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The Effect of Employer-Provided General Training on Turnover: Examination of Tuition Reimbursement Programs

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The Effect of Employer-Provided General Training on Turnover: Examination of Tuition Reimbursement Programs

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Abstract

Tuition reimbursement programs provide financial assistance for direct costs of education and are a type of general skills training program commonly offered by employers in the United States. Standard human capital theory argues that investment in firm-specific skills reduces turnover, while investment in general skills training could result in increased turnover. However, firms cite increased retention as a motivation for offering tuition reimbursement programs. This rationale for offering these programs challenges the predictions of the standard human capital model. This paper tests empirically whether tuition reimbursement programs increase employee retention. The empirical analysis combines two data sources: a case study of a non-profit institution and the Survey of Employer-Provided Training, 1995 (SEPT95), which consists of training data collected from a cross section of establishments. From the case study analysis, this paper finds that participation in tuition reimbursement increases retention. Results from SEPT95 confirm this finding. These results are consistent with a theory in which investment in general human capital is used to complement investments in firm-specific human capital.

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1.0 Introduction

Becker's (1964) seminal work on investment in human capital makes a fundamental distinction between general and firm-specific skills, which has implications for investment and employee turnover. Firm-specific human capital is defined as having value only to the current employment relationship, while general human capital is valuable to both current and potential employers. Becker's theory predicts that employees will bear the full cost of general skills training – either by paying for training directly or by accepting lower wages during training periods – because employers face the threat of not capturing the return on their investment due to "poaching" of trained employees by other employers. In a competitive labor market, workers have the incentive to invest efficiently in general human capital because they receive a wage equal to the value of their marginal product. In the case of investment in firm-specific human capital, employers and employees share the costs. Neither party is willing to bear the full amount due to the risk of opportunistic behavior by the other. The employer and the employee share the surplus, or rents, from the investment; the relative bargaining power of the two parties determines how these rents are allocated.

This standard theory on investment in human capital has implications for turnover. Investment in firm-specific human capital reduces turnover because rents accrue only if the employment relationship is maintained. However, this result does not hold for investments in general human capital because these skills are transferable across employers. According to Becker's theory, offering employees general skills training would increase turnover.

Despite the predictions of this theory, recent empirical studies show that firms provide general training to their workers and argue that firms bear part of the cost.[2] Tuition reimbursement programs are an example of general skills training provided by firms. Employers reimburse employees for direct costs of coursework taken at accredited academic institutions. Because instruction and degree accreditation occur at third-party institutions, skills acquired are transferable – as well as observable – to many potential employers. Hence, tuition reimbursement programs closely resemble general skills training as described by Becker.

[2] These include, but are not limited to Loewenstein and Spletzer (1999a, 1999b), Acemoglu and Pischke (1998, 1999), Autor (1998), and Cappelli (2004).

A primary reason firms give for offering these programs is to reduce turnover, which challenges standard human capital theory.[3] This paper examines empirically whether tuition reimbursement programs increase employee retention. The analysis uses two data sources to test the effect of tuition reimbursement programs on turnover: 1) a case study analysis of workers at a non-profit institution that offers a tuition reimbursement program; and 2) a cross section of establishment-level data collected in the Survey of Employer-Provided Training, 1995 (SEPT95). Taking these two perspectives – that of the employee and that of the establishment – ensures a more complete depiction of the effect.

Results from both the case study and SEPT95 indicate that tuition reimbursement programs reduce turnover. Hence, the firm's motivation for offering this program is supported by empirical evidence: general skills training increases retention. The prediction of standard human capital theory that investment in general human capital increases turnover is incorrect. However, the empirical findings of this paper can be interpreted within standard theory by allowing firm-specific and general human capital to interact, such as through complementarities between these two types of skills.

The remainder of this paper is organized as follows. Section 2 describes the prevalence of tuition reimbursement programs and their typical characteristics. Section 3 reviews previous studies of these training programs. The case study is presented in Section 4, while Section 5 presents the analysis using SEPT95. To facilitate interpretation of the results within Becker's theory of investment in human capital, Section 6 outlines one possible mechanism for how general training could increase employee retention. Conclusions and areas for future research are given in Section 7.

2.0 Background on Tuition Reimbursement Programs

2.1 Program Prevalence

Employer-sponsored tuition reimbursement programs are widespread and constitute a nontrivial part of non-wage compensation. The amount spent on these programs is substantial:

[3] Increased retention is a response given by human resource professionals in interviews with the author. Cappelli (2004) and Corporate Leadership Council (2002) report the same finding.

Workforce Management estimates that companies paid $10 billion toward tuition reimbursements in 2003.[4] Using SEPT95, firms employing 50 or more workers spent $2.8 billion in 1994 on tuition reimbursement.[5] Hence, expenditures on tuition reimbursement programs are increasing and represent a significant source of investment in general skills of employees.

A substantial fraction of firms offer tuition reimbursement. Using the 1994 National Employer Survey of Educational Quality in the Workforce (NES-EQW), Lynch and Black (1998) report that 47 percent of firms employing 20 or more employees offer tuition reimbursement programs. Results from SEPT95 show that 61 percent of establishments employing 50 or more workers offer tuition reimbursement programs. The estimates from SEPT95 and 1994 NES-EQW are comparable because the probability of offering a tuition program increases with firm size (see Section 5.1).

The tax-advantaged status of reimbursements from employer-provided programs has probably contributed to their prevalence. The tax exclusion for employer-provided tuition programs from personal income and payroll tax was passed into law as a part of the Revenue Act of 1978 (P.L. 95-600) and codified in Section 127 of the U.S. Internal Revenue Code.[6] The maximum income exclusion for a single calendar year is $5,250, and reimbursements under this level are exempt from federal income tax, payroll tax, and state income tax. The U.S. Federal Government estimates the tax exclusion will cost $3.2 billion in lost federal tax revenues from 2006 to 2010.[7] Tuition reimbursement is interesting to study from a labor economics perspective because it is a prevalent training program that clearly meets Becker's definition of investment in general skills; the tax-advantaged status of these programs makes them relevant to public policy as well.

[4] *Workforce Management*, May 1, 2004. Copyright 2004 Crain Communications Inc.
[5] The confidence interval for this estimate is $2.6 to $3.0 billion
[6] Section 127 of the 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.§ 127).
[7] Office of Management and Budget, Fiscal Year 2006.

2.2 Program Characteristics

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. A 2002 survey by Eduventures of human resource professionals and managers at over 500 firms finds that 70 percent of firms offering a tuition reimbursement program cap annual reimbursement, and over half of these firms (57 percent) have maximums that exceed $4,000 (Eduventures 2003).[8] Table 1 shows the distribution of reimbursement maximums from the Eduventures survey. The majority of firms choose maximums below or equal to the maximum annual tax exclusion, $5,250, but a significant fraction of firms have reimbursement maximums that exceed the tax exempt limit or have no maximum reimbursement amount. Among firms offering tuition benefits, nearly 40 percent offer reimbursements beyond the level that receives tax-advantaged status (i.e. amounts greater than $5,250).

Most firms in the Eduventures survey allow employees to become eligible for the program after six months of service; rarely do eligibility requirements exceed one year. Twenty percent of firms impose service requirements after participation. Service requirements after participation are more common in plans that have unlimited tuition reimbursement. The 2002 survey by Eduventures also reports that over 90 percent of programs have a minimum grade standard for reimbursement, typically set at a "C" or better. Many companies tie grades directly to reimbursement percentages, making the cost of participation higher for workers who receive lower grades. The tuition reimbursement program analyzed in the case study has an eligibility requirement of one year of service and does not have a service requirement after participation. The maximum reimbursement amount is $5,250 for a single year and the program only reimburses costs of tuition for participants obtaining a "C" grade or better. Hence, the case study program is typical in its reimbursement amount and requirements, making it a good candidate for case study analysis.

In addition to the above characteristics, the firm must follow guidelines set by the Internal Revenue Code for tuition reimbursements to be exempt from taxation. To qualify for the

[8] The survey was sponsored by Cenquest, a provider of managed education solutions, which helps companies create and manage tuition assistance programs (www.cenquest.com). Eduventures, who conducted the survey, is an independent research and advisory firm of corporate, post-secondary, and pre-K-12 learning markets (www.eduventures.com).

tax exclusion, a firm must have a written plan for the exclusive benefit of providing employees with educational assistance. The program must meet non-discrimination clauses and employees cannot be offered a choice between educational assistance and other forms of compensation. Before 1978, all employer-provided educational expenses fell under Section 162 of the U.S. Internal Revenue Code. Section 162, enacted in 1954, excludes employer-provided educational assistance from taxation as long as the coursework is job-related. Over time, the "job-related" requirement became narrowly interpreted due to court case rulings, thus limiting the educational opportunities of employees in low-level positions relative to employees in higher-level positions who typically have broad job descriptions. The legislative intent of the tax exclusion in Section 127 was to provide educational opportunities at the workplace for lower-level employees – those employees who could not take advantage of educational assistance for job-related coursework because they were limited by narrow job descriptions.

The tax exclusion affects program characteristics by requiring firms to establish a separate plan offered to all regular employees. The program also needs to satisfy non-discrimination clauses, meaning that firms cannot restrict the use of this program to highly compensated employee. In addition, the maximum reimbursement exempt from taxation provides a focal point for reimbursement levels offered by firms. Hence, even though establishment-level information on program characteristics is not available in SEPT95, the requirements stipulated in the tax code imply that tuition reimbursement programs are similar across firms.

3.0 Literature on Tuition Reimbursement Programs

Despite the prevalence of tuition reimbursement programs, few academic studies have looked explicitly at these programs. The primary reasons given by firms as to why they offer tuition reimbursement programs are: recruitment and employee retention. The first reason implies that tuition reimbursement programs are a non-wage benefit. The rationale for the second reason is that tuition reimbursement programs are training programs that affect worker productivity, and thus retention.

3.1 Tuition Reimbursement and Recruitment

The use of benefits as a recruiting device is prevalent in labor and personnel economics. Rosen's (1986) work on "equalizing differences" established a theory for how non-wage benefits affect the composition of workers attracted to a firm. In the case of a tuition reimbursement, workers who value continuing education are willing to trade-off wages (at some rate) for tuition payments. This tradeoff implies that the incidence of tuition reimbursement is on the worker. The tax-advantaged status increases the value of a given level of tuition benefits; the value increases with the worker's marginal tax rate.

A common reaction to these programs is to only attribute their provision by firms to their tax-advantaged status. However, this overlooks the trade-off between wage and non-wage compensation. If total compensation reflects the value of a worker's marginal product, then benefits and wages are substitutes at the margin. Firms offer tuition reimbursement program instead of additional wages or other benefits if tuition benefits are more effective at attracting a certain type of workers. The tax-advantaged status of tuition reimbursement programs increases the value of these benefits to a worker facing a positive tax rate, but cannot explain why a firm offers tuition benefits instead of other forms of compensation.

Cappelli (2004) addresses the effect of tuition reimbursement programs on recruitment by developing a model in which provision of these programs generates a separating equilibrium in which only high-ability workers choose to work at firms with a tuition program. His model includes two types of agents – low and high ability – in which ability is known to the worker, but unknown to the firm. Participation in a tuition reimbursement program is assumed to reveal the worker's type to all potential employers because instruction takes place outside the firm. Because participation is assumed to be more costly to workers with low ability, wages can be set such that all high-ability types participate and no low-ability types participate. Hence, in his model, firms use tuition reimbursement programs as a screening device to attract high-ability workers. Using educational attainment as a proxy for ability, Cappelli tests his theory using the 1997 National Employer Survey (NES-EQW) and finds that the average education attainment of new hires is higher for firms with tuition reimbursement programs, which is consistent with his theory if educational attainment is a direct measure of ability.

However, the sharp prediction of his model – all high ability types participate – is inconsistent with empirical participation rates. Participation in tuition reimbursement programs by employees is low, typically between three and five percent.[9] The Corporate Leadership Council (2002) reports that low participation rates could be due to a lack of marketing by firms. If employees lack information about the program, it cannot influence an employee's selection of employer. Cappelli (2004) controls for recruiting costs when he obtains his result that the education level of new hires is higher in firms that offer tuition reimbursement programs, but his estimation does not control for benefits and wages. This omission could confound his result because high wage, high benefit firms are more likely to offer tuition programs (see Section 5.1) and these firms are also more likely to employ workers with higher educational attainment. Additionally, his model does not address why some firms offer tuition reimbursement and others do not. Due to the limitations of the data used in this analysis, 1997 NES-EQW, Cappelli does not examine determinants of offering a tuition reimbursement program. In the 1997 NES-EQW, 85 percent of firms respond affirmatively to the question pertaining to the provision of tuition reimbursement programs. A change in the wording of the question in the NEW-EQW between 1994 and 1997 resulted in the reported incidence of tuition programs increasing from 47 percent in 1994 to 85 percent in 1997. This paper is the first to examine the determinants of offering tuition reimbursement programs.

Aside from the sharp predictions and shortcomings listed above, the general idea of Cappelli's (2004) model is attractive because it is consistent with Rosen's (1986) prior work. The low participation rates found empirically could be reconciled in his model by thinking of workers as attaching an option value to participation: non-participants at firms that offer the program could be systematically different (i.e. of higher ability) than workers at firms that do not offer this program if high ability workers are willing to trade-off wages for the option of participating.[10] Data on how implementation of a tuition reimbursement program affects the applicant pool would be ideal to test the effect of these program on recruitment. However, this type of data is difficult to obtain. Results from the case study in Section 4 provide inconclusive

[9] References include: Corporate Leadership Council, statistics from Watson Wyatt, Buddin and Kapur (2004), and conversations with HR personnel at firms with a program.

[10] Low participation rates could be explained by adding a exogenous shock that decreases the cost of participation, or by modeling heterogeneity in ability as a continuous distribution.

evidence that implementation of a tuition reimbursement program differentially affects new hires and existing employees in terms of the impact of participation on employee retention.

3.2 Tuition Reimbursement and Retention

In contrast to using tuition benefits as a recruiting device, the claim by firms that they use tuition reimbursement programs to reduce turnover does not have support in the theoretical literature. Rather, the theoretical literature predicts the opposite: provision of general skills training would increase turnover. Becker's (1964) theory of investment in human capital argues that, because general skills are fully transferable (by definition) firms risk having their trained employees poached or "cherry-picked" by outside firms if they provide workers with general skills training. The labor market is assumed to be competitive, resulting in the worker's wage set equal to the value of her marginal product. Because the worker captures the full return on the investment, Becker's theory implies that the worker bears the full cost of general training. Because the market is competitive and skills are transferable, the worker is indifferent between employers. Therefore, even if the incidence of general skills training falls on the worker, turnover would be non-decreasing in the provision of general skills training. This disconnect between the theoretical literature and the intended use of these programs by firms presents an opportunity to analyze empirically the effect of tuition reimbursement programs on retention.

There are several case studies that examine the tuition reimbursement programs offered by the U.S. Department of Defense.[11] The two studies most similar in their econometric methodology to the case study analysis in this paper are Garcia, Arkes, and Trost (2000) and Buddin and Kapur (2005), which examine the impact of tuition reimbursement on retention in the U.S. Navy. Garcia, Arkes, and Trost (2000) follow a cohort of enlistees who began service in 1992 and study the effect of participation on the likelihood of remaining with the Navy for at least six years. They find that participation increases the probability of staying in the Navy by nearly 13 percentage points.

Buddin and Kapur (2005) find the opposite: participation in tuition reimbursement decreases the probability of re-enlisting after four years by 16.5 percent. Buddin and Kapur

[11] These include Boesel and Johnson (1988), Garcia and Joy (1998), Garcia, Arkes, and Trost (2000), and Buddin and Kapur (2002, 2005).

criticize Garcia, Arkes, and Trost's (2000) definition of retention and instead use re-enlistment after the end of a four-year contract as the relevant measure. Buddin and Kapur (2005) argue that the time window for which enlistees have access to participation in tuition reimbursement should be held fixed, and so they limit their sample only to those enlistees who served a full four-year contract. These two studies also differ in the variables used as exclusion restrictions in their bivariate probit estimation: Garcia, Arkes, and Trost (2000) use participation in the orientation session for educational opportunities offered to enlistees, while Buddin and Kapur (2005) use the enlistee's proximity to a four-year college before enlistment and an interaction between the number of courses offered on base and the size of the base. Buddin and Kapur argue that the instrument used by Garcia, Arkes, and Trost (2000) fails the exogeneity test.[12]

While the exclusion restriction in Garcia, Arkes, and Trost (2000) is untenable, this paper does not agree with Buddin and Kapur's (2005) criticism that the window of opportunity for participation needs to be held constant for "leavers" and "stayers". If enlistees jointly determine their participation and retention decisions, constraining the duration of service to be the same across participants and non-participants imposes restrictions on the effect of the program. By using different criteria for their samples, Garcia, Arkes, and Trost (2000) and Buddin and Kapur (2005) are addressing slightly different research questions. Garcia, Arkes, and Trost (2000) examine the effect of participation on the likelihood of staying six years, while Buddin and Kapur (2005) analyze the effect of participation on the likelihood of staying a fifth year after already completing four years with the Navy. Even in the absence of these complications, generalizing results from the Armed Services to civilian workers is difficult due to the fundamentally different employment relationship.

Benson, Finegold and Mohrman (2004) present a civilian analysis of the impact of participation in tuition reimbursement on retention using a case study of a large U.S. manufacturing firm (roughly 10,000 employees). Employees at this firm have a high participation rate in the tuition program – nearly 60 percent – which may be due to the program's unlimited reimbursement of tuition, stock rewards for degree completion, and the fact that the firm strives to be a leader in the provision of continued education for its workers. This number is also inflated because it includes individuals who took only a single course rather than limiting

[12] Participation in the orientation session is not random, but is positively correlated with an individual's intention to use the program, and thus also is correlated with the probability of staying in the Navy.

the sample to those enrolled in a degree program. Hence, their study examines an atypical tuition reimbursement program in terms of characteristics and participation rates. Benson, Finegold and Mohrman (2004) use a Cox-proportional hazard model to analyze how degree completion affects the probability of leaving the firm between January 1996 and June 2000. They argue that promotion after degree completion would reduce the likelihood of leaving because it produces a better match between responsibilities and skills sets. However, their theory falls short of fully explaining their empirical findings. They find that promotion decreases the likelihood of leaving for employees who obtain a graduate degree. However, these individuals have a greater likelihood of leaving than non-participants. Additionally, promotion does not affect the likelihood of leaving for those employees earning a bachelor's or associate's degree. More importantly, their assumption that hazard rates are proportional might not be appropriate. They claim there is a sharp increase in the hazard upon degree completion, which suggests that the effect of participation on the separation hazard is not proportional over time.

While few studies examine tuition reimbursement programs, there have been many studies that examine the provision of general skills training by employers. These studies develop models in which a variety of mechanisms, such as asymmetric information or mobility costs, could create a wedge between wages and productivity. This wedge provides firms with an incentive to offer and pay for general skills training.[13] These studies relax Becker's assumption that labor market is competitive to explain why firms offer general training.

This paper contributes to the literature by empirically evaluating the effect of employer-provided general training – provided through tuition reimbursement programs – on employee retention. If general training decreases employee turnover then a central prediction of Becker's model is incorrect. In order to continue to use this standard theory, it would need to be amended to account for this negative relationship between general training and turnover. Allowing for general human capital and firm-specific human capital to interact is one possible amendment, which is addressed in Section 6.

[13] These include, but are not limited to: Black and Lynch (1998), Loewenstein and Spletzer (1999*)* and Acemoglu and Pischke (1999a, 1999b), Autor(2001), and Cappelli (2004).

4.0 Case Study Program: CSP

To examine the impact of tuition reimbursement programs on employee retention, this paper analyses data from a single firm as well as from a cross-section of firms. This section focuses on the case study, presenting the program characteristics, an econometric framework, and the results. The data were obtained from a non-profit institution in the education sector, which implemented a tuition reimbursement program in September 1999. (The case study program will be referred to as CSP in the remainder of the text.) Employees considered in this analysis are staff members in supervisory and non-supervisory positions who were employed on December 15, 1999, and those who were hired between December 15, 1999 and September 1, 2001. A panel of observations was constructed based on seven "point-in-time" observations from administrative records. Individuals are observed on December 15 of each year from 1999 to 2005. The data include gender, age, and race as well as start date, job characteristics, and annual wage rates. One shortcoming of the data is that those employees who start and end employment between December 15 of one year and December 15 of the subsequent year are not included in the sample. Individual records of participation in CSP include the amount reimbursed, the degree type, and the major or area of concentration from September 1, 1999 to August 31, 2004.[14] Total expenditure on tuition reimbursement over these five years totaled over $2 million dollars (nominal) with a participation rate of 4.5 percent.

4.1 Characteristics of CSP and Descriptive Statistics

As mentioned in Section 2, employees are required to have one year of service to be eligible for CSP. Employees need to be admitted into a degree program, but the program does not need to be job-related. The intent of CSP at the case study institution is given below:

> [CSP] supports employee development by providing partial or full reimbursement of costs of courses, seminars and workshops that enable employees to improve performance in current jobs, prepare for career development, or meet requirements of degree programs related to current performance or planned career development (Administrative Guide Memo 22.11).

[14] Major or area of concentration was not available for 22 participants.

The employee's supervisor must approve the request to participate in CSP, but this is not a binding constraint since the employee can appeal directly to the benefits department for reimbursement if her supervisor does not grant the request. A staff member working full-time (more than 30 hours per week) qualifies for $5,250 in reimbursement per year; this amount is pro-rated for members working part-time. The maximum reimbursement amount was $2,000 for the first two years of the program, September 1, 1999 through August 31, 2001, but was increased to $5,250 as of September 1, 2001. CSP qualifies under Section 127 of the Internal Revenue Code, allowing reimbursements to be exempt from income and payroll taxation

Under CSP, reimbursements are only allowable for costs of tuition fees. Tuition reimbursements are made directly to the institution prior to the quarter or semester. The employee assumes responsibility of satisfactory completion of the course (grade C or better); if not, the funds must be repaid in total to the employer.

Table 2 displays sample means for workers used in the case study analysis. Participants in CSP differ from non-participating employees in terms of observable demographic and employment variables. Participants are more likely to be female, younger, identify themselves as Black, have a lower starting wage and are less likely to be in a supervisory role.[15] Of those who participate between September 1, 1999 through August 31, 2004, average total reimbursement was approximately $5,200 and participants spend an average of two years in the program. The participation rate of an employee's peers is also higher for participants. Peer groups were constructed using both the location of an employee's department and the general classification of her job to define a group of workers whose participation behavior could influence that individual employee's participation decision, such as through the dissemination of information about the program. The peer participation rate assigned to each employee does not include that particular employee's participation behavior. This variable will be used later in the paper as an exclusion restriction for the separation equation in the econometric analysis.

Tables 3 and 4 show the retention behavior of non-participants and participants. The raw data show that participants are less likely to leave in each year compared to non-participants. The largest difference in the leaving percentages occurs for the three-year time window, but the

[15] "Exempt" and "Non-exempt" refer to whether the employee is subject to the Fair Labor Standards Act of 1938 (FLSA), which establishes minimum wage and over-time pay laws for full-time and part-time workers in the private and government sectors. Workers who are non-exempt from FLSA are those paid on an hourly basis and occupy non-supervisory positions; salary of exempt workers must also meet the minimum wage.

difference still persists for the five-year mark. Whether the worker separates from the institution before five years is the outcome evaluated in this study. Unfortunately, the data do not contain information on degree completion, so the retention behavior of participants after completing their coursework cannot be directly examined. The five-year time window is used as an approximation for degree completion.

Figures 1 and 2 graphically show differences between participants and non-participants in their propensities to separate from the institution using plots of the survival functions. These survival functions use actual employment start dates, but end dates are randomly assigned for the year in which the employee leaves the institution to produce a smoothed curve.[16] The survival function of participants lies to the right of non-participants, meaning that for any year of service, participants are more likely to still be employed by the institution. Differences in survival rates are largest just before three years of service.

Figures 3 and 4 show that survival rates differ by the type of degree pursued: participants in undergraduate programs have higher survival rates than those in graduate programs. The analysis in the next section examines whether this difference between degrees persists when controlling for characteristics of the participants. While these tables and figures show lower survival rates for non-participants, a proper analysis of the effect of participation on retention needs to account for differences across individuals and the interdependence of the participation and retention decision. The next section of the paper will examine how participation affects retention using econometric analyses to control for differences in observable characteristics as well as unobservable characteristics.

4.2 Estimation

This section models the event of an employee leaving the institution using a latent variable framework. The individual compares the utility from staying with the employer to that obtained from separating. The propensity to separate from the employer is a continuous variable, but the observed outcome is binary, taking a value equal to 1 if the individual separates, and equal to 0 otherwise. The likelihood of leaving depends on observable characteristics, X,

[16] For employees hired before September 1999, length of service is measured as the difference between implementation of the program (September 1, 1999) and end date, or censoring date (December 15, 2005) when relevant.

participation in CSP, *P,* and factors unobservable to the researcher, ε. Let *S** be the underlying index – unobservable to the researcher – that determines whether the individual separates from the employer within a specified time frame:

$$S^* = X'\beta + \alpha P + \varepsilon \tag{1}$$

$$S = \begin{cases} 1 \;\; if \;\; S^* \geq 0 \Rightarrow' X\beta + \alpha P \geq -\varepsilon \\ 0 \;\; if \;\; S^* < 0 \Leftrightarrow X'\beta + \alpha P < -\varepsilon \end{cases} \tag{2}$$

If we assume ε to have a standard normal distribution, then we can estimate how worker characteristics affect the probability of separating from the institution using a probit model.

The same framework can be applied to participation in CSP because participation is also a binary outcome. Let *P** be the underlying latent variable that determines whether the individual participates, while *Z* represents individual characteristics and let *u* be unobservable characteristics. Again, the individual compares the utility from participating to that from not participating.

$$P^* = Z'\gamma + u \tag{3}$$

$$P = \begin{cases} 1 \;\; if \;\; P^* \geq 0 \Rightarrow Z'\gamma \geq -u \\ 0 \;\; if \;\; P^* < 0 \Leftrightarrow Z'\gamma < -u \end{cases} \tag{4}$$

As with the analysis of the probability of separation, determinants of participation can be examined using a probit model if *u* has a standard normal distribution.

If participation in CSP were exogenous in equation 1, then α would measure the effect of participation in CSP on the probability of separation. For participation to be exogenous, the decision to participate cannot be related to the decision to leave the employer in terms of unobservable characteristics, or cov(ε,*u*) = 0. However, because participation in CSP affects employment and promotion opportunities due to an increase in general skills, arguing that the two decisions are uncorrelated is tenuous. This paper models the two decisions jointly, allowing for participation in CSP to be endogenous in equation 1, or that cov(ε,*u*) ≠ 0. The distribution of (ε,*u*) is assumed to be bivariate standard normal with cov(ε,*u*) = corr(ε,*u*) = ρ, or that:

$$\begin{pmatrix} \varepsilon \\ u \end{pmatrix} \sim BVN\left(\begin{pmatrix} 0 \\ 0 \end{pmatrix}, \begin{bmatrix} 1 & \rho \\ \rho & 1 \end{bmatrix} \right) \tag{5}$$

Equations 1 and 2 are estimated jointly using bivariate probit maximum likelihood estimation. Garcia, Arkes and Trost (2000) and Buddin and Kapur (2005) use this technique in their studies of the U.S. Navy. In order to estimate the model, Z in equation 3 needs to include a variable that affects the likelihood of participating, but does not affect the likelihood of leaving (i.e. not contained in X from equation 1). This paper uses an information effect or knowledge "spillover", measured by the participation rate of peers, to satisfy this exclusion restriction. Peer groups were created based on the division (18 in total) in which the employee worked and a broadly defined job classification (administrative, professional, researcher, or manager). The participation rate of peers attached to each individual does not include the participation decision of that particular individual. This rate is used as a measure of how informed an individual is about CSP.[17]

Because the sample consists of both employees hired before and after the implementation of CSP, the empirical analysis will be conducted on two groups: 1) employees hired before September 1, 1999; and 2) employees hired after September 1, 1999. The groups need to be separated because, as discussed in Section 3, implementation of CSP could affect the applicant pool. The effect of CSP on retention for future hires will be determined based on results collected from the second group, which is the measure most applicable to firms who have an established program. If a firm is considering implementing a tuition reimbursement program, the effect of CSP on current and future workers is relevant.

4.3 Results from Case Study

The first set of results estimate the effect of participation in CSP on the probability of separating from the employer (voluntarily or involuntarily) within 5 years when participation is treated as exogenous. Table 5 lists the marginal effects from a simple probit estimation with *leave* as the dependent variable. For workers hired before CSP was implemented, $S = 1$ if they separate from institution within five years measured from September 1, 1999; and = 0 otherwise.

[17] The direction of the effect in unclear: Does the participation of peers inform the individual or does participation by the individual inform her peers? While it does not matter for the purposes of this study, a robustness check was performed that assigned participation rates by workers hired before September 1, 1999 in the first year of the program (1999) to new hires. Because these new hires were not eligible to participate in the first year due to the eligibility rule while the existing employees were, the direction of this information effect is clear. By distinguishing between these two cohorts, concerns regarding whether the individual and her peer group experience the same shock to their participation probabilities are also mitigated. This alternative measure of peer participation does not affect the results.

For workers hired after implementation, $S = 1$ if separate within five years of hire date; and $S = 0$ otherwise. Individual and employment characteristics, such as age, wage, and years of service, are taken as of December 15 of the first year observed. Participation in CSP is equal to 1 if the individual ever participated in the program from September 1, 1999 through August 31, 2003. This definition of participation is used because when workers participate, they typically spend the maximum amount possible, which corresponds to a binary decision.[18]

As seen in Table 5, if participation in CSP were exogenous, participation would lower the probability of leaving by over 20 percentage points for employees hired before or after September 1, 1999. This impact on retention is equivalent to the effect of being three and a half years older, or having six additional years of experience (as of December 15, 1999) for those employees hired before September, 1999. For recent hires, the effect is similar to being four and half years older.

Table 6 separates the effect of undergraduate and graduate degrees on retention assuming exogeneity of participation. The effect of pursuing an undergraduate degree in CSP is roughly one and a half times as large as the effect of pursuing a graduate degree across the two groups. However, if participation is endogenous, these estimates of how participation in CSP affects retention are inconsistent.

Tables 7 and 8 display the marginal effects from the bivariate probit maximum likelihood estimation for employees hired before and after September 1, 1999, which allows for an interdependence between participation and retention decisions. For those hired before implementation of CSP, the probability of participation is significantly higher for females (relative to males) and Blacks (relative to those identifying themselves as White), and lower for Asians and for those with higher weekly wages. While the magnitude of the marginal effects appears small, they are influential when compared to the average participation rate of 4.5 percent. The probability of participating in CSP increases in step with the participation rate of peers. The probability of leaving is decreasing (at a decreasing rate) in age and experience, and is lower for Hispanics and Asians. At mean values, a $500 dollar increase in the weekly starting wage increases the probability of leaving by one percent.

[18] The results do not change when spending as a percent of the maximum reimbursement amount is used instead of the binary indicator.

The impact of participation in CSP on retention is estimated as negative for both groups and significantly different from zero for those hired after the program was implemented (hired after September 1, 1999). As opposed to the estimates in Table 5 when participation is assumed to be exogenous, the estimated effect of participation in CSP is only slightly negative and not significantly different from zero for those employees hired before September 1, 1999. The change in the magnitude can be attributed to the correlation between the unobservable characteristics. A negative correlation implies that individuals (those hired before September 1, 1999) who participate in CSP were those predisposed to staying at the institution.

For those hired after September 1, 1999, participation in CSP is significantly higher for workers in a non-supervisory role and is increasing in wage (Table 8). Participation in CSP has a large effect on retention: it reduces the probability of separating within five years by 50 percentage points. The correlation between the error terms is positive and significant at the ten percent level. A positive correlation implies that those individuals who are more likely to participate in CSP are more inclined to leave within 5 years.

The estimated effect of participation in CSP on retention in Tables 7 and 8 is a specification in which the type of degree pursued does not matter for separation rates. A second specification is found in Tables 9 through 12, which allows the effect to vary by degree pursued. Tables 9 and 10 give the estimate for how pursuing an undergraduate in CSP affects retention. The effect is large and negative for both groups of hires: the probability of leaving within five years is reduced by over 40 percent for those hired before September 1, 1999, and nearly 60 percent for recent hires. The correlation between the error terms is positive for both groups, meaning that those most likely to participate are those predisposed to separating from the institution.

The effects of pursuing a graduate degree in CSP on retention are listed in Tables 11 and 12. Unlike undergraduate degrees, the effect of pursuing a graduate degree differs across the two cohorts of employees. For those hired before CSP was implemented, pursuing a graduate degree increases the probability of leaving the institution by 22 percentage points; although, the effect is not statistically significant at conventional levels. The correlation between the errors is negative for this group, meaning that those who are more likely to pursue a graduate degree are also more likely to stay.

For those hired after September 1, 1999, pursuing a graduate degree reduces the probability of leaving within five years by fifty percent. Similar to undergraduate degrees, the correlation between the errors is positive. Hence, those employees pursuing graduate degrees who were hired before September 1, 1999 behave differently from the other three groups of participants.[19]

These results indicate that participation in CSP increases retention for those employees hired after the program was implemented, and for those employees hired before implementation who choose to pursue undergraduate degrees. This analysis shows that participation in CSP is endogenous: the correlation between the error terms is positive for the aforementioned groups. Because of this endogeneity, single-equation estimation of the effect of CSP on the probability of separation underestimates the impact of participation on retention due to the positive correlation between the error terms. Participation in CPS decreases the probability of separating from the employer within 5 years by 50 percentage points when participation is allowed to be endogenous, up from 20 percent point decrease in the probability of separation when participation is treated exogenously. Hence, the effect of CSP on retention is even larger in magnitude when we take into account the correlation between the unobservable factors contained in the error terms.

For those employees hired before implementation of CSP who pursue graduate degrees, CSP reduces retention. The correlation between the unobserved heterogeneity affecting participation and separation is negative for these workers, which means that those more likely to participate are less likely to separate from the institution within five years. When treated exogenously, participation appears to decrease the probability of leaving by 18 percentage points; however, when participation is modeled as endogenous, participation increases the probability of leaving by nearly 22 percentage points. Hence, participation in CSP accelerates departure from the institution for those existing employees who choose to pursue graduate degrees.

This case study finds that tuition reimbursement programs increase retention of new hires. Hence, this paper finds empirical support for the explanation given by firms for providing tuition reimbursement programs – to increase employee retention – despite the predictions of the

[19] This difference could be explained by dynamics leading to the implementation of CSP, which is currently being explored.

standard theory of human capital that provision of general training could increase turnover. It is important to note that implementation of a program appears to affect existing and future employees differentially. This difference provides some evidence that tuition programs affect the composition of a firm's applicant pool. However, this evidence is not fully conclusive due to the fact that it only applies to those workers pursuing graduate degrees.

Because CSP is a typical program in terms of its characteristics, this paper's findings improve the literature's understanding of tuition reimbursement programs and their effect on retention, especially for civilian employees. However, the conclusions from a case study may not be generalized to all firms. The following section tests whether the conclusion of this case study is supported by SEPT95, a dataset containing training information from over 1000 establishments.

5.0 Analysis using Survey of Employer-Provided Training, 1995 (SEPT95)

5.1 Information on SEPT95

SEPT95 was conducted by the Bureau of Labor Statistics (BLS), part of the U.S. Department of Labor, and sponsored by the Employment Training Administration with the purpose of collecting nationally representative data on employer-provided training practices (Bureau of Labor Statistics, Press Release July 10, 2006). The sample represents establishments employing 50 or more workers; smaller employers were not sampled because previous research has shown that they seldom offer formal training.

The survey consisted of personal visits conducted from May to October in 1995 of private, nonagricultural business establishments. The 1995 survey was the second Survey of Employer-Provided Training; the first, conducted in 1994, collected information on types of formal training provided or financed by establishments in 1993. The two surveys differ in that SEPT95 collected information from both employers and randomly selected employees.

In SEPT95, establishments report expenditures on training for 1994: payments for wages and salaries of in-house trainers, payments to outside trainers, spending on tuition reimbursement, and payments to training funds. In addition to information on formal training, the employer questionnaire collected information on firm characteristics, such as benefits, work

practices, occupation composition, and employee turnover. While SEPT95 collected a training log from establishments, as well as two questionnaires and training logs from randomly selected employees, this paper only uses responses to the employer questionnaire in its analysis because the other survey instruments have lower response rates.[20] A sample of 1,433 establishments was drawn. Usable employer questionnaires totaled 1,062, giving a response rate of 74.1 percent. Twelve observations were dropped subsequently for this paper's analysis.[21] Detailed information on the universe of firms and sampling procedure is provided in the appendix.

To obtain information on wages, this analysis merged average quarterly wage data from the Quarterly Census of Employment and Wages (QCEW) from 1993, 4th quarter, which was when the sample of establishments was drawn. Average wages were computed by dividing total wages in the 4th quarter of 1993 by the sum of monthly employment over this quarter (average "monthly" wage). Access to these wage data was not available for all firms due to variation in confidentiality restrictions across States.[22]

Few authors have used the data collected by SEPT95, likely due to their classification as restricted data.[23] Economists employed by the BLS conducted the two studies that make prior use of the data: Frazis et al. (1998) and Frazis, Gittleman, Joyce (2000). These two studies relate firm and employee characteristics to provision and receipt of training. Frazis et al. (1998) is a descriptive paper and documents provision and spending on formal training. During 1994, establishments with 50 or more employees spent $139 per employee on wages and salaries of in-house trainers, $98 per employee on payments to outside trainers, and $51 per employee on tuition reimbursement. They find evidence of economies of scale in the provision of formal training: larger firms are more likely to provide formal training, and employees at larger firms spend a greater percentage of their training hours in formal training. High-benefit employers and those using innovative workplace practices, such as total quality management and work teams, are more likely to offer training. They find a negative relationship between the provision of

[20] Sample attrition for these other three instruments could be related to the amount of training done at the firm. This paper only uses the responses to the employee questionnaire, which has the highest response rates, to minimize the problem of non-random attrition.
[21] Two were dropped because employment reported in 1995 dropped to one employee, and an additional ten observations were dropped due to outliers in the number of reported hires relative to current employment.
[22] Wage data was acquired for 833 firms. Colorado, Michigan, New Hampshire, New York, Oregon, Pennsylvania, Vermont, Washington, and Wyoming did not allow access to QCEW.
[23] Analysis of SEPT95 requires approval from the BLS that its use will not jeopardize the confidentiality of its respondents; all analysis using SEPT95 must be conducted onsite at the BLS office in Washington, D.C.

training and turnover using both the employee and employer survey instruments. Employees working at high turnover establishments receive less training, and these establishments report a lower provision of training than firms with low or medium turnover rates. However, the direction of causation between training and turnover cannot be determined from a simple correlation.

Frazis, Gittleman, and Joyce (2000) provide a clearer picture of how firm characteristics relate to the provision and intensity of training by using multivariate regression analysis. Their main findings mirror those of Frazis et al. (1998); they consistently find a positive relationship between training and fringe benefits and high-performance work practices, whether they look at incidence or intensity, receipt or provision of training.

To give credibility to these data, Frazis, Gittleman, and Joyce (2000) relate estimates of training from SEPT95 to other survey results. Results from SEPT95 show that 93 percent of establishments with 50 or more employees provided some type of formal training activity in the 12 months prior to being surveyed in 1995. Studies using the 1994 EQW-NES report that 81 percent of establishments with 20 or more employees offer formal training (Black and Lynch, 1998). The disparity between these two estimates is attributed to the difference in the size of employers surveyed, because the definition of formal training is similar across the two surveys.[24] The Small Business Administration (SBA) Survey of training in 1992 finds that only 43 percent of firms employing 100 or more workers provide formal training. The estimates from SEPT95 and SBA differ substantially; Frazis, Gittleman and Joyce (2000) argue that the divergence between these estimates stems from differences in the type of training program being reported: SBA asks about training programs, while SEPT95 asks about any type of formal training activity. A training program could imply a curriculum with multiple courses for instructing a number of participants; in contrast, a solitary incident of training would result in an affirmative response to the SEPT95 survey question.

Information on tuition reimbursement programs provided by firms is difficult to obtain due to the proprietary nature of training practices; SEPT95 provides a limited opportunity for an analysis of this general training program. In SEPT95, firms indicate whether they offer a tuition

[24] The two results are compatible because the provision of training increases with firm size due to economies of scale (Frazis et al. 1998).

reimbursement program as a part of their formal training programs, and also report total expenditures on reimbursements for 1994.[25]

Using sample weights, 61 percent of establishments with 50 or more employees offer tuition reimbursement and 46 percent had positive expenditures on reimbursements in 1994. The remainder of the analysis does not use sample weights and instead focuses on the relative characteristics of respondents. Seventy-five percent of respondents offer a tuition reimbursement program, but 14 percent of these firms had zero expenditures on reimbursements in 1994. Unfortunately, SEPT95 does not contain information on the specifics of these tuition reimbursement programs so these data cannot be used to evaluate how plan characteristics affect participation rates. However, expenditures of $0 for 1994 imply a participation rate of zero for the entire year. To be considered as having a tuition reimbursement program in this analysis, firms must indicate that they have a program and have positive expenditures in 1994. Using this requirement, 64 percent of establishments have an "operational" tuition reimbursement program.

Table 13 shows mean characteristics of respondents. The third and fourth columns of Table 13 show the mean value of firm characteristics by whether the firm has a tuition reimbursement program. Firms with a tuition reimbursement program offer more benefits, have higher wages, have lower separation rates and have more employees than firms without a program.[26] Table 14 shows how provision of tuition reimbursement programs varies by industry. Industries that are more production intensive, such as mining and manufacturing, are more likely to offer this program. The financial, insurance, and real estate industry also has a high incidence, which probably reflects the certifications and licensing required in these jobs. Because provision varies by industry and the degree of firm-specificity is arguable higher in productive intensive jobs, these findings suggest that general skills acquired through tuition reimbursement are used to complement firm-specific skills.

Whether tuition reimbursement is provided in conjunction with other training programs is another way to assess whether these programs are related firm-specific human capital. If tuition reimbursement programs are offered as a complement to other training programs, rather than as a substitute, then there is likely an interaction between firm-specific and general skills training.

[25] The National Employer Survey used by Black and Lynch (1998) and Cappelli (2004) asks whether the firm reimburses tuition for employees, but does not collect information on expenditures.

[26] Separation rate = (current employment + hires – previous employment)/(.5*(current employment + previous employment), where previous employment is the number of employees on staff three months prior to survey.

Table 13 shows that firms with tuition reimbursement programs are both more likely to hire trainers from outside the firm and to employ in-house trainers.[27] Table 15 gives results from a simple probit model relating the provision of tuition reimbursement to establishment characteristics, including other types of training provided by the establishment. The probability of offering a tuition program is nearly twenty percentage points higher for firms that also hire outside trainers and ten percentage points higher for those with in-house trainers. Hence, tuition reimbursement programs are offered in conjunction with other training practices. These results regarding the determinants of providing tuition reimbursement are consistent with tuition reimbursement programs being used to complement investments in firm-specific human capital, thereby increasing worker productivity at the current firm. This discussion will be revisited in Section 6 of this paper.

5.2 Econometric Framework and Results

Similar to problems confronted in the case study when estimating how participation in CSP affects retention, estimating the effect of tuition reimbursement on separation rates for firms in SEPT95 needs to address the problem of an endogenous right-hand side variable. First, suppose program provision is exogenous and the effect of tuition reimbursement on separation rates is estimated by running OLS on equation 6.

$$separation\ rate_i = X_i'\beta + \delta\ tuition_i + u_i \qquad (6)$$

In the above equation, X is a vector of firm characteristics, *tuition* is a binary variable that equals 1 if the firm has a tuition reimbursement program with positive expenditures in 1994, and u is an error term. Table 16 shows the results from an OLS regression of separation rates on firm characteristics, including tuition reimbursement. The OLS estimates shows that the relationship between tuition reimbursement programs and separation rates is negative and significant. Using the mean separation rate (0.110) as a benchmark, the OLS estimates imply that tuition reimbursement programs are associated with nearly a 35 percent lower separation rate. Including

[27] Firms are classified as hiring an outside trainer if they had positive expenditures for this training category in 1994; similarly for expenditures on in-house trainers (fulltime or part-time).

establishment wage in the regression does not change the result. These estimates, however, assume that provision of tuition reimbursement is exogenous.

Recall that increasing employee retention is a primary reason for why firms implement tuition reimbursement programs. This suggests that unobservable firm heterogeneity causing higher separation rates is positively correlated with unobservable determinants of providing tuition reimbursement. This implies that the decision by the firm to provide tuition reimbursement is endogenous. In addition, the degree to which skills used by workers in production are firm-specific affects both separation rates and investment in general skills training. However, because firm-specificity is not directly observable, it is absorbed into both error terms, which is another reason why the provision of tuition reimbursement is endogenous in the separation rate equation.

Equations 7 and 8 model a firm's decision to offer a tuition reimbursement program, where X and Z are vectors of exogenous variables and v is an error term.[28]

$$tuition_j^* = X_j'\beta + Z_j'\phi + \varepsilon_j \tag{7}$$

where *tuition* is a binary variable and *tuition** is a latent index related by the following:

$$tuition_j = \begin{cases} 1 & if\ tuition_j^* > 0 \\ 0 & if\ tuition_j^* \leq 0 \end{cases} \tag{8}$$

As argued above, *tuition* is endogenous in equation 6. Because *tuition* is a binary variable, it is referred to as a "dummy endogenous variable" and needs to be handled in a self-selection framework. Roy (1951) presents an early discussion of self-selection in the context of occupational choice and his framework has been used extensively to in the program evaluation literature. He shows that occupational differences in earnings cannot be estimated by comparing the average wages of those workers in occupation A to occupation B because workers self-select into the occupation that gives them the highest payoff. In order to estimate the return to an occupation for a randomly selected individual, one needs to take into account the covariance

[28] Establishment wage is not included in the estimation of either equation 6 or 7 because it is endogenous in both equations if the error term contains a measure of firm-specific human capital.

between the unobservable characteristics that affect occupation selection and the unobservable characteristics that affect wages.

To estimate the effect of tuition reimbursement on separation rates, this paper assumes the error terms in equations 6 and 7 are distributed bivariate normal with mean zero and covariance matrix given by:

$$\begin{pmatrix} u \\ v \end{pmatrix} \sim BVN\left(\begin{pmatrix} 0 \\ 0 \end{pmatrix}, \begin{bmatrix} \sigma & \rho \\ \rho & 1 \end{bmatrix}\right)$$

The effect of tuition reimbursement programs on separation rates (δ from equation 6) estimated in this framework is the "average treatment effect", or the effect of tuition programs on separation rates for establishments selected at random. Identification of δ requires that at least one variable or factor affects the provision of tuition reimbursement, but does not affect separation rates (e.g. elements of vector *Z*, which is included in equation 7 but excluded from equation 6). This condition is difficult to satisfy with the establishment-level characteristics collected in SEPT95, because training and workplace conditions are related to separation rates. However, variation across States provides some hope.

Recall that the definition of tuition reimbursement used in this analysis is that firms must offer the program and have paid reimbursements in 1994. Because participation in tuition reimbursement programs is voluntary, positive expenditures on reimbursements by the establishment indicate a demand for continued education by workers. If demand for education by workers at the establishment is affected by the educational attainment of peers (or fellow citizens), then the probability of having positive expenditures on tuition reimbursement will be increasing in the State's educational attainment. This paper uses educational attainment by the adult population as one set of exclusion restrictions, which includes the percent of adults (25 years or older) in the State with a bachelor's degree or higher in 1990 and the percent change from 1990 to 2000 computed from the U.S. Census.[29]

In addition, the return to education was estimated for each State using the 1994 Current Population Survey. The estimated return to education is the coefficient on years of schooling in

[29] Data were constructed using *American Fact Finder*, Summary 3 File for 1990 and 2000 Decennial Censes (www.census.gov).

a simple Mincer equation.[30] The relationship between provision of tuition reimbursement and return to education is expected to be positive because workers' demand for continued education is increasing in the return schooling. Returns to schooling along with educational attainment by State comprise the other set of exclusion restrictions. Table 17 shows the means for these variables; the level and change in educational attainment, as well as the estimated return to education, are higher for firms with tuition reimbursement programs.

Table 18 shows the estimated probability of a firm offering a tuition reimbursement program using a probit model. Two sets of results are shown, one for each set of exclusion restrictions. In both equations, the exclusion restrictions are jointly significant.[31] The probability of offering a tuition reimbursement program increases with the educational attainment of adults in 1990, the percentage change from 1990 to 2000, and the estimated return to education by State.

Tables 19 and 20 show the results from the bivariate probit maximum likelihood estimation using the two sets of exclusion restrictions. After controlling for the endogeneity of program provision, the effect of tuition reimbursement programs on retention is even larger: positive spending on tuition reimbursement reduces separation rates by .075 points. Using the mean separation rate of 0.110 as a basis of comparison, these programs reduce separation rates by nearly 70 percent. The covariance between the unobservable firm characteristics that affect program provision and separation rates is estimated to be positive. This positive covariance is due to the simultaneous relationship between separation rates and provision of tuition of reimbursement. Because offering tuition reimbursement is endogenous, OLS underestimates the effect of tuition reimbursement programs on separation rates. The results from SEPT95 are consistent with the finding from the case study: tuition reimbursement programs increase employee retention.

Estimation by instrumental variables is also used in the literature to estimate the effect of a binary endogenous variable on an outcome of interest. Unlike the analysis above which makes a distributional assumption to estimate the average effect of tuition programs on separation rates, instrumental variables does not require an assumption about the distribution of unobservable

[30] To estimate the return to education, ln(wage) was regressed on years of schooling, by state. Because the estimated parameter enters the reduced form equation and is not a parameter of interest in this analysis, the simple specification of the wage equation is not problematic. Results are presented with and without this exclusion restriction.

[31] These instruments were found to be jointly significant using a likelihood ratio test: p-values of 0.0123 and 0.0117.

characteristics. However, in order to interpret the estimated effect of a binary endogenous treatment as an average treatment effect using instrumental variables, one must assume that the effect of the treatment is homogenous. Homogeneity of treatment implies that the effect of the treatment would be the same for those who opted for treatment (binary variable = 1) and for those who opted not to treat. In the case of tuition reimbursement programs, if those firms that offer tuition reimbursement have unobservable characteristics that make investment in general human capital more effective at increasing worker productivity (i.e. the presence of firm-specific human capital) than at firms that do not offer tuition reimbursement, then assuming that the effect is homogenous is tenuous. Using instrumental variables, the effect of tuition reimbursement on separation rate is quite large in magnitude: -0.26 (over double the mean separation rate). When the homogeneity assumption is violated, instrumental variables estimates the "local average treatment effect", which is only clearly interpretable in certain policy evaluations.[32] Hence, when the effect of a treatment is heterogeneous, instrumental variables is estimating a parameter different from the average treatment effect.

5.3 Case Study and Cross Section Results: Combining Two Perspectives

The results from the case study and cross-section analyses tell a consistent story: tuition reimbursement programs increase employee retention. However, the two analyses evaluate the effect from different perspectives. The first compares the separation behavior of participants relative to non-participants, while the second compares separation rates at establishments with a program to those without. The cross-section analysis is a comparison across establishments rather than a comparison within establishments.

The case study shows that workers who are predisposed to having a higher probability of separating from the institution are more likely to participate in the tuition program. This suggests that these workers may have intended to acquire general skills through tuition reimbursement to make a career or firm change. However, participation substantially reduces the probability of leaving after five years. This is consistent with participants accumulating firm-specific human capital during the time period before they become eligible and during

[32] The local average treatment effect (LATE), which was introduced by Imbens and Angrist (1994), measures the average treatment effect for those who would be induced to treat (binary variable = 1) by changes in the value of the instrument (Wooldridge, 2002).

participation in the program, as well as possibly due to the increase in productivity of firm-specific skills from the interaction of these skills with general skills acquired through tuition reimbursement. Because those who participate stand to gain the most from participation in terms of wage increases and promotion opportunities, tuition reimbursement programs are effective at lowering the separation rate of the most ambitious employees.

The cross-section analysis finds that positive spending on tuition reimbursement programs negatively affects separation rates. Because establishments implement tuition programs to affect separation rates, implementing a program at a randomly selected establishment has an even larger effect on separation rates. As described above, tuition reimbursement programs reduce the separation probabilities of the most "mobile" workers. However, because participation rates are typically less than five percent, the cross-section results imply that the program must also affect separation rates of non-participants.

Allowing for workers to place a positive option value on future participation can explain the effect on non-participants. Non-participants at firms with a tuition program differ from workers at firms without a tuition program in terms of their separation rates because of this positive option value. Because reimbursement is tied to successful completion of coursework, the option value for many workers is zero. To the extent that the incidence of the cost of the program falls on the worker in the form of lower wages, workers with a zero option value will be less likely to work at firms with tuition reimbursement programs. Hence, program provision affects the type of worker attracted to the firm and this contributes to the effect on establishment separation rates.

The cost of separation, or replacement cost of a worker, increases in the degree to which a firm uses firm-specific skills in production. As seen in cross-section analysis, firms that use more firm-specific human capital in production are more likely to offer tuition reimbursement programs. If the stock of firm-specific human capital is increasing in tenure, then offering these general training programs increases investment in firm-specific capital of both participants and non-participants due to service length requirements, course duration, and increased tenure resulting from a positive option value on future participation. Therefore, separation rates decline and investment in firm-specific human capital increases. Depending on these two effects, firms could find it profitable to offer tuition reimbursement even if the full incidence of the cost of program falls on the firm.

6.0 General Training and Turnover

This section presents a mechanism that could result in general skills training increasing employee retention, which provides a context for interpreting the empirical finding that tuition reimbursement programs reduce turnover. By definition, general skills improve worker productivity at more than one potential employer. If employers provide general skills training in a competitive market, turnover would increase due to poaching of trained workers by outside firms (Becker 1964). The standard theory of investment in human capital implies that workers bear the full cost of general training due to this risk of poaching. Hence, turnover would be non-decreasing in general skills training under standard human capital theory because the worker is indifferent between employers because skills are transferable. Pencavel (1972) first incorporates turnover into the firm's set of choice variables, which implies that firms can reduce turnover rates by increasing compensation. He shows evidence that firms pick a wage-quit strategy, which depends on how costly turnover is to the firm, or how much firm-specific human capital is used in production. The use of tuition reimbursement programs to influence turnover requires that general skills training be more cost-effective at reducing turnover than wage increases.

How could general skills decrease turnover? If workers use firm-specific human capital in production, mechanisms exist in which provision of general skills training could increase employee retention. Recall that investment in firm-specific skills lowers turnover because rents from the investment are shared between the worker and firm; both parties have an incentive to continue employment because rents only accrue if the relationship is maintained. If provision of general skills training by a firm increases the stock or productivity of firm-specific skills, then general skills training could reduce turnover.

If complementarities exist between general and firm-specific human capital in production, general skills training could increase employee retention. Acemoglu and Pischke (1999a, 1999b) argue that if general and firm-specific human capital are complements, wage structures could become compressed, thereby giving firms an incentive to provide general skills training. Acemoglu and Pischke define compression in the wage structure to mean that profits

from trained workers are higher than those from untrained workers.[33] With complementarities between general and specific human capital, general skills acquired through participation in tuition reimbursement could increase the productivity of firm-specific human capital, thereby increasing employee retention.

As discussed in Section 5, the determinants of whether a firm offers a tuition reimbursement program appear to be related to technology and skills used in production. Firms in mining, manufacturing, and finance are more likely to offer these programs relative construction, wholesale, and retail. Controlling for industry, firms with a higher fraction of professionals, managers, and administrative support are more likely to offer tuition reimbursement relative to firms with a higher fraction of sales, service, and production workers. In addition, firms that provide other types of training to their employees (even after controlling for industry) are more likely to offer tuition reimbursement. High-training firms with higher-skilled workers that are in technology-intensive industries arguably require a greater amount of firm-specific human capital in production. This suggests that firms provide general skills training to complement investments in firm-specific human capital.

For motivation and clarity, the following is a simple model to outline how investment in the general human capital of employees in the presence of complementarities between firm-specific and general human capital in production could increase employee retention. Suppose that a worker's production at the current firm (c) is a simple function of her stock of general human capital (g) and firm-specific human capital (s), while production at any other potential employer (p) is a function only of her general human capital:

$$f_C(g,s) = g + h(s), \text{ where } h'(s) > 0 \text{ and } h''(s) < 0 \quad (9)$$

$$f_P(g,s) = g \quad (10)$$

Since g is transferable across employers, workers with general skills g will be paid no less than a wage equal to the value of their marginal product. Normalizing the price of output to one, a worker's outside wage option is $wage_P = f_P(g,s) = g$. At the current firm, rents from firm-specific human capital will be shared between the worker and the firm. Her wage is given by:

$$wage_C = f_C(g,s) = g + \beta\, h(s) \quad (11)$$

[33] Acemoglu and Pischke (1999a, 1999b) list several other market imperfections that could result in compressed wages, including search costs, mobility costs, and minimum wage laws.

Where β is the relative bargaining power of employees and $0 < \beta < 1$.[34] Costs of the investment in firm-specific human capital are also shared, so h(s) is negative when the worker starts to accumulate firm-specific human capital. The worker pays her share of the investment in the form of a lower wage during training: she is paid a wage lower than her outside option, *g*, but above her actual productivity while in training. Thus, the firm contributes to its share of the investment cost by paying her a wage above her productivity initially. As rents accrue with the accumulation of firm-specific human capital, *s*, the worker and firm split the difference between the worker's productivity at the current firm and her outside option, with the share being determined by the relative bargaining power. If the worker separates from her current firm, she will incur a wage loss of:

$$loss(s) = \beta\, h(s) \qquad (12)$$

When $s > s^*$, where s^* is defined as the level of firm-specific capital such that $h(s^*) = 0$, wage loss is increasing in *s* and the employee will not want to separate from the firm.

Profits at the current firm from a worker with general human capital *g* and firm-specific human capital *s* are given by[35]:

$$\pi_C = g + h(s) - (g + \beta\, h(s)) = (1 - \beta)\, h(s) \qquad (13)$$

As in the case of the worker, the firm has an incentive to maintain the employment relationship when $s > s^*$ because profits are increasing in *s* after this point. Figure 5 shows productivity and wages with investment in firm-specific human capital at the current firm, as well as the outside option for the worker (i.e. $wage_P = g$), for a hypothetical production function, *h(s)*. Notice that the outside option (or outside wage) is flat because there is no investment in general human capital in this case. The vertical axis measures the wage (or productivity), which has been normalized to 0 for a stock of general human capital equal to g.

Now suppose that general human capital and firm-specific human capital are complements in production. Worker productivity at the current firm becomes:

$$f_C(g,s) = g + h(s,g), \text{ where } h(s,0) \equiv h(s) \text{ and } \frac{\partial^2 h(s,g)}{\partial s\, \partial g} > 0 \qquad (14)$$

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[34] This condition needs to be satisfied because if β =0, the worker has no incentive to stay with the firm because his wage at the current firm is equal to his outside option, g. Similarly, the firm has no incentive to maintain the employment relationship if β =1.

[35] Because the market is competitive, profits at firms only employing general human capital are zero.

The condition on the cross-partial derivative implies complementarities in production. Suppose the firm invests u in general human capital of its workers. Then the wage of the worker at the current firm and other potential employers becomes:

$$wage_C = f_C(g,s) = g + u + \beta\, h(s, g+u) \tag{15}$$

$$wage_P = f_P(g,s) = g + u \tag{16}$$

The wage loss incurred upon separation from the current employer is even larger under the complementarities assumption:

$$loss(s) \equiv loss(s,0) < loss(s, g+u) \rightarrow \beta\, h(s,0) < \beta\, h(s, g+u) \tag{17}$$

Hence, the employee has a greater incentive to stay with the current firm because her relative productivity at the current firms compared to other potential employers is higher with complementarities between general and firm-specific human capital.

Because courses are typically taken outside of the firm, investment in general skills through tuition reimbursement does not decrease the worker's productivity. However, the firm must pay for the reimbursement. With investment of u in general skills, the firm's profits become:

$$\pi_C = g + u + h(s, g+u) - (g + u + \beta\, h(s, g+u)) - u = (1-\beta)\, h(s, g+u) - u \tag{18}$$

Whether the firm will provide general training, u, depends on the present value of the additional rents accrued though $h(s, g+u)$ relative to the cost u, as well as β. The firm's incentive to continue the employment with the worker is greater under the complementarities assumption if:

$$(1-\beta)\, h(s,0) < (1-\beta)\, h(s, g+u) - u \Leftrightarrow h(s,0) < h(s, g+u) - u \tag{19}$$

Figure 6 displays the productivity and wages with complementarities between firm-specific human capital and general human capital. Notice that the outside option is now increasing due to the investment in general skill by the firm. This figure does not include cost of investment in general skill, u, but the profits of the firm (excluding u) are represented by the area between $h(s, g+u)$ and the wage.

There are other mechanisms that could result in general skills training reducing turnover in the presence of firm-specific human capital. Lazear (2005) presents a model in which all skills are general, but how these skills are combined in production is specific to the firm. Hence, in his model providing general skills training is essentially equivalent to investing in firm-specific skills. Alternatively, firms could use general training as an insurance mechanism: if workers are

reluctant to work at a firm which requires investment in firm-specific human capital due to the risk of wage loss in the event of involuntary separation, firms could offer general training as a way to mitigate this risk (Feuer, Glick, and Desai 1987). Additionally, if providing general skills training attracts a type of worker who values investment in human capital, these workers likely have a lower discount rate, and thus could be less likely to turnover a priori. For the case of tuition reimbursement programs, participation could increase the amount of firm-specific skills if these skills increase over time because coursework takes several semesters to complete. Service length requirements before and after participation would add to this effect (Cappelli 2004).

It is important to note that the presence of firm-specific human capital is not required for the provision of general training if other market imperfections are present (Acemoglu and Pischke 1999a, 1999b). While these rigidities, such as mobility costs, could explain why firms invest in general human capital of its workers, they cannot explain why the provision of general training reduces separation rates. Evidence from SEPT95 indicates that firms who offer tuition reimbursement programs are more likely to offer other types of training programs (see Section 5.1). Because "high-training" firms are more likely to offer tuition reimbursement programs, this suggests that these firms rely more heavily on firm-specific skills in production. Testing this hypothesis explicitly would require developing an index of firm-specificity, which could then be related to the provision of tuition reimbursement programs.

7.0 Concluding Remarks

Tuition reimbursement programs are a type of general training commonly offered by employers. Counter to the prediction of Becker's theory of investment in human capital, firms claim that they use these programs to increase employee retention. Using case study and cross-section analyses, this paper finds that provision of these general training programs increases employee retention. Results from the case study imply that participation in CSP substantially reduces the probability of separating from a firm: participation by those employees hired after the program was implemented reduced their probability of leaving within five years by over 50 percentage points. Using the cross-section of establishments, this paper finds that positive spending on tuition reimbursement has a large negative effect on employee turnover: reduces

separation rates by 70 percent. This result overturns the prediction of standard theory that investment in general human capital by firms increases turnover.

However, the establishment-level factors that determine which firms offer this general training program suggest that it is offered to complement investments in firm-specific human capital. By allowing for an interaction between firm-specific and general human capital, the empirical finding that general training reduces turnover can be interpreted within standard theory. Future work could test this amendment by explicitly evaluating how the use of firm-specific human capital in production affects a firm's probability of providing general skills training, such as tuition reimbursement programs.

The large estimated impact of tuition programs on retention implies that these programs affect the turnover rate of non-participants because participation rates are typically less than five percent. This implies that non-participants either intend to be participants in the future (i.e. they place a positive option value on participation) or that the provision of these programs improves the workplace environment or worker satisfaction.[36] Hence, non-participants at firms with tuition reimbursement programs are different from workers at firms without a tuition reimbursement program. Future work is needed to examine the strength of this "spill-over" effect, which might involve fieldwork and surveys of workers.

[36] Tuition reimbursement program are offered by many of Fortune Magazine's "Top 100 Companies to Work for".

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Appendix on SEPT95 Survey Methodology

The universe of firms represented by the firms in SEPT95 are all private establishments in 50 U.S. states and the District of Columbia with 50 or more employees during the fourth quarter of 1993. The data was collected by experience field economics in BLS regional offices. Establishments were first contacted by telephone to request a personal visit to the establishment. The BLS economists administered the employer questionnaire using computer-assisted personal interviewing, while training log data were either collected during the visit or the log was left to be completed by the employer over the following two weeks. The availability and quality of existing training records and schedules determined this decision.

The sample was drawn from the Bureau of Labor Statistics' Universe Data Base (UDB), and limited to firms with two-digit Standard Industrial Classifications (SIC codes) that indicated nonagricultural, private establishments.[37] The UDB is based on reports for Unemployment Insurance purposes to state Employment Security Agencies. The sample was drawn after stratifying the sample frame into categories based on industry and size.[38] A sample size of 170 establishments was set for each of the 9 industries. Within industry, the sample was allocated to the employment classes approximately proportional to their total employment. Within each stratum, a sample was randomly selected. Each unit was given a Sampling Weight that was the ratio of the number of frame units to the number of sampled units. If the UDB entry contained more than one establishment, one of these was randomly selected for the sample. Each establishment was assigned a Sub-sampling Factor that was equal to the number of establishments in its frame unit. Each sampled establishment was assigned a 14-day contiguous interval within the reference period, May – October, 1995 (Bureau of Labor Statistics, July 10, 2006).

There were 1,543 establishments selected, and 1,433 were eligible for the survey (out-of-business or out of the scope of the universe resulted in exclusion). Usable employer

[37] SIC Codes based on the 1987 SIC Manual include: Mining (SIC 10, 12-14); Construction (SIC 15-17); Nondurable Manufacturing (SIC 20-23, 26-31); Durable Manufacturing (24,25,32-39); Transportation and Public Utilities (SIC 41, 42, 44-49); Wholesale Trade (SIC 50-51); Retail Trade (SIC 52-59); Finance, Insurance, and Real Estate (SIC 60-65, 67); Services (SIC 07, 70, 72, 73, 75, 76, 78-84, 86, 87, 89).

[38] Five size classes: 1) 50 – 249; 2) 250-499; 3) 500 – 2499; 4) 2500 – 5000; 5) 5000 and above. Nine industries: 1) Mining; 2) Construction; 3) Nondurable Manufacturing; 4) Durable Manufacturing; 5) Transportation and Public Utilities; 6) Wholesale Trade; 7) Retail Trade; 8) Financial, Insurance and Real Estate, and 9) Services.

questionnaires totaled 1,062, giving an adjusted response rate of 74.1 percent. Usable employer logs were collected from 949 establishments, for an adjusted response rate of 66.2 percent. A usable questionnaire was required in order for the employer log to be considered for use. For missing information in otherwise usable surveys, the BLS employed a hot-deck procedure to impute a value for any item for which the establishment could not provide a response. Final weights were computed based on non-response adjustments and sampling weights.[39]

In addition to the establishment surveys, over 1,000 employees were surveyed. BLS field economists requested permission to select two employees for interviews from responding establishments. The employee questionnaire was administered during the interview, as well collecting the past three days of training information for the training log. The log was left for the employee to complete over the next seven days, and then mail back to the BLS economist. The employee questionnaire collected demographic and employment information, as well as formal and informal training received while at the current employer. The training log collected detailed information on training and learning activities. In total, 1,074 usable questionnaires and 1,013 usable training logs were collected from employees. Taking the 1,062 participating establishments s the eligible pool, the number of eligible employees was 2,214, giving a 50.6 percent response rate for the questionnaire and 47.7 percent from the training log (Bureau of Labor Statistics, December 19, 2006). Breaking these numbers down further, 470 establishments have two employee records, while 134 establishments have data on one employee questionnaire. Hence, nearly 60 percent of the 1,012 establishments include information on at least one randomly selected employee.

***

This paper only uses the employer questionnaire for its analysis. It uses the sample weights to compute what percentage of firms employing 50 or more workers offer tuition reimbursement program, and what percentage have positive spending. However, analyses of the effect of tuition reimbursement programs on turnover do not use sample weights.

[39] Final weights were computed for each establishment by computing the product of the Sampling Weight, Questionnaire Non-response Adjustment, and Sub-sampling factor. Similarly, the Final Weight is the product of the Sampling Weights, Non-response Adjustment, Sub-sampling factor, and the constant 13.143, which is the total number of days in the Survey's reference period divided by 14 days (Bureau of Labor Statistics, July 10, 2006).

Tables and Figures

Table 1: Distribution of Maximum Reimbursements for Tuition Programs

Less than $1,000	6.22%
$1,001 to $2,500	19.12%
$2,501 to $4,000	15.67%
$4,001 to $5,250	19.82%
$5,251 to $7,000	4.84%
More than $7,000	3.69%
No Maximum	30.65%
Observations	434

Source: Eduventures (2003)

Table 2: Sample Means	**Non-Participants**	**Participants**
Female	**66.86%**	**73.77%**
Age	**40.8**	**34.6**
White	**68.96%**	**62.60%**
Black	**5.01%**	**10.65%**
Hispanic	7.33%	9.61%
Asian	18.70%	17.14%
Leave within 5 years	**48.32%**	**33.25%**
Weekly Wage ($2001)	**$1,485**	**$1,237**
Supervisor (Exempt)	**62.88%**	**48.31%**
Non-Supervisor (Non-Exempt)	**37.12%**	**51.69%**
Hired Before Sept. 1999	**67.86%**	**62.85%**
Years in Tuition Program	**-**	**1.96**
Tuition Spending (nominal)	**-**	**$5,213**
Participation Rate of Peers	**1.98%**	**2.49%**
Observations	8229	385

Bold = Different at 5% level

Table 3: Retention of Participants (Unconditional)

Year Hired	Number	% Leave before 3 Years	% Leave before 4 years	% Leave before 5 years
1999 or before	253	13.83%	20.95%	30.43%
2000	74	11.84%	19.74%	32.89%
2001	58	24.14%	31.03%	44.83%

Table 4: Retention of Non-Participants (Unconditional)

Year Hired	Number	% Leave before 3 Years	% Leave before 4 Years	% Leave before 5 Years
1999 or before	5621	33.45%	39.35%	44.39%
2000	1378	41.51%	51.16%	58.85%
2001	983	41.20%	50.05%	56.97%

Table 5: Probability of Separating from Employer Before 5 years

Probit Model: Pr(S=1)	Hired Before Sept., 1999		Hired After Sept., 1999	
	dF/dX	St. Error	dF/dX	St. Error
Participation in CSP	-0.217	0.027**	-0.238	0.042**
Years of Service	-0.034	0.003**	0.136	0.149
Years of Service - Squared	0.001	0.000**	-0.274	0.143
Female	0.010	0.015	0.007	0.021
Age	-0.062	0.004**	-0.050	0.006**
Age - Squared	0.001	0.000**	0.001	0.000**
Black	0.034	0.031	-0.019	0.046
Hispanic	-0.055	0.026*	-0.080	0.038*
Asian	-0.087	0.018**	-0.101	0.025**
Non-Supervisor (Not Exempt)	-0.018	0.016	-0.072	0.023**
Weekly Wage (in thousands), $2001	0.020	0.010*	-0.045	0.015**
Observations	5826		2788	
Log-Likelihood	-3565.0		-1790.1	

* significant at 5% ** significant at 1%

Table 6: Probability of Separating from Employer Before 5 years

Probit Model: Pr(S=1)	**Hired Before Sept., 1999**		**Hired After Sept., 1999**	
	dF/dX	St. Error	dF/dX	St. Error
Graduate Degree	-0.180	.036**	-0.204	.051**
Undergraduate Degree	-0.267	0.36**	-0.307	.066**
Years of Service	-0.034	0.000**	0.135	0.149
Years of Service - Squared	0.001	0.000**	-0.274	0.143
Female	0.010	0.512	0.007	0.021
Age	-0.062	0.000**	-0.049	.006**
Age - Squared	0.001	0.000**	0.001	.000***
Black	0.035	0.262	-0.015	0.046
Hispanic	-0.054	0.040*	-0.078	.038*
Asian	-0.087	0.000**	-0.101	.025**
Non-Supervisor (Not Exempt)	-0.017	0.311	-0.071	.023**
Weekly Wage (in thousands), $2001	0.020	0.046*	-0.045	.015**
Observations	5826		2788	
Log-Likelihood	-3563.6		-1789.4	

* significant at 5%; ** significant at 1%

Table 7: Probability of Participating in CSP and Separating from Employer before 5 years

Bivariate Probit Model	Pr(CSP=1)		Pr(S=1)	
Hired Before Sept., 1999	**dF/dX**	**St. Error**	**dF/dX**	**St. Error**
Participation in CSP			-0.0299	0.2291
Years of Service	0.0014	0.0010	-0.0340	.0026**
Years of Service - Squared	-0.0001	0.0000	0.0007	.0001**
Female	0.0096	.0045*	0.0071	0.0155
Age	-0.0002	0.0016	-0.0607	.0048**
Age-squared	0.0000	0.0000	0.0006	.0001**
Black	0.0273	.0120*	0.0264	0.0318
Hispanic	0.0045	0.0079	-0.0565	.0260*
Asian	-0.0127	.0046*	-0.0834	.0182**
Non-Supervisor (Not Exempt)	0.0023	0.0054	-0.0209	0.0166
Weekly Wage (in thousands), $2001	-0.0122	.0059*	0.0209	.0102*
Participation in CSP by Peers (%)	0.0100	.0019**		
Correlation Between Errors	-0.2516	0.2668		
Log-Likelihood	-4488.3			
Observations	5826			

* significant at 5%; ** significant at 1%

Table 8: Probability of Participating in CSP and Separating from Employer before 5 years

Bivariate Probit Model	Pr(CSP=1)		Pr(S=1)	
Hired After Sept., 1999	**dF/dX**	**St. Error**	**dF/dX**	**St. Error**
Participation in CSP			-0.5188	.0788**
Years of Service	0.0667	0.0599	0.1521	0.1476
Years of Service - Squared	-0.0279	0.0559	-0.2693	0.1419
Female	-0.0024	0.0082	0.0061	0.0209
Age	0.0010	0.0028	-0.0493	.0062**
Age - Squared	0.0000	0.0000	0.0005	.0001**
Black	0.0243	0.0201	-0.0071	0.0452
Hispanic	-0.0062	0.0125	-0.0824	.0373*
Asian	0.0078	0.0098	-0.0948	.0246*
Non-Supervisor (Not Exempt)	0.0288	.0094**	-0.0585	.0239*
Weekly Wage (in thousands), $2001	0.0121	.0056*	-0.0422	.0148*
Participation in CSP by Peers (%)	0.0148	.0033**		
Correlation Between Errors	0.5051	0.2379		
Log-Likelihood	-2317.2			
Observations	2788			

* significant at 5%; ** significant at 1%

Table 9: Probability of Pursuing an Undergraduate Degree in CSP and Separating from Employer before 5 years

Bivariate Probit Model	**Pr(Undergrad=1)**		**Pr(S=1)**	
Hired Before Sept., 1999	**dF/dX**	**St. Error**	**dF/dX**	**St. Error**
Undergraduate Degree in CSP			-0.4197	.0285**
Years of Service	0.0004	0.0005	-0.0335	.0026**
Years of Service - Squared	0.0000	0.0008	0.0008	.0001**
Female	0.0040	0.0026	0.0107	0.0152
Age	0.0005	0.0009	-0.0609	.0044**
Age-squared	0.0000	0.0000	0.0006	0.0001**
Black	0.0136	0.0076	0.0433	0.0313
Hispanic	0.0075	0.0057	-0.0480	0.0263
Asian	-0.0010	0.0030	-0.0829	.0176**
Non-Supervisor (Not Exempt)	0.0131	.0042**	-0.0051	0.0172
Weekly Wage (in thousands), $2001	-0.0015	0.0031	0.0215	.0102*
Participation in CSP by Peers (%)	0.0024	.0011*		
Correlation Between Errors	0.5522	0.3155		
Log-Likelihood	-4027.9			
Observations	5826			

* significant at 5%; ** significant at 1%

Table 10: Probability of Pursuing an Undergraduate Degree in CSP and Separating from Employer before 5 years

Bivariate Probit Model	Pr(Undergrad=1)		Pr(S=1)	
Hired After Sept., 1999	**dF/dX**	**St. Error**	**dF/dX**	**St. Error**
Undergraduate Degree in CSP			-0.5823	.0132**
Years of Service	0.0235	0.0249	0.1342	0.1477
Years of Service - Squared	-0.0191	0.0238	-0.2716	0.1419
Female	0.0035	0.0033	0.0087	0.0210
Age	0.0002	0.0012	-0.0478	.0062**
Age-squared	0.0000	0.0000	0.0005	.0000**
Black	0.03239	.0157*	0.01678	0.0443
Hispanic	0.0086	0.0080	-0.0660	0.0371
Asian	0.0021	0.0045	-0.0971	.0243**
Non-Supervisor (Not Exempt)	0.0190	.0061**	-0.0596	.0231**
Weekly Wage (in thousands), $2001	0.0024	0.0036	-0.0440	.0149**
Participation in CSP by Peers (%)	0.0029	0.0016		
Correlation Between Errors	0.8128**	0.1540		
Log-Likelihood	-2002.9			
Observations	2788			

* significant at 5%; ** significant at 1%

Table 11: Probability of Pursuing an Graduate Degree in CSP and Separating from Employer before 5 years

Bivariate Probit Model	**Pr(Grad=1)**		**Pr(S=1)**	
Hired Before Sept., 1999	**dF/dX**	**St. Error**	**dF/dX**	**St. Error**
Graduate Degree in CSP			0.2198	0.1951
Years of Service	0.0009	0.0007	-0.0339	.0026**
Years of Service - Squared	0.0000	0.0000	0.0008	.0001**
Female	0.0048	0.0033	0.0046	0.0152
Age	-0.0004	0.0012	-0.0588	.0046**
Age-squared	0.0000	0.0000	0.0006	0.0001**
Black	0.0116	0.0084	0.0237	0.0305
Hispanic	-0.0011	0.0052	-0.0560	.0258*
Asian	-0.0108	.0032**	-0.0790	.0180**
Non-Supervisor (Not Exempt)	-0.0097	.0034**	-0.0197	0.0164
Weekly Wage (in thousands), $2001	-0.0106	.0044*	0.0219	.0102*
Participation in CSP by Peers (%)	0.0065	.0014**		
Correlation Between Errors	-0.4449	0.2120		
Log-Likelihood	-4200.2			
Observations	5826			

* significant at 5%; ** significant at 1%

Table 12: Probability of Pursuing an Graduate Degree in CSP and Separating from Employer before 5 years

Bivariate Probit Model	**Pr(Grad=1)**		**Pr(S=1)**	
Hired After Sept., 1999	**dF/dX**	**St. Error**	**dF/dX**	**St. Error**
Graduate Degree in CSP			-0.5024	.1087**
Years of Service	0.0402	0.0501	0.1345	0.1476
Years of Service - Squared	-0.0101	0.0068	-0.2589	0.1422
Female	-0.0050	0.0068	0.0043	0.0210
Age	0.0003	0.0024	-0.0493	.0062**
Age-squared	0.0000	0.0000	0.0005	.0001**
Black	-0.0152	0.0094	-0.0363	0.0455
Hispanic	-0.0161	0.0078	-0.0888	.0375*
Asian	0.0040	0.0077	-0.0982	.0246**
Non-Supervisor (Not Exempt)	0.0065	0.0072	-0.0734	.0232**
Weekly Wage (in thousands), $2001	0.0085	.0043*	-0.0437	.0150**
Participation in CSP by Peers (%)	0.0111	.0027**		
Correlation Between Errors	0.4913	0.2926		
Log-Likelihood	-2194.4			
Observations	2788			

* significant at 5%; ** significant at 1%

Table 13: Means of Firm Characteristics	Full Sample	No Tuition Reimbursement	Offer Tuition Reimbursement
Number of Employees	668	210	926
Average Monthly Wage*	$2,966	$2,470	$3,267
One of Multiple Establishments (0 or 1)*	40.21%	31.33%	45.59%
Separation Rate	11.00%	16.89%	7.68%
Total Number of Benefits (0 to 11)	6.1	4.9	6.8
Training Programs			
Tuition Reimbursement Program	63.95%	-	100.00%
Hire In-house trainers	45.13%	23.47%	57.48%
Hire trainers from outside the firm	72.18%	50.67%	84.15%
Occupation Composition			
Managers	10.24%	8.65%	11.13%
Professionals	14.68%	8.14%	18.37%
Sales	7.80%	10.32%	6.39%
Administrative Support	13.37%	10.33%	15.08%
Service	7.97%	12.95%	5.16%
Production	45.90%	49.51%	43.87%
Number of Firms	1057	381	676

***Not available for all States (N = 838; 522 offer tuition reimbursement and 316 do not).**
Column 3 Significantly Different from Column 4 at 1% Level

Table 14: Tuition Programs by Industry (SEPT95)	% in Sample	% Offer Tuition Reimbursement
Mining	11.64%	73.98%
Construction	11.54%	50.00%
Non-Durable Manufacturing	11.54%	72.13%
Durable Manufacturing	13.25%	82.86%
Transportation/Utilities	10.50%	62.16%
Wholesale	10.12%	54.21%
Retail	9.37%	26.26%
Financial/Insurance/Real Estate	9.93%	81.90%
Services	12.11%	63.28%

Table 15 : Probability of Offering Tuition Reimbursement Program	**dF/dX**	**St. Error**	**dF/dX**	**St. Error**
Probit Model	**Pr(Tuition = 1)**		**Pr(Tuition = 1)**	
Hire Trainer from Outside Firm (0 or 1)	**0.194**	**0.040**		
In-house Trainers on Staff (0 or 1)			**0.105**	**0.036**
Firm Size: 100 to 500 workers	**0.128**	**0.035**	**0.109**	**0.036**
Firm Size: 500 to 1000 workers	**0.253**	**0.340**	**0.222**	**0.039**
Firm Size: Over 1000 workers	**0.269**	**0.037**	**0.234**	**0.044**
Fewer than 100 workers is Excluded				
Number of Benefits (0 to 11)	**0.086**	**0.010**	**0.090**	**0.010**
Separation rate	-0.165	0.092	**-0.213**	**0.094**
Fraction Managers	**0.726**	**0.239**	**0.750**	**0.238**
Fraction Professionals	0.102	0.098	0.117	0.096
Fraction Sales	0.084	0.101	-0.020	0.105
Fraction Administrative Support	0.231	0.123	0.228	0.123
Fraction Service	0.084	0.101	0.034	0.100
Fraction Production is Excluded				
Industry Controls	**Included**		**Included**	
Log Likelihood Value	-475.3		-483.8	
Observations	1057		1057	

Bolded = Significant at 5% Level

Table 16: Relating Tuition Reimbursement and Separation Rates	**Coefficient**	**St. Error**	**Coefficient**	**St. Error**
OLS: LHS Variable	**Separation Rate**		**Separation Rate**	
Offer Tuition Reimbursement	**-0.036**	**0.013**	**-0.036**	**0.014**
Number of Benefits (0 to 11)	**-0.009**	**0.003**	**-0.007**	**0.003**
Ln(Average Monthly Wage)	Not Included		**-0.069**	**0.014**
One of Multiple Establishments (0 or 1)	Not Included		0.004	0.012
Fraction Managers	-0.115	0.066	0.003	0.072
Fraction Professionals	**-0.125**	**0.029**	**-0.087**	**0.033**
Fraction Sales	-0.006	0.036	0.020	0.039
Fraction Administrative Support	0.059	0.038	0.044	0.437
Fraction Service	0.007	0.032	0.013	0.037
Fraction Production is Excluded				
Firm Size Controls	Included		Included	
Industry Controls	**Included**		**Included**	
Constant	**0.314**	**0.026**	**0.777**	**0.098**
R-squared	0.160		0.183	
Observations	1057		838	

Bolded = Significant at 5% Level

Table 17: Means of Excluded Variables	Full Sample	Without Tuition Reimbursement	With Tuition Reimbursement
Percent with a BA or higher in 1990 (by State)	20.31%	**20.00%**	**20.48%**
Percent with a BA or higher in 2000 (by State)	24.23%	**23.76%**	**24.49%**
Percent change from 1990 to 2000 (by State)	20.01%	19.54%	20.27%
Estimated Return to Schooling (by State)	6.07%	6.01%	6.10%
Observations	1057	381	676

Bolded = Different at 5% Level

Table 18: Probability of Offering Tuition Reimbursement Program	dF/dX	St. Error	dF/dX	St. Error
Probit Model (First Stage)	**Pr(Tuition = 1)**		**Pr(Tuition = 1)**	
Firm Size: 100 to 500 workers	**0.135**	**0.034**	**0.135**	**0.034**
Firm Size: 500 to 1000 workers	**0.246**	**0.034**	**0.247**	**0.034**
Firm Size: Over 1000 workers	**0.273**	**0.035**	**0.274**	**0.035**
Fewer than 100 workers is excluded				
Number of Benefits (0 to 11)	**0.095**	**0.010**	**0.095**	**0.010**
Fraction Managers	**0.855**	**0.238**	**0.870**	**0.238**
Fraction Professionals	0.163	0.095	0.162	0.095
Fraction Sales	-0.021	0.104	-0.013	0.104
Fraction Administrative Support	**0.252**	**0.122**	**0.254**	**0.122**
Fraction Service	0.049	0.099	0.050	0.098
Fraction Production is excluded				
Industry Controls	**Included**		**Included**	
Instruments				
Percent with BA of Higher: 1990	0.007	0.005	0.007	0.005
Percent Change: 1990 to 2000	**0.007**	**0.002**	**0.006**	**0.002**
Return to Additional Year of Schooling	Not Included		0.025	0.017
Log Likelihood Value	-485.7		-484.6	
Observations	1057		1057	

Bolded = Significant at 5% Level

Table 19: Effect of Tuition Program on Separation Rates (Bivariate Normal MLE)	**Coefficient**	**St. Error**	**Coefficient**	**St. Error**
LHS Variable	**Separation Rate**		**Pr(Tuition=1)**	
Offer Tuition Reimbursement	**-0.075**	**0.029**		
Number of Benefits (0 to 11)	-0.006	0.004	**0.277**	**0.029**
Fraction Managers	-0.095	0.067	**2.517**	**0.692**
Fraction Professionals	**-0.121**	**0.029**	0.503	0.277
Fraction Sales	-0.006	0.036	-0.089	0.301
Fraction Administrative Support	0.067	0.039	0.739	0.352
Fraction Service	0.008	0.032	0.144	0.283
Fraction Production is Excluded				
Firm Size Controls	Included		Included	
Industry Controls	**Included**		**Included**	
Constant	**0.311**	**0.026**	**-3.098**	**0.455**
Exclusion Restrictions				
% BA or higher in 1990			0.019	0.015
Change in % BA: 1990 to 2000			**0.021**	**0.007**
Return to Schooling by State			Not Included	
Covariance between Error Terms	0.140	0.095		
St. Dev. of Separation Equation	0.167	0.004		
Log-Likelihood	-86.85			
Observations	1057			

Table 20: Effect of Tuition Program on Separation Rates (Bivariate Normal MLE)	**Coefficient**	**St. Error**	**Coefficient**	**St. Error**
LHS Variable	**Separation Rate**		**Pr(Tuition=1)**	
Offer Tuition Reimbursement	**-0.076**	**0.029**		
Number of Benefits (0 to 11)	-0.006	0.004	**0.278**	**0.029**
Fraction Managers	-0.094	0.067	**2.569**	**0.694**
Fraction Professionals	**-0.121**	**0.029**	0.503	0.277
Fraction Sales	-0.006	0.036	-0.065	0.302
Fraction Administrative Support	**0.067**	**0.039**	0.746	0.352
Fraction Service	0.008	0.032	0.146	0.283
Fraction Production is Excluded				
Firm Size Controls	Included		Included	
Industry Controls	**Included**		**Included**	
Constant	**0.310**	**0.026**	**-3.537**	**0.535**
Exclusion Restrictions				
% BA or higher in 1990			0.020	0.015
Change in % BA: 1990 to 2000			**0.019**	**0.007**
Return to Schooling by State			0.075	0.048
Covariance between Error Terms	0.140	0.095		
St. Dev. of Separation Equation	0.167	0.004		
Log-Likelihood	-85.63			
Observations	1057			

Bolded = Significant at 5% Level

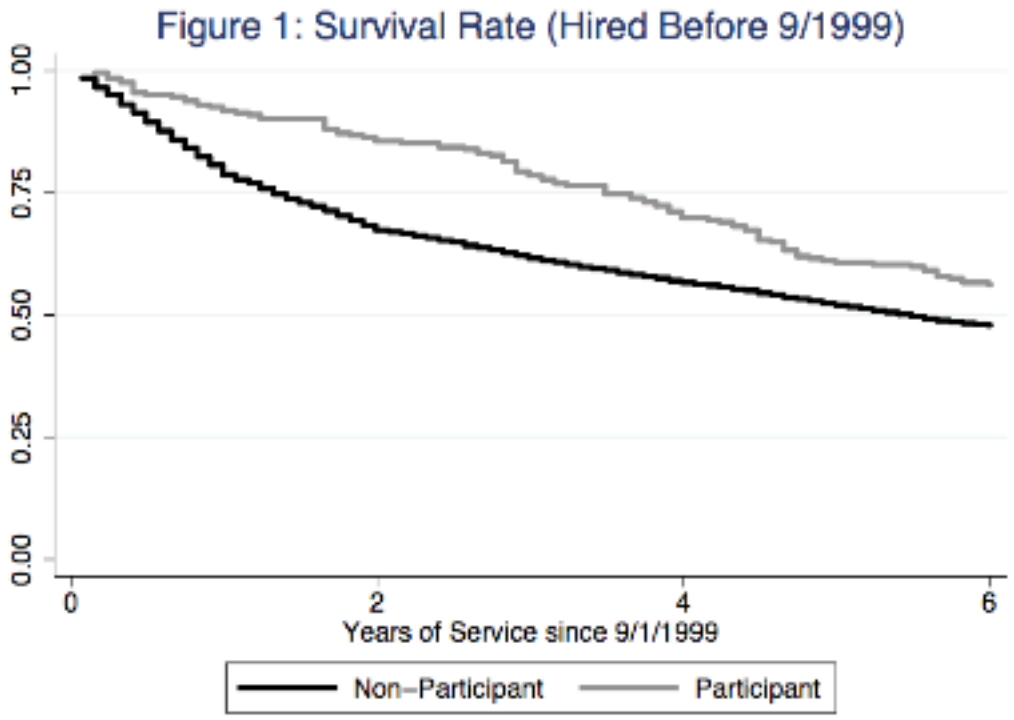


Figure 1: Survival Rate (Hired Before 9/1999)
1.00
0.75
0.50
0.25
0.00
0
2
4
6
Years of Service since 9/1/1999
Non-Participant
Participant

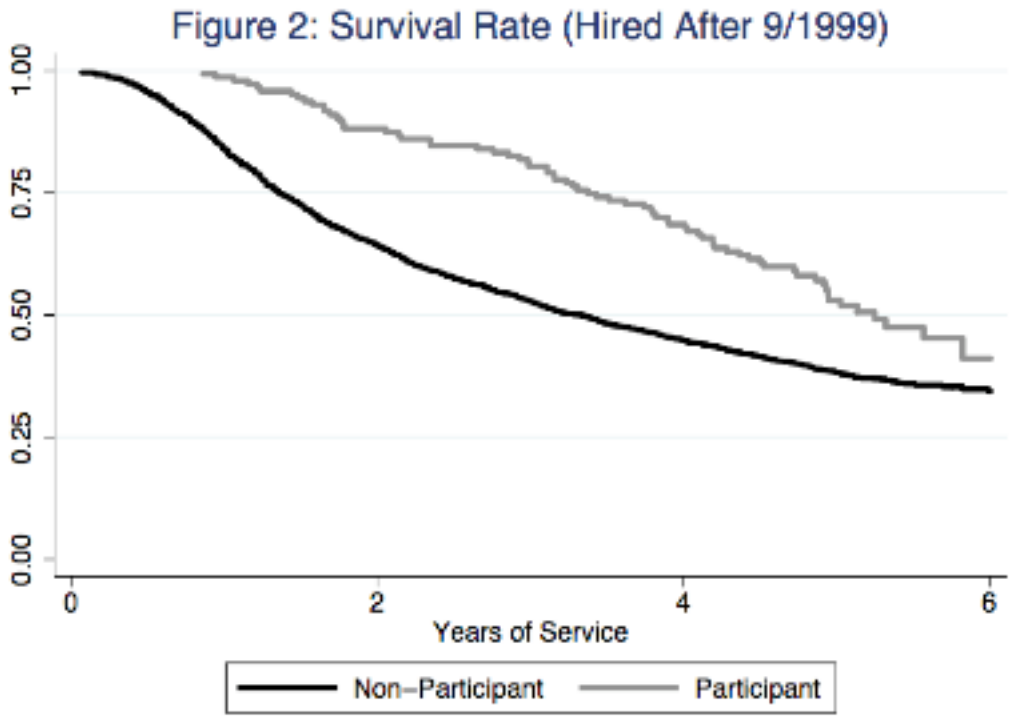


Figure 2: Survival Rate (Hired After 9/1999)
1.00
0.75
0.50
0.25
0.00
0
2
4
6
Years of Service
Non-Participant
Participant

Figure 3: Survival Rates by Degree (Hired Before 9/1999)

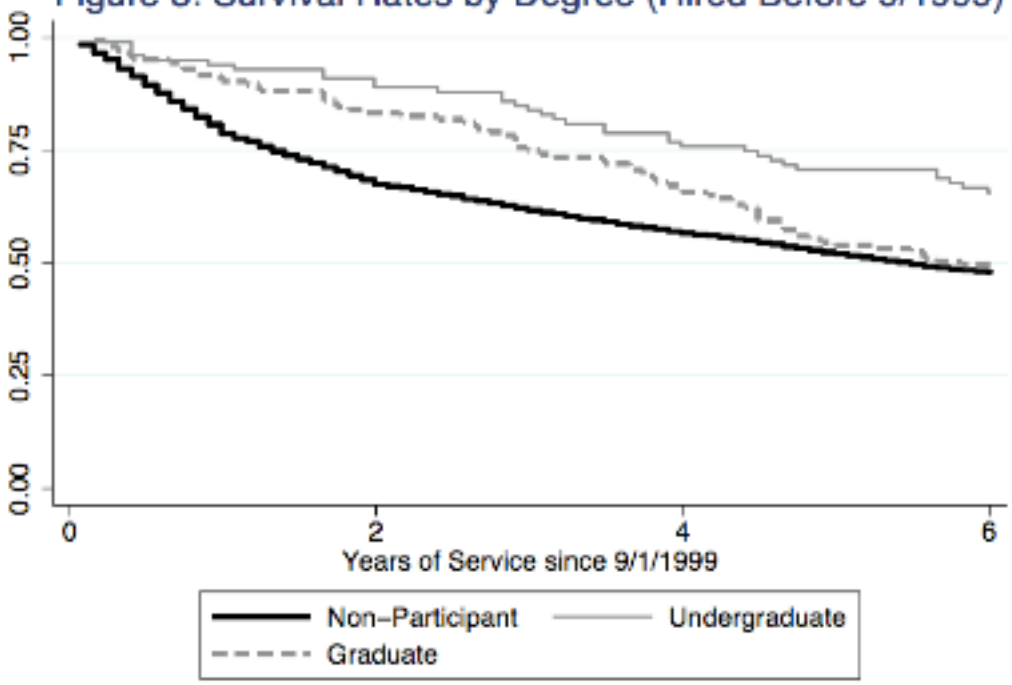
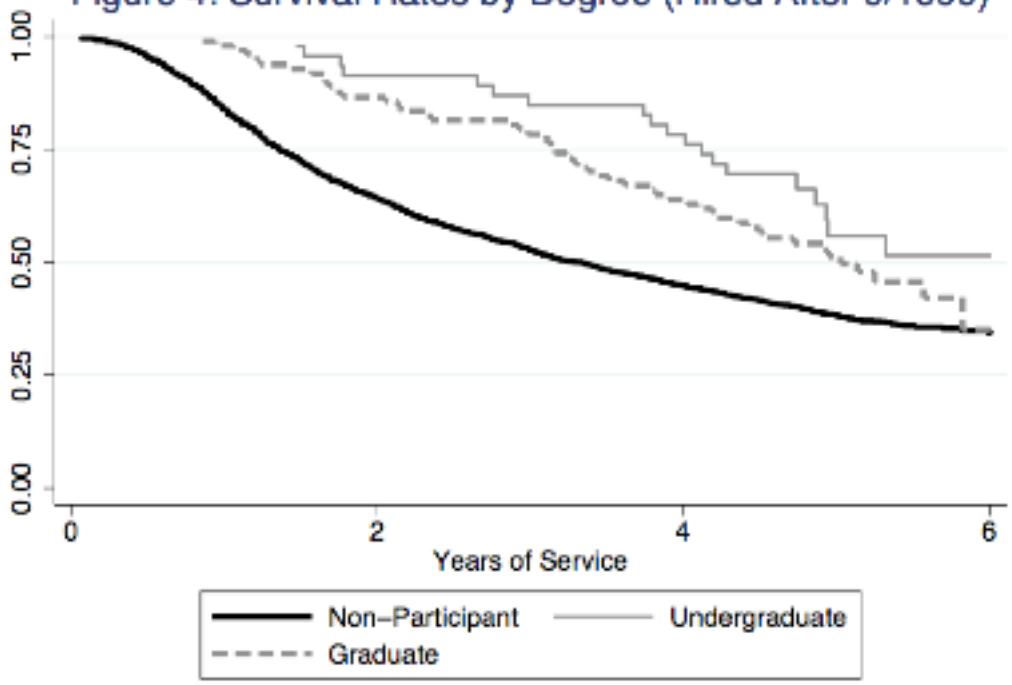


Figure 4: Survival Rates by Degree (Hired After 9/1999)



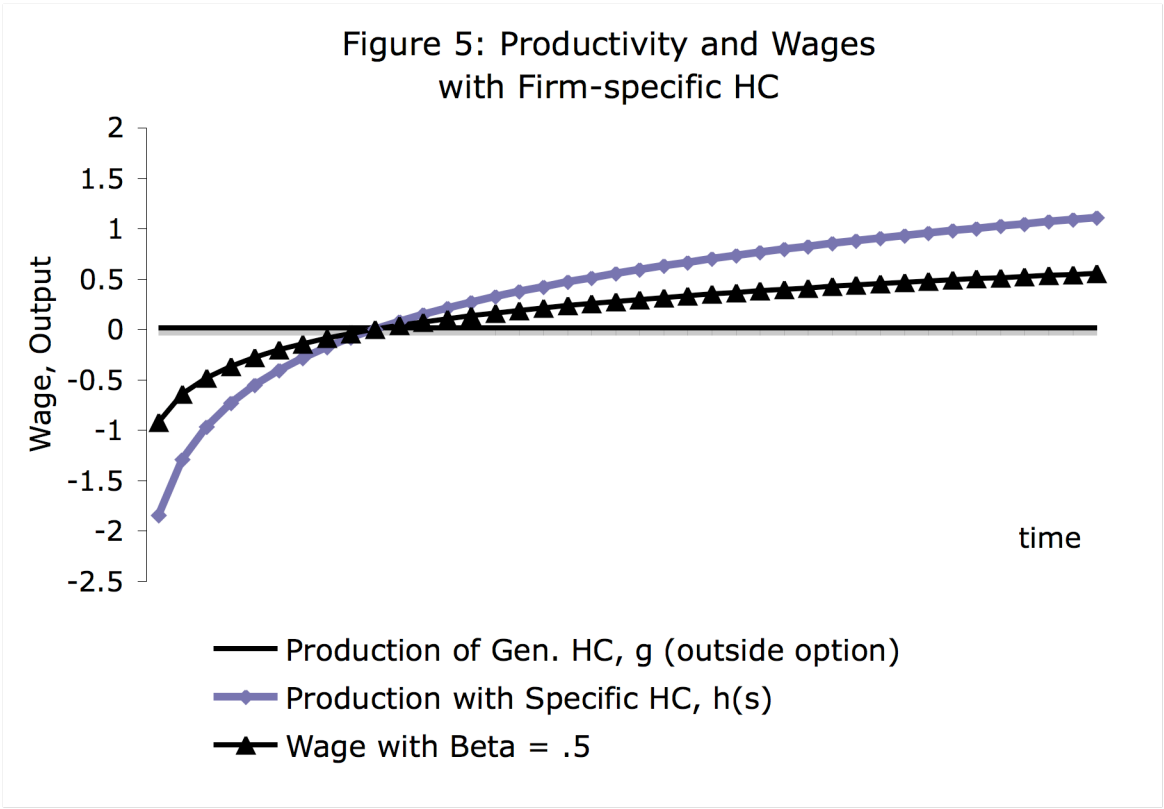


Figure 5: Productivity and Wages
with Firm-specific HC
Wage, Output
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
-2.5
time
Production of Gen. HC, g (outside option)
Production with Specific HC, h(s)
Wage with Beta = .5

Figure 6: Productivity and Wages
with Complementarity