, instruction, and certification typically take place outside the firm at accredited institutions, which makes the skills acquired transferable and observable to many potential employers. Because tuition reimbursement programs provide general skills, the widespread prevalence of these programs appears to question the predictions of standard theory: Black and Lynch (1998) report that nearly 50% of firms with more than 20 employees have a formal tuition reimbursement program. The prevalence of tuition reimbursement programs indicates that firms are able to capture at least some return on their investment, potentially through increased employee retention despite the prediction of standard human capital theory regarding the transferability of general skills.

In this article I evaluate two channels through which these programs may generate a positive retention effect. The first channel, which I call the *sorting effect*, operates through the type of workers that sort into firms with tuition reimbursement programs versus firms without a program. The second channel, or the *participation effect*, is the effect of the program on retention due to employees taking coursework. Only the second channel has been studied in regard to tuition reimbursement programs. By explicitly considering both channels, I evaluate their relative importance, which provides the greatest insight to date into the influence of these programs on employee retention.

Identifying the relative importance of these two channels has implications for the relevance of human capital theory to the training practices of firms. If the higher retention from sorting stems from the lower discount rates of new employees, then the reduced turnover induced by sorting is consistent with human capital theory because it predicts that individuals with lower discount rates place a greater value on opportunities to invest in human capital. Increased retention of those who participate, however, is a puzzle because the transferability of skills acquired through these programs should make it easier for workers to find attractive jobs elsewhere. Therefore, to the extent that the retention effect is dominated by sorting, the more able firms are to capture returns to general training despite the transferability of these skills. This would imply that the prevalence of these programs is consistent with the net present value framework of human capital theory, and program provision would not hinge on the reduced mobility of employees who participate in the program. Alternatively, if participation drives the total retention effect, then the widespread prevalence of these programs severely questions the applicability of standard theory to firm training practice.

For the analysis, I use data on participation and retention at an employer that introduced a tuition reimbursement program. By using employees hired just before the program's implementation as the control group, I am able to identify the retention effect due to the sorting. I then evaluate the effect of program participation on retention and quantify the relative importance of the two channels in explaining the total effect of tuition reimbursement on retention. Finally, I test various mechanisms proposed in the

human capital literature as alternatives to the competitive paradigm used in standard human capital theory that may result in general training having a positive effect on retention by exploiting information on the type of coursework pursued by the employee.

The primary contribution of this article to the literature lies in quantifying the importance of worker sorting in explaining the negative relationship between program provision and turnover that was first documented by Cappelli (2004). My analysis of the effect of participation on retention is largely consistent with past studies, such as Benson, Finegold, and Mohrman (2004) and Garcia, Arkes, and Trost (2002), but extends existing work by identifying its contribution to the total effect of these programs on retention. In addition, I use information on degree type to explicitly evaluate asymmetric information and mobility constraints as possible explanations for how these programs directly increase retention through participation. While Pattie, Benson, and Baruch (2006) find that, among business graduate students, those pursuing job-related degrees have lower turnover intentions, in this article I extend existing research by evaluating actual turnover behavior and investigate the role of job-relatedness over a wide variety of degrees.

Data and Program Description

The administrative data used for this article were obtained from a nonprofit, academic institution that implemented a tuition reimbursement program on September 1, 1999, for employees pursuing degree programs off-site. Even though the setting is an academic institution, degree classes offered at the employer site are available only to full-time students, not to employees, which precludes any concern that this program has negligible marginal cost to the employer. In addition, salary and position are not tied to number of credits earned, or to highest degree completed. Therefore, the context can be generalized to most employers that value the accumulation of general human capital by its employees through attainment of degrees. This specific program will be referred to as TRP hereafter.

Tuition reimbursement programs typically consist of three parts: 1) a maximum reimbursement amount; 2) an eligibility requirement; and 3) a reimbursement policy based on academic performance. Most firms limit the annual reimbursement level, with the majority of maximum reimbursement amounts set in excess of $4,000 (Eduventures 2003). The most common annual limit is $5,000, which is approximately equal to the tax-exempt limit.[1] A minimum length of service is often required before an employee is

[1]Section 127 of the U.S. Internal Revenue Code outlines the tax-advantaged status of educational assistance plans provided by employers: "Gross income of an employee does not include amounts paid or expenses incurred by the employer for educational assistance to the employee if the assistance is furnished pursuant to a [educational assistance] program" (26 U.S.C. S127). The current maximum income exclusion for a single calendar year is $5,250.

eligible to participate in the program, typically between six months and one year. A smaller fraction of firms also stipulate a service requirement following participation (Eduventures 2003); this requirement is more common in programs with unlimited annual tuition reimbursement. To receive reimbursement, firms usually require that the employee receive a passing grade in the course. Some programs tie the level of reimbursement to course performance, making the cost of participation higher for workers who receive lower grades.

TRP is typical in terms of program characteristics: 1) a maximum reimbursement of $5,250 a year; 2) a one-year service requirement prior to eligibility, but no requirement following participation; and 3) employees must receive a C grade or better to receive reimbursement. In addition, employees need to be admitted into a degree program, but the program or major does not need to be job-related. TRP qualifies under Section 127 of the U.S. Internal Revenue Code, allowing reimbursements to be exempt from federal income taxation.

Employees included in the analysis are new hires in supervisory and nonsupervisory white-collar positions. Those who were hired between September 1, 1998, and August 31, 2000, are used to evaluate retention due to sorting, while employees hired between September 1, 1999, and September 1, 2001, are used to evaluate retention due to participation. Retention data are available annually through December 2005. The administrative data do not include an indication of whether the employee's separation was voluntary or involuntary; however, historically nearly all separations from this employer were voluntary. Individual records of participation in TRP include the amount reimbursed, the degree type, and the major or area of concentration for those who participated at any point from September 1, 1999, to August 31, 2004. The amount reimbursed over these five years totaled nearly two million dollars for all employees at the institution, while those hired after September 1, 1999, received approximately $700,000 in reimbursements.

To initially evaluate the two channels for increasing retention, I consider two sets of descriptive statistics. First, Table 1 displays descriptive statistics of employee characteristics by participation status for the sample of employees hired after the program was implemented (i.e., hired between September 1, 1999, and September 1, 2001). This sample will be used to evaluate the direct effect of participation on retention. Second, Table 2 reports descriptive statistics for employees by participation status for employees hired within one year before and one year after implementation of TRP. This sample is used to investigate the possible indirect effect of TRP on retention through sorting.

For the first sample, shown in Table 1, approximately 6% of these employees participated between September 1, 1999, and August 31, 2004, with the average participant receiving nearly $5,000 in reimbursement and using the program for nearly two years.[2] Two-thirds of participants used TRP to

[2]This participation rate is similar to the median rate of 7% among the 200 plans included in a 2006 report by the International Foundation of Employee Benefit Plans (IFEBP 2006).

Table 1. Sample Means: Nonparticipants Compared with Participants

Employee characteristics	*Nonparticipants*	*Participants*
Left before 5 years (%)	57.4	38.6***
Female (%)	69.7	68.6
Age at hire	35.2	30.8***
Asian (%)	20.7	23.6
Black (%)	5.1	8.6
Hispanic (%)	8.1	7.4
White (%)	66.1	60.7
Starting wage (weekly) ($2001)	$1,298	$1,224
Supervisor[a] (%)	54.0	42.9**
Nonsupervisor (%)	46.0	57.1**
Years in TRP	—	1.79
TRP spending (nominal $)	—	$4,924
Graduate degree (%)	—	67.1
Observations	2,311	140

Notes: Sample includes employees hired between September 1, 1999, and August 31, 2001.
[a] Workers are categorized as supervisors if they are "exempt" from the Fair Labor Standards Act of 1938 (FLSA).
* Significantly different by participation status at the 10% level; ** at the 5% level; *** at the 1% level.

Table 2. Sample Means: Hire Pre-TRP Compared with Post-TRP

	Nonparticipants		*Participants*	
Employee characteristics	*Pre-TRP*	*Post-TRP*	*Pre-TRP*	*Post-TRP*
Left before 5 years (%)	71.2	57.0**	54.3	37.3*
Female (%)	74.4	69.5**	69.6	71.2
Age at hire	36.2	34.9***	33.1	30.2*
Asian (%)	23.0	18.6**	17.4	23.7
Black (%)	6.7	5.0	13.0	10.2
Hispanic (%)	8.3	9.1	4.3	6.8
Supervisor[a] (%)	52.0	51.9	41.3	40.7
Nonsupervisor	48.0	48.1	58.7	59.3
Starting wage (weekly) ($2001)	$1,215	$1,232	$1,086	$1,136
Years in TRP	—	—	1.87	1.81
TRP spending (nominal $)	—	—	$4,634	$5,152
Graduate degree (%)	—	—	47.8	64.4*
Observations	882	953	46	59

Notes: Sample restricted to employees hired one year prior to and after implementation of TRP; Pre-TRP were hired between September 1, 1998, and August 31, 1999, while Post-TRP were hired between September 1, 1999, and August 31, 2000.
[a] Workers are categorized as supervisors if they are "exempt" from the Fair Labor Standards Act of 1938 (FLSA).
* Significantly different by participation status at the 10% level; ** at the 5% level; *** at the 1% level.

pursue a graduate degree. Table 1 also shows that participants in TRP differ from nonparticipating employees in terms of observable demographic and employment characteristics. Participants are younger, on average, and are less likely to be in a supervisory role. A five-year window is used to evaluate retention because it is the longest retention-time outcome available in the

data that can be consistently applied to new hires who joined the employer before and after TRP's introduction. Although not part of the administrative record, turnover at this employer is, with few exceptions, voluntary. Unconditionally, a large and significant difference exists in the propensity to leave the employer within five years: TRP participants are nearly 20 percentage points less likely to separate within five years as compared to nonparticipants.

Note that this difference in retention rates between participants and nonparticipants among employees hired after TRP was implemented does not take into account any potential retention effects attributable to the type of employees that sort into the institution because of the availability of a TRP. Table 2 provides an initial estimate of this effect, which shows that the retention rate within participation status significantly differs by whether the employee was hired just before or just after the introduction of TRP. Among nonparticipants, 71% of those hired in the year before TRP was implemented left the employer within five years as compared with 57% of those hired in the year following TRP's introduction (difference is significant at the 5% level). A similar difference is present among participants: 54% of those hired in the year before TRP left within five years, while just 37% of those hired in the year following TRP left within five years (significant at the 10% level).[3] Statistics reported in Table 2 indicate that a few significant differences in employee demographics by hire year occur among nonparticipants. The multivariate analysis in the next section estimates the sorting effect taking into account these differences.

Effect of TRP on Retention

First Channel: Sorting

I take advantage of TRP's implementation to examine the effect of the program on retention through its effect on the composition of workers. Rosen's (1986) work on equalizing differences, which explains how nonwage aspects of a job affect the composition of workers attracted to the firm, provides a basic framework for thinking about increased retention due to worker sorting. Holding total compensation fixed, workers will sort across firms based on their preferences for nonwage characteristics, such as tuition reimbursement. Despite empirical evidence that firms pay for at least part of tuition reimbursement (Cappelli 2004; Arcidiacono, Cooley, and Hussey 2008), this does not preclude sorting. Even if the firm bears the entire tuition cost, tuition reimbursement programs could still induce sorting because participation in the program imposes a cost on employees in terms of time and effort. Cappelli (2004) uses these time and effort costs of participation as the foundation for his model of asymmetric information that generates a separating equilibrium in which all high-ability individuals work in firms

[3]Table 2 shows that Post-TRP hires were more likely to pursue graduate degrees relative to Pre-TRP hires, which could contribute to higher retention among Post-TRP hires.

with a tuition reimbursement program by relying on the standard assumption that learning costs are decreasing in ability.

Cappelli (2004) considers sorting across employers based on unobserved ability; however, I consider a different aspect of the individual's decision to invest in human capital to motivate the potential for increased retention due to sorting. A major innovation of standard human capital theory is that it applies the net present value framework used for investments in physical capital to human capital. An investment decision based on a net present value calculation depends on the stream of benefits and costs as well as the discount rate. The returns to investing in human capital are higher for individuals who have lower discount rates because the benefits to human capital investment (i.e., higher wages) accrue in the future whereas the costs are immediate. Workers with lower discount rates place a higher value on future consumption relative to workers with higher discount rates and therefore find tuition reimbursement programs more attractive. Moreover, workers with lower discount rates are also likely to have lower mobility risk because they place greater weight on types of deferred compensation or advancement opportunities offered by the firm. Hence, tuition reimbursement programs may indirectly increase retention in that workers at a firm with a program may have lower turnover propensities than workers at firms without a program.

To quantify the first channel by which a TRP program may affect retention, I examine the extent to which nonparticipants hired after the introduction of TRP have significantly lower turnover rates than those hired just before the introduction.[4] This strategy uses employees hired in the year prior to program implementation as the control group, because these employees would not be expected to have systematically different turnover propensities than those hired in the following year if the program had not been implemented. I compare these Pre-TRP hires, or employees hired in the year preceding TRP (between September 1, 1998, to August 31, 1999) to Post-TRP hires, or employees hired in the first year of TRP's implementation (between September 1, 1999, and August 31, 2000).[5]

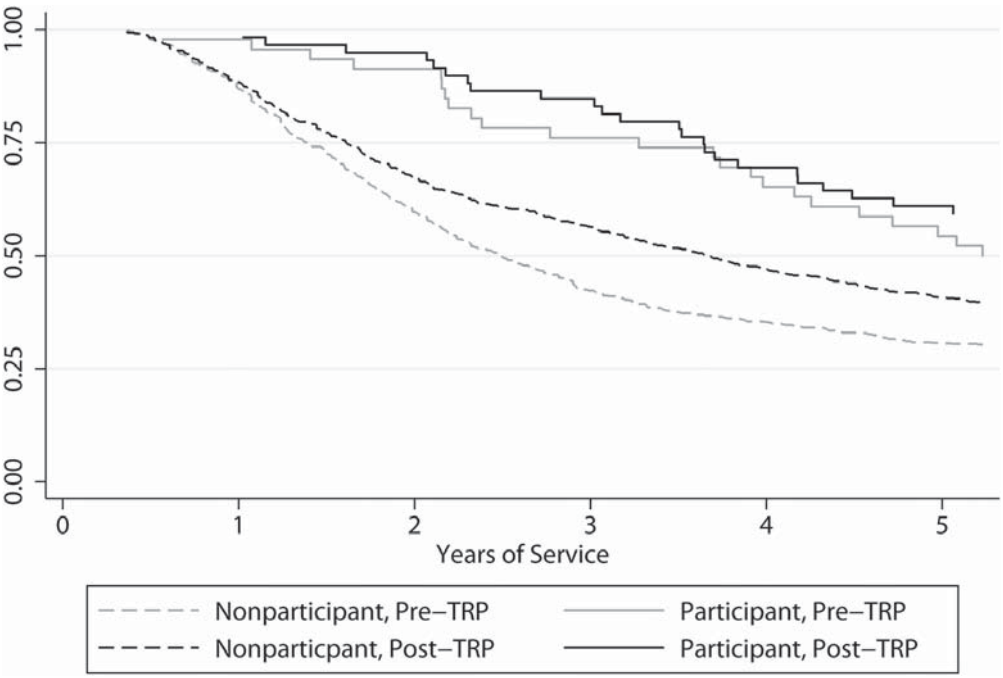
Figure 1 displays the Kaplan-Meier survival functions for the two groups of employees by participation status. For both cohorts of employees, the survival functions of participants lie above those of nonparticipants, which indicates higher survival rates of participants. More important for the analysis of the sorting effect, this figure also shows that the survival function of nonparticipants hired after the program was implemented lies clearly above that of nonparticipants hired before TRP.

Next, I estimate the magnitude of the sorting effect in a multivariate framework using whether the employee left the employer within five years of being hired as the outcome. Because the outcome is binary, I estimate the

[4]I estimate the effect of sorting on retention using only nonparticipants, which may imply that the estimated effect is conservative if differences also occur among participants.

[5]The findings are robust to extending the time window to approximately two years on either side of the implementation date.

Figure 1. Kaplan-Meier Survival Rates by Participation in TRP and Hire Year Cohort



effect using a probit model. Table 3 presents the estimate of the effect on turnover due to sorting, which is measured by the coefficient on *Nonparticipant, Post-TRP* (marginal effects reported). This indirect effect is economically meaningful and statistically significant: Nonparticipants hired after TRP was implemented have a 10.2 percentage point lower probability of turnover relative to nonparticipants hired immediately prior to TRP's introduction. This corresponds to an 18% reduction in turnover (using 57.4% from Table 1 as the baseline separation rate).

Returning to the question of whether the prevalence of tuition reimbursement programs limits the applicability of human capital theory to firm practice, these results indicate that sorting plays a role. More specifically, these results are consistent with the net present value framework of investing proposed by standard human capital theory if the increased retention of these employees is due to lower discount rates. Sorting alone may explain the widespread prevalence of these programs because it generates cost-savings in the form of increased retention particularly among nonparticipants, as demonstrated here, as well as potentially attracting higher-ability workers as argued by Cappelli (2004). Formally considering the importance of this first channel requires that I also quantify the effect of participation in TRP on retention.

Second Channel: Participation

The second channel, the retention effect due to employees taking coursework, has been the focus of past studies of tuition reimbursement programs.

Table 3. Effect of TRP on Turnover Due to Sorting

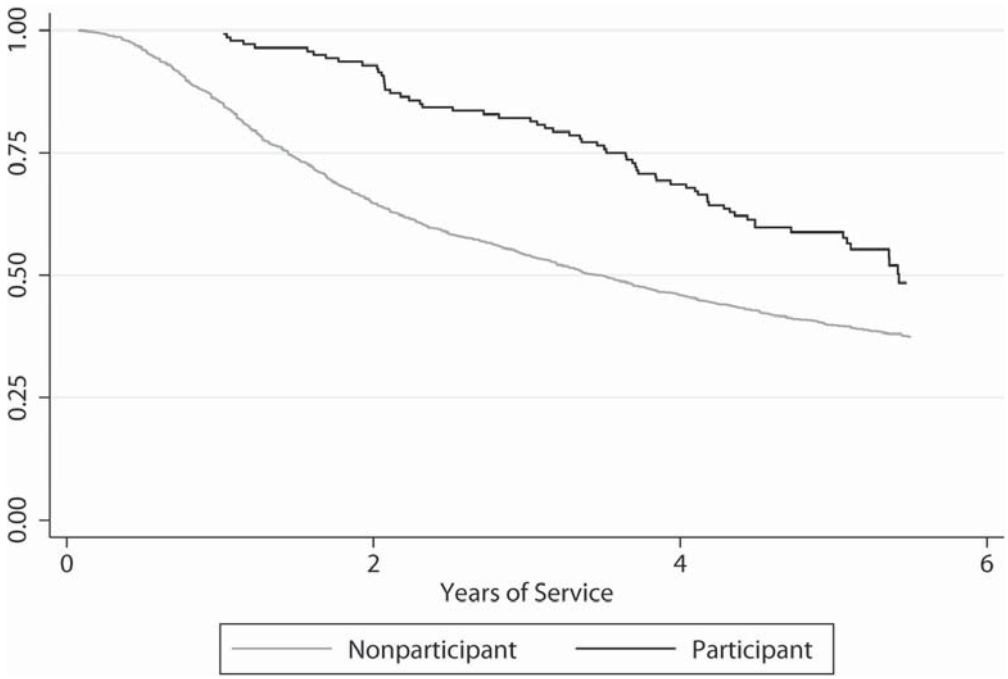
Employee characteristics	*Probit marginal effects*
Nonparticipant, Post-TRP	–0.102***
	(0.023)
Participant, Post-TRP	–0.261***
	(0.067)
Participant, Pre-TRP	–0.215***
	(0.078)
Excluded: Nonparticipant, Pre-TRP	
Female	0.074***
	(0.026)
Age	–0.052***
	(0.007)
Age, squared	0.001***
	(0.000)
Asian	–0.143***
	(0.029)
Black	0.085*
	(0.044)
Hispanic	–0.061
	(0.042)
Nonsupervisor	–0.043
	(0.027)
Starting wage (weekly) *(in thousands)*, $2001	–0.059**
	(0.027)
Log-Likelihood	–1,1165.8
Observations	1,940

Notes: Pre-TRP includes those employees hired between September 1, 1998, and August 31, 1999, while Post-TRP were hired between September 1, 1999, and August 31, 2000. Turnover is measured as a binary variable for whether the employee left the employer within 5 years of being hired. Estimated using a probit model; marginal effects reported (calculated at the mean of the independent variable). Standard errors listed in parentheses.
* Significantly different by participation status at the 10% level; ** at the 5% level; *** at the 1% level.

This effect, however, has been considered only in isolation. My primary contribution through this article is quantifying the importance of participation relative to sorting for explaining increased retention. I rely on methods similar to those applied in past studies to estimate the effect of participation in TRP on retention.

I begin by showing unconditional differences in survival rates for participants and nonparticipants for the sample of employees hired after TRP was implemented. Figure 2 graphically displays the difference between participants and nonparticipants in their propensities to separate from the institution by plotting Kaplan-Meier survival functions. The survival function of participants lies to the right of nonparticipants, meaning that for any year of service, participants are more likely to still be employed at the institution. This difference in survival rates, however, does not condition on differences in observable (or unobservable) characteristics between participants and nonparticipants.

Figure 2. Kaplan-Meier Survival Rates by Participation in TRP



To fix ideas for the multivariate analysis, I explicitly model the propensity to turnover as depending on observable characteristics, X_i; participation in the program, TRP_i; and factors unobservable to the researcher, ε_i. Let T_i* be the underlying index that determines whether the individual separates from the employer ($\text{Turnover}_i = 1$) within a specified time frame:

(1) $$\text{T}_\text{i}* = X_i\beta + \alpha TRP_i + \varepsilon_i$$

$$\text{Turnover}_\text{i} = \begin{cases} 1 \text{ if } \text{T}_\text{i}* \geq 0 \Leftrightarrow X_i\beta + \alpha TRP_i \geq \varepsilon_i \\ 0 \text{ if } \text{T}_\text{i}* < 0 \Leftrightarrow X_i\beta + \alpha TRP_i < \varepsilon_i \end{cases}$$

If I assume ε_i has a standard normal distribution, then I can estimate how worker characteristics and participation affect the probability of turnover using a probit model.

The same framework can be applied to TRP by modeling participation as a binary choice. Let P_i* be the underlying latent index that determines whether the individual participates in TRP_i, while Z_i and μ_i represent observable and unobservable characteristics:

(2) $$\text{P}_\text{i}* = Z_i\gamma + \mu_i$$

$$\text{TRP}_\text{i} = \begin{cases} 1 \text{ if } \text{P}_\text{i}* \geq 0 \Leftrightarrow Z_i\gamma \geq \mu_i \\ 0 \text{ if } \text{P}_\text{i}* < 0 \Leftrightarrow Z_i\gamma_i < \mu_i \end{cases}$$

Table 4. Effect of TRP on Turnover from Program Participation

		Jointly estimated bivariate probit	
Employee characteristics	*Single equation probit*	*Pr(TRP = 1)*	*Pr(Turnover = 1)*
Participant in TRP	–0.222***	—	–0.449***
	(0.042)	—	(0.146)
Female	0.004	–0.008	0.003
	(0.023)	(0.024)	(0.023)
Age	–0.052***	0.002	–0.052***
	(0.007)	(0.003)	(0.007)
Age, squared	0.001***	–0.0001	0.001***
	(0.000)	(0.0000)	(0.000)
Asian	–0.113***	0.009	–0.109***
	(0.027)	(0.011)	(0.026)
Black	–0.019	0.033	–0.010
	(0.047)	(0.024)	(0.047)
Hispanic	–0.093**	–0.007	–0.095***
	(0.039)	(0.015)	(0.039)
Service length[a]	0.055	0.102	0.078
	(0.157)	(0.070)	(0.158)
Service length, squared	–0.204	–0.060	–0.213
	(0.153)	(0.066)	(0.152)
Nonsupervisor	–0.092***	–0.028***	–0.082***
	(0.026)	(0.010)	(0.027)
Starting wage (weekly) (*in thousands*), $2001	–0.132***	0.010	–0.127***
	(0.024)	(0.007)	(0.024)
Exclusion restrictions: *Community-education program*			
Continuing studies classes	—	0.030**	—
	—	(0.013)	—
Wellness classes	—	0.029	—
	—	(0.021)	—
Corr. between errors	—	0.366	—
	—	(0.314)	—
Log-Likelihood	–1,556.3	–2,066.9	—

Notes: Sample includes employees hired between September 1, 1999, and August 31, 2001 (N = 2,451). Turnover is measured as a binary variable for whether the employee left the employer within 5 years of being hired. The left panel estimates the effect using a single equation probit model, while the right panel jointly estimates participation in TRP and Turnover using bivariate probit maximum likelihood estimation. Marginal effects reported (calculated at the mean of the independent variable). Standard errors listed in parentheses.

[a] Measured as of December 15 of hire year.

* Significantly different by participation status at the 10% level; ** at the 5% level; *** at the 1% level.

As with the analysis of the probability of turnover, determinants of participation can be estimated using a probit model assuming that μ_i has a standard normal distribution.

If participation in TRP is exogenous in Equation 1, then α measures the effect of participation on the probability of leaving the employer. The left panel of Table 4 displays the estimate of the effect of participation in TRP on the probability of turnover within five years when participation is treated as exogenous. Participation in TRP significantly lowers the probability of turnover by 22 percentage points, which implies nearly a 40% reduction in the propensity to leave the employer (using 57.4% from Table 1 as the base-

line separation rate). Therefore, the sizable unconditional difference reported in Table 1 persists after controlling for observable characteristics.

A potential shortcoming of estimating the effect using a single equation framework is that it does not allow for the possibility that participation and turnover are jointly determined. Because participation in TRP affects employment opportunities outside the firm and promotion opportunities within the firm due to an increase in general skills, employees may self-select into the program based on observable as well as unobservable characteristics. To address this concern, I also model and estimate the decision to participate and leave the employer jointly by allowing for participation in TRP to be endogenous in Equation 1 as a robustness check. If I assume that the distribution of (ε_i, μ_i) is bivariate standard normal with $\text{cov}(\varepsilon_i, \mu_i) = \text{corr}(\varepsilon_i, \mu_i) = \rho$, I can estimate Equations 1 and 2 jointly using bivariate probit maximum likelihood estimation. Garcia et al. (2002) and Buddin and Kapur (2005) also use this technique in their analyses of the tuition assistance program offered by the U.S. Navy (see Buddin and Kapur [2005] for a detailed description of the technique and error structure).

To strengthen the identification, I include a variable in Z_i in Equation 2 that affects the likelihood of participating in TRP but does not affect the likelihood of leaving (i.e., excluded from X_i in Equation 1).[6] The exclusion restriction used in this article is based on exposure to additional information about TRP. At this institution, employees also have access to funds that can be used toward classes that are offered on campus as part of a community education program (CEP). These include nondegree classes in the continuing-studies program, which have topics that satisfy personal interest, such as drama, painting, and creative writing, as well as wellness classes, such as Sitting Comfortably at Your Computer, Bicycle Commuting 101, and CPR, AED, and First Aid. Although employees are immediately eligible for CEP funds upon hire, they must complete one year of service before qualifying for TRP. This one-year delay makes additional exposure to TRP potentially important for future participation. Because reimbursement for CEP and TRP is operated out of neighboring desks in the same HR office, utilization of CEP funds increases the employee's knowledge about TRP and the reimbursement process. Therefore, the proximity of the reimbursement processes justifies why use of CEP funds is likely correlated with participation in TRP. The right panel of Table 4 confirms that participation in CEP, measured as an indicator for whether the employee used CEP funds for continuing studies or wellness classes in their first year of employment, is positively related to participation in TRP.

While CEP utilization is positively correlated with participation in TRP, several reasons are feasible as to why use of these funds is not likely to be directly related to turnover in this context, which makes it a valid exclusion restriction. First, these community-based classes are short, detached courses

[6]Technically, no exclusion is needed because the effect could be identified solely off the nonlinearity induced by the normal distribution assumption for the unobservables.

that range from a one-time seminar to a five-week sequence, and so participation is not expected to affect retention measured over a five-year time window. Second, use of CEP classes is either based on personal interest (e.g., interest in painting) or personal situation (e.g., living along a bike route), which have no clear connection to turnover propensities. Finally, the two types of community classes satisfy standard tests for instruments (i.e., weak instrument and overidentification test). Admittedly, I cannot definitively rule out the possibility that those who participate in CEP classes are more loyal overall or that they use these classes as a stepping stone to taking productivity enhancing courses in the future. In such a case, identification of the bivariate probit model more tenuously relies on the nonlinearity of the normal distribution, for which the conclusions are similar.

The results from the joint estimation of Equations 1 and 2 are shown in the right panel of Table 4. The estimated effect of participation on retention is statistically significant and larger in magnitude using the joint-estimation technique (–0.449) relative to the single-equation estimate (–0.222), which is due to the positive correlation between the unobservable characteristics affecting the two decisions. The estimated correlation between the unobservable factors in the two equations, however, is not statistically significant and the single-equation estimate is within the 90% confidence interval of the joint-equation estimate. Therefore, I fail to reject the null hypothesis that participation is exogenous, which implies that the single-equation estimate that I obtained using a probit model is robust to endogeneity concerns. I conclude that participation in TRP significantly lowers the probability of turnover by 22 percentage points (left panel of Table 4).

The positive effect of participation in TRP on retention is consistent with past studies that analyze participation in programs offered by civilian employers (Benson et al. 2004; Manchester 2008) as well as several of the studies that investigate tuition assistance provided by the military (Boesel and Johnson 1988; Garcia, Joy, and Reese 1998; Garcia et al. 2002; Mehay and Pema 2009), but are different from those of Buddin and Kapur (2005).[7] Despite providing skills that are transferable, I find that participation in tuition reimbursement programs increase retention, which is counter to the prediction of standard theory regarding general skills and worker mobility. As shown in the sorting analysis above, however, participation is not the only way in which tuition reimbursement programs affect turnover rates.

Relative Importance of Two Channels

In this subsection I examine the relative importance of the two channels—sorting and participation—for increasing retention, and I perform a return

[7]One of the ways in which Buddin and Kapur's (2005) analysis differs from the other military studies is that they examine how participation in tuition reimbursement affects the probability of re-enlisting in the U.S. Navy after the end of a four-year term, which implies that they are addressing a different outcome (i.e., re-enlistment versus retention).

on investment calculation for the case study program. To conduct these analyses, I construct counterfactual turnover numbers by computing separation rates by year of service for those hired before TRP was implemented (from December 1997 to June 1999). I apply these rates to employees hired after September 1, 1999, to predict the *expected* number of employees to turn over between time of hire and December 2005 if TRP had not been implemented. I then compare the number of employees *expected* to turn over to the *actual* turnover numbers between time of hire and December 2005.

These numbers are shown in Table 5. Of the 2,451 employees hired between September 1, 1999, and August 31, 2001, I estimate that the number of additional employees remaining at the employer through 2005 due to TRP is 182 employees. Comparing the two channels, 30 additional employees were due to the higher retention rates of participants, while 152 employees were due to the higher retention rates of nonparticipants, or due to sorting. Despite the larger magnitude of the estimated effect of participation on retention, the relative contribution of this second channel to total turnover is approximately 16% because just 6% of new hires participated in TRP. Nearly 84% of the total retention effect is due to the first channel, or sorting. While I cannot test the exact sorting mechanism, I conjecture that it is driven by the lower discount rate of workers who value opportunities to invest in human capital. One potential concern is that the participation effect is identified from 140 participants. Nonetheless, even if a sizeable fraction of these employees had different outcomes, this would not affect the program's overall effect because retention is primarily driven by sorting, which is estimated from nearly 2,000 employees.

While the finding that sorting has the predominant effect on retention is robust, the exact magnitude of the relative size of the sorting and participation effects may be affected by other factors not explicitly considered. First, if the results from the joint estimation of participation and retention had been used in the above calculation, then the retention effect among participants would be greater, reducing the sorting effect to about 77% of the total effect. Second, participants include two types of employees: those who sorted into the employer due to the program and those who would have sorted into the employer even *without* the program. Therefore, some of the participation effect is actually stemming from the sorting of workers. In light of these offsetting factors, sorting accounts for approximately 80% of the retention effect. The important point from this analysis is that *the sorting effect dominates*.

I compute TRP's return on investment by comparing program outlays to the cost savings from lower turnover, which depends on the cost of replacing a worker. Industry estimates for this cost, which includes hiring costs, training costs, and the lost productivity due to replacing a trained worker with an inexperienced one, range from 25 to 150% of a worker's annual compensation. To be conservative, I use the lower bound of 25% as the worker replacement cost to calculate the firm's benefit from reduced turn-

Table 5. Analysis of Overall Effect of TRP on Turnover

Employee characteristics	*New hires*	*Expected turnover*	*Realized turnover*	*Savings*
Nonparticipants	2,311	1,542	1,390	152
Participants	140	97	67	30
Total	2,451	1,639	1,457	182

Notes: Values represent number of employees. *Expected turnover* is computed using separation rates of employees hired before TRP was implemented. *Realized turnover* is actual number of new hires who left the firm between time of hire and December 2005. Savings is the difference between *Expected turnover* and *Realized turnover.*

over, which is $12,450 per worker in 1999 (based on the median annual compensation of $49,800).[8] I apply this number to the total additional employees retained over five years (182 employees from Table 5). Because the replacement cost savings is realized over time (i.e., fewer employees leave in 1999, in 2000, etc.), I apply a nominal wage growth rate of 5%, which was calibrated from the data, and a 3% discount rate in the calculation of the firm's benefit from reduced turnover. This results in a total cost savings of $2,010,743. The program outlay during this time period is the discounted sum of tuition costs ($689,379) and fixed costs ($256,672), which is the cost of compensating the program administrator for five years. Thereby, the net benefit of the program (using the lower-bound worker replacement cost) is approximately $1,105,000, or a return on investment of approximately 120%. Alternatively, instead of using a given replacement cost in the calculation, I can determine the break-even cost, or the cost of replacing a worker that would equate TRP's costs and benefits. This is equal to approximately $4,981, which is just 10% of average compensation at this employer. Based on these turnover numbers alone, which do not take into account any potential gains from increased productivity of participants due to acquired skills or higher ability of nonparticipants due to sorting, I conclude that TRP was highly cost-effective for this employer.

One potential concern to these calculations is the influence of macroeconomic conditions, namely the economic expansion in the late 1990s and the downturn that started in early 2001. First, the economic expansion may have affected the applicant pool in that workers pursuing employment at a nonprofit institution as opposed to the growing technology industry were likely to be more risk averse and potentially had lower mobility risk, on average. This may imply that the above calculations underestimate TRP's effect on retention and its cost-effectiveness. Second, while all employees experienced the same macroeconomic environment, the downturn may contribute to the total effect of TRP on retention if the effect of the recession on mobility was larger for workers with the lowest levels of tenure. Using extensive data on work histories, Farber (1994) finds that separation risk in the

[8]I computed the median annual compensation by taking median starting salary in 1999 of $38,280 and added 30% for benefits, which is the average benefit cost as calculated by the Employee Benefit Research Institute.

first five years of tenure is far from uniform. The survival rate falls sharply in the first six months of tenure and then begins to decline at a slower rate from 65% at six months to 50% after one year, and declining to around 20% by year four. As stated above, I use the separation pattern of those hired between December 1997 and June 1999 from 1999 to 2005 to compute baseline retention propensities, and I apply these rates to workers hired Post-TRP (i.e., hired between September 1999 and August 2001) to calculate the total effect of TRP on retention. At the start of the recession in March of 2001, the tenure of the Pre-TRP hires ranged from 21 months to 39 months, while the Post-TRP hires ranged from newly hired to 18 months. If newly hired employees are more affected by the recession, this difference in tenure could understate the true baseline turnover propensity and thereby cause the overall effect of TRP on retention to be overestimated. This cannot fully explain the retention effect because the results from Table 3, which were used to demonstrate the significant effect of sorting, show higher retention of Post-TRP hires when the sample is restricted to employees hired before the recessionary period, which implies a more homogenous tenure profile at the start of the economic downturn (i.e., all of these employees had surpassed six months of service). Because these two possible influences of the macroeconomic environment cut in opposite directions, they potentially at least partially offset each other, and whatever overall effect on the cost-effectiveness calculation that remains is ambiguous.

For this employer, and for potentially many other employers, investment in tuition reimbursement programs has a high return on investment. Given the prominent role of worker sorting in this calculation, the widespread prevalence of these programs does not completely undermine the applicability of standard human capital theory to firm practice because this finding is consistent with the net present value framework endorsed by this theory. In particular, firms may just use tuition reimbursement to attract employees with lower discount rates and reap the benefit of lower turnover. However, the finding that participation in the program leads to increased retention is counter to the prediction regarding general skills and mobility given the transferability of skills acquired through tuition reimbursement. Because the results from this article as well as those from past studies on tuition reimbursement continue to show that investment in general skills leads to increased retention, this aspect of human capital theory needs to be revisited. The next section evaluates possible mechanisms that could drive the positive effect of participation on retention.

What Drives the Retention Effect from Participation?

The human capital literature has sought to explain how firms may potentially extract greater rents from trained workers relative to untrained workers, or the potential causes of wage compression, in order to justify the provision of general training by firms. While I cannot consider differences between wages and marginal productivity, the ability of the firm to extract

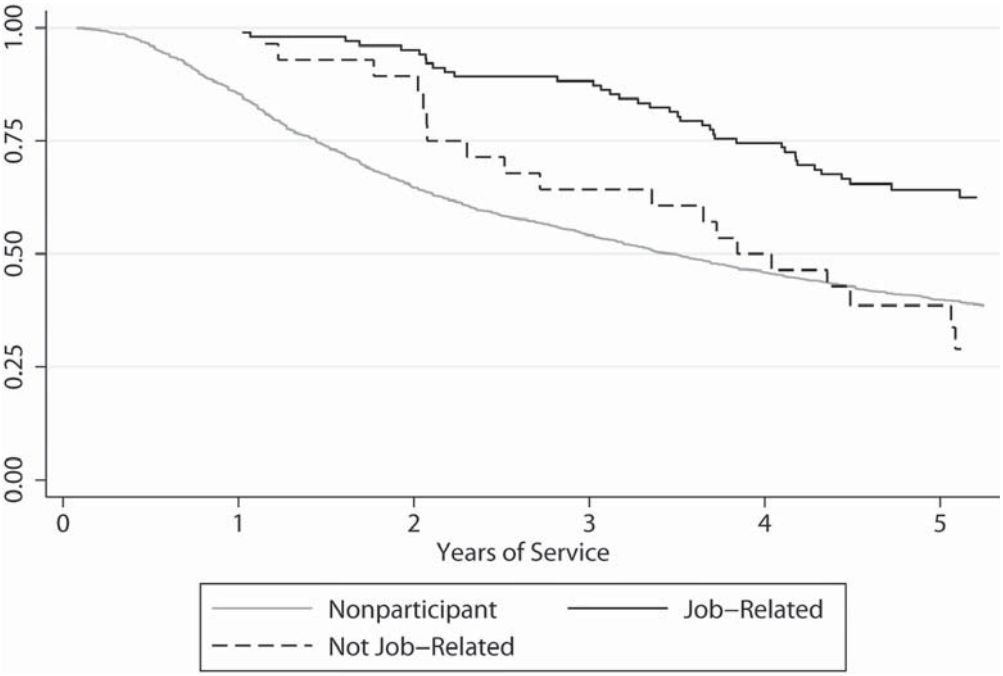
rents requires that these trained workers be retained. Therefore, I can evaluate the relative merits of the literature's proposed mechanisms for wage compression by investigating whether they plausibly explain the increased retention of TRP participants.[9] In particular, I can rule out a possible mechanism based on whether its prediction for increased retention depends on the type of coursework pursued. I accomplish this by examining if the effect of participation on retention differs by whether or not the degree pursued by the employee is job-related.

A prominent explanation for how firms might recoup investment in general skills is asymmetric information between the employer doing the training and outside employers. One type of asymmetric information concerns the content of the training: If outside employers cannot observe the type of investment, then outside wage offers will not reflect worker productivity even if the skills are transferable (Katz and Ziderman 1990; Chang and Wang 1996). A second type of asymmetric information concerns the ability of the employee, which occurs if the employer, who does the training, has an advantage in ascertaining information on the worker's ability during the training period (e.g., Acemoglu and Pischke 1998; Autor 2001). Either type of informational advantage drives a wedge between employee productivity and market wages creating a situation in which the employer has monopsony power, which leads to increased employee retention. For tuition reimbursement, however, the training firm does not have an informational advantage in either case. The training employer and outside employers learn about the content of newly acquired general skills and the performance of the employee in the course at the same time because instruction and evaluation take place outside the employer at an academic institution. Because transcript information is easily communicable and verifiable, outside firms are not at an informational disadvantage.

While the structure of tuition reimbursement programs makes asymmetric information an unlikely driver of the increased retention among participants, I can nonetheless test this possible mechanism using the available data on TRP. In particular, the prediction from either type of asymmetric information regarding increased retention does not depend on the actual content of the coursework pursued, but only on whether the content and performance are externally verifiable. Therefore, I can explicitly test the role of asymmetric information by exploiting information on a participant's major. To conduct the test, I classified participants by academic major and whether it related to their job. Because many degree majors are potentially job-related due to the myriad of tasks a white-collar worker engages in at this academic institution (e.g., business, computer science, and English), the majority of participants are classified as job-related (approximately 75%). Only if the major had no connection to plausible tasks that the employee

[9]Note that Cappelli (2004) finds that average wages are higher at firms with tuition reimbursement relative to those without a program; however, this finding does not rule out wage compression because his analysis does not include measures of productivity.

Figure 3. Kaplan-Meier Survival Rates by Type of Major



might conduct in his or her job was "not job-related" assigned (e.g., a computer technician pursuing a major in art history). If asymmetric information is responsible for the retention effect, then there should be no differential effect on retention by whether the degree program is classified as job-related because the effect should be independent of course content.[10] This test is valid even if I misclassify degrees because the prediction of the asymmetric model for retention is independent of the coursework content and depends only on whether the coursework is externally verifiable, which applies to all majors in this context.

Figure 3 shows the unconditional Kaplan-Meier survival functions for nonparticipants and participants, with the latter group divided by type of degree pursued. The survival function of participants pursuing job-related degrees lies clearly above the survival function of nonparticipants, while that of participants who are pursuing a non–job-related degree bisects the nonparticipant's survival function. I also estimate the magnitude of the effect using a probit model and include the results in Table 6. I find that the positive retention effect from participation in TRP is present only for workers who pursued job-related degrees: Participants pursuing job-related degrees are 27 percentage points less likely to have left within five years relative to nonparticipants, while the retention of those pursuing degrees not related to their job is not significantly different from nonparticipants. This

[10]Because degrees are pursued off-site at accredited academic institutions, all coursework is externally verifiable.

Table 6. Effect of TRP on Turnover, by Type of Major

Employee characteristics	*Probit marginal effects*
Job-related major	–0.270***
	(0.048)
Non–Job-related major	–0.049
	(0.095)
Female	0.006
	(0.023)
Age	–0.052***
	(0.007)
Age, squared	0.001***
	(0.000)
Asian	–0.114***
	(0.026)
Black	–0.014
	(0.047)
Hispanic	–0.090**
	(0.039)
Service length[a]	0.064
	(0.158)
Service length, squared	–0.212
	(0.153)
Nonsupervisor	–0.091***
	(0.026)
Starting wage (weekly) (*in thousands),* $2001	–0.132***
	(0.024)
Log-Likelihood	–1547.7

Notes: Sample includes employees hired between September 1, 1999, and August 31, 2001; 10 employees were dropped due to missing degree information (N = 2,441). Nonparticipant is the excluded participant category. Turnover is measured as a binary variable for whether the employee left the employer within 5 years of being hired. Estimated using a probit model; marginal effects reported (calculated at the mean of the independent variable). Standard errors listed in parentheses.

[a] Measured as of December 15 of hire year.

* Significantly different by participation status at the 10% level; ** at the 5% level; *** at the 1% level.

differential effect by course content runs counter to the argument that the retention effect from participation is due to asymmetric information across employers.

The stronger retention results for job-related degrees is consistent with Pattie et al. (2006), who find that turnover intentions among business graduate students are higher if the degree is not related to their current job. With this present analysis, I extend this past finding by evaluating actual turnover behavior and by confirming this finding across a wide variety of majors. In addition, in contrast to Pattie et al., I find that the retention of employees pursuing degrees unrelated to their jobs is not significantly different from nonparticipants.

The job-related finding can also be used to eliminate another mechanism for increased retention of participants: differential mobility constraints, either formal or informal (Acemoglu and Pischke 1998, 1999a, 1999b). A formal mobility constraint that is relevant to tuition reimbursement programs

is contractual requirements that specify a minimum service length following participation and a repayment rate for breaches of the contract. (This is not a concern for this analysis because no such requirement exists for TRP.) Informal constraints, such as norms stemming from perceived organizational support (Pattie et al. 2006) or feelings of reciprocity following participation (Leuven et al. 2005) could lead to retention differences between participants and nonparticipants. The retention effect differs by coursework content (i.e., job-relatedness of the degree), so differential informal mobility constraints is not a plausible mechanism because one would expect this to apply to all coursework regardless of content.

The differential retention result by whether coursework is job-related suggests that the effect of participation on retention is driven by skill acquisition. For this to operate, it relies on the assumption that the institution provides opportunities for these employees to apply their new skills, such as through a strong internal labor market. While I cannot test this explicitly, the employer does have numerous job tracks (e.g., administrative, professional, and managerial) and within each there are five ranks, or steps, which indicates opportunities for advancement within this institution are possible. That retention may be driven by skill acquisition is consistent with Manchester (2010), which finds lower turnover intentions among MBA students who take coursework they report as providing a productivity advantage at their current employer relative to potential alternative employers.

Two explanations are given in the human capital literature for increased retention based on acquisition of general skills that are agnostic regarding the internal labor market of the firm. First, Acemoglu and Pischke (1999a, 1999b) show that complementarities between general and specific human capital would allow a firm to capture returns to general training. The general skills acquired through participation in tuition reimbursement would increase firm-specific human capital in the presence of complementarities, which increases wages at the current employer relative to outside employers thereby increasing employee retention. Second, the results are also consistent with the recently proposed skill-weights approach to firm-specific human capital developed by Lazear (2009), which abandons the traditional dichotomy between general and firm-specific skills. The theory models all skills as general, but allows firms to use different combinations of skills in production, or different skill-weights. This theory explicitly allows for firms to invest in skills one would argue as "general" because the technology associated with the skill is not what makes it general or firm-specific, but rather, whether the *combination* of skills used at a particular firm can be readily transferred across firms is what determines whether a worker's skills are firm-specific. In either explanation, investment in seemingly general skills by means of tuition reimbursement may make the individual's skill set more firm-specific, thereby leading to increased retention.

A limitation of the current study is that all possible mechanisms that could be responsible for the retention effect among participants cannot be

evaluated. For example, the differential retention effect by coursework is also consistent with a story of occupational attachment: Employees who are uncertain about their career may take courses outside their job and subsequently turn over, while those with strong occupational attachment pursue job-related coursework. Information on subsequent positions taken outside this employer would be required to investigate this explanation. In addition, job-relatedness of degree is imputed and not reported by the employee or the institution, which inserts some noise into this measure. While this may weaken the conclusion that retention is driven by skill acquisition, my ability to eliminate asymmetric information and mobility constraints as possible mechanisms is robust to this concern.

Conclusion

In this article, I contribute to the literature by decomposing the effect of tuition reimbursement on retention into two channels, sorting and participation, using data from an employer that implemented a tuition reimbursement program. Despite the focus in the existing literature on how participation in a tuition reimbursement program affects employee retention, I find that just 20% of the turnover reduction from the case study program comes from participation. I estimate that the majority of the retention effect (80%) stems from the sorting of workers into firms that have a tuition reimbursement program relative to those that do not. This study is the first to investigate this indirect channel and to quantify its importance relative to the effect of participation.

The lower turnover propensities among employees hired after the program was implemented may be explained by lower discount rates, which makes tuition reimbursement more valuable and mobility less likely. Therefore, the widespread prevalence of these programs does not necessarily undermine the applicability of standard human capital theory to firm practice because the sorting effect is consistent with workers differentially valuing opportunities for human capital investment based on their discount rates. The higher retention of participants, however, shows that the specific prediction of standard human capital theory regarding general skills and mobility is limited. By using information on job description and major, I am able to rule out asymmetric information and mobility constraints as alternative explanations to standard human capital theory for the increased retention among participants because the effect is concentrated among those employees pursuing job-related degrees. This result suggests that retention is related to skill acquisition, and therefore consistent with complementarities between general and firm-specific skills or with the skill-weights theory of human capital. Because it explicitly allows for firms to invest in skills that would be typically thought of as general, the new skill-weights theory of firm-specific human capital represents a promising alternative to standard human capital theory. Future work should attempt to determine whether

human capital investment is best characterized by adding complementarities to the standard dichotomy between firm-specific and general human capital, or whether the dichotomy should be abandoned in favor of the skill-weights perspective.

Alternative explanations may drive the two retention effects. First, for example, the sorting effect may be due to employees viewing the adoption of TRP as a signal of a desirable place to work. This mechanism is consistent with lists of top-ranked employers including tuition reimbursement programs among the set of desirable characteristics. Given that an empirical difference in separation rates occurs between those hired before and after TRP's introduction, however, this story would need to also explain why employees hired before TRP are less likely to stay even after the employer implements TRP. Second, the finding that the retention effect from participation is concentrated among those who pursue job-related degrees could be due to differences in occupational attachment instead of skill acquisition.

One main limitation of this study is that the analysis is limited to a single program. While the characteristics of TRP are typical in terms of reimbursement amount and policy, the external validity of findings from any case study is often questioned. Even if the estimate that 80% of the cost-savings is due to sorting is context specific, the large magnitude of this effect suggests that its role is likely to be an important part of a firm's ability to capture returns on its investment. Another potential criticism is that by using data from one program over a single time period, one cannot rule out that concurrent changes at the firm caused the retention effect. I am unaware of other such changes in HR practices during this time period, but the overall effect of TRP on retention may be confounded in part by macroeconomic conditions. Because the estimation of the two effects is a comparison of workers within the firm, however, any changes instituted or experienced would affect new hires as well as existing hires, and participants as well as nonparticipants, and, therefore, likely cannot explain the differentials that I find.

Finally, data limitations prevent me from investigating the retention effect following degree completion. Although I use the longest window available (five years), it is possible that turnover among participants spikes following degree completion. For example, Benson et al. (2004) finds higher turnover of participants after degree completion for those pursuing graduate degrees, but not undergraduate degrees. Even if employees at this institution exhibited a similar pattern, the program induces cost-savings due to the higher retention of these employees during participation. More important, this concern does not affect the analysis of the sorting effect and the relative importance of this channel. So, while future work should continue to examine the pattern of retention following degree completion, more recognition of the importance of sorting is needed in discussions of how tuition reimbursement programs affect turnover rates.

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