The Role of Fringe Benefits in Employer and Workforce Dynamics*

March 2005

Anja Decressin**
Cornell University and U.S. Census Bureau

Tomeka Hill
Cornell University and U.S. Census Bureau

Kristin McCue
U.S. Census Bureau

Martha Stinson
U.S. Census Bureau

---

* The authors wish to acknowledge the substantial contributions of LEHD staff, in particular Paul Lengermann, Kevin McKinney, and Kristin Sandusky, and wish to thank John Abowd, Dan Beller, Dan Black, Keenan Dworak-Fisher, Nick Greenia, Ron Jarmin, Julia Lane, Javier Miranda, John Phillips, Joe Piacentini and seminar participants at the LEHD State Workshop 2003, the CES seminar, the U.S. Department of Labor Research Conference 2003, and the NBER-CRIW Pre-Conference for their comments.

 This research uses confidential data from the Census Bureau's Longitudinal Employer-Household Dynamics Program (LEHD), which is partially supported by the National Science Foundation Grant SES-9978093 to Cornell University (Cornell Institute for Social and Economic Research), the National Institute on Aging, and the Alfred P. Sloan Foundation. Integration of the Form 5500 data has also received support from the Employee Benefits Security Administration of the Department of Labor. The Census Bureau is preparing to support external researchers' use of these data; please consult http://lehd.dsd.census.gov.

** Corresponding author:
Anja.Decressin@census.gov
U.S. Census Bureau
Washington, DC 20233
(301) 763-6447

Abstract

This paper examines how the evolution of a firm's human capital stock is related to firms' benefit choices using integrated data on firms, their employees, and their benefit offerings from the Census Bureau's Longitudinal Employer-Household Dynamics Program and from IRS Form 5500. It then estimates the relationship between compensation packages and firm productivity and survival, controlling for workforce characteristics. The authors find that firms that offer benefits have significantly lower turnover rates and faster growth rates. Benefit-offering firms have higher labor productivity and higher survival rates, even when controlling for firm and workforce characteristics and the level of wage compensation. Greater labor productivity explains some but not all of the differences in survival rates.

I. Introduction

A growing literature in economics examines the role of human resource practices in determining firm performance. One strand of this literature has focused on how compensation design can affect employee incentives and through them a firm's success Fringe benefits are an important share of compensation, and economists have long studied the role of pensions and health insurance in labor markets, but have devoted relatively little attention to how decisions about benefits might interact with firm performance. Our aim here is to pull together these issues by examining how providing part of compensation to employees in the form of benefits affects a firm's human capital stock, and further, what effects it may have, direct or indirect, on firm productivity, growth, and survival.

We do so using a very rich dataset that combines administrative data on benefit plans from IRS Form 5500 with the LEHD integrated employer-employee data. These data allow us to explore whether different benefit policies attract different types of workers and to examine the relationship between wages and benefits holding worker quality constant. We then examine firm productivity, growth, and survival to see the extent to which a firm's success is related to benefit offering. In doing so, we examine the extent to which the differing workforce characteristics of benefit-offering firms can explain differences in outcomes.

The paper proceeds as follows. In section II we briefly discuss the literature that we build on and present a framework for thinking about our estimation. We discuss data issues in some detail in section III, and then present results in section IV. Section V gives our conclusions and planned extensions.

II. Background

As background for our empirical work we briefly review related work on human resource practices and firm performance to give a context for our approach. Following that we provide a framework for our estimation.

A. How do firms use benefits to shape their human capital stock?

In hedonic wage models, workers face a continuum of different compensation packages given by the envelope of firms' varying wage/benefit isoprofit lines.[1] In response to this set of choices they sort themselves into different types of firms. Variation in workers' willingness to trade off wages for benefits leads to sorting of workers into firms on the basis of fringe benefit offerings. In this model, sorting matches workers with their preferred compensation package and minimizes employers' costs of employing labor.

Workers vary in their willingness to trade off wages for benefits because of differences in factors such as marginal tax rates, age, and rates of time preference. Firms that prefer to hire young workers, for example, thus might make themselves more attractive to the employees they are most interested in hiring and retaining by offering higher wages and no benefits, if young workers have a lower willingness to trade off cash wages for fringes. The relative cost of fringe benefits may vary across firms because of economies of scale in providing benefits or varying access to particular types of fringe plans. For example, large firms may have lower costs of providing benefits because of the cost advantages of pooling across a large group of employees. As Montgomery and Shaw (1992) point out, any direct productivity-enhancing effects of benefits will also alter the firm side of this trade off, increasing the cost effectiveness of fringes relative to wages.

Alternatively, dual labor market theory posits that there are two sectors: one with rationed 'good' jobs that pay well and have good fringe benefits; and a second with 'bad' jobs having low pay and few benefits (Bulow and Summers 1986; Dickens and Lang 1985). Sorting in this model need not reflect differences in the costs of providing benefits, nor in willingness to trade off wages for fringes. Similarly, efficiency wage models also generate an equilibrium in which workers with the same productive characteristics would have jobs with different levels of compensation which might include different benefits.

A long literature has documented that both pensions and health insurance are associated with a workforce with lower turnover. Economists have found a negative relationship between pensions and quit rates for both defined benefit (DB) and defined contribution (DC) plans.[2] In the case of DB plans, implicit contract theory has been the primary framework used to interpret this pattern: a loss of pension wealth penalizes workers who break their implicit contract by leaving prior to retirement. This compensation structure leads to self-selection so that firms offering pensions end up with a workforce made up of stayers, which is what motivates offering the DB plan.

Ippolito (2002) offers an alternative explanation. One problem for implicit contract theory has been the finding that quit rates are low for firms offering DC plans as well as those offering DB plans, despite the fact that DC plans impose much smaller quitting costs (Gustman and Steinmeier 1993 and 1995; Even and Macpherson 1996; Ippolito 2002). Ippolito argues that quit rates are low because pensions in general attract savers, and that those who save at a higher rate also have lower quit propensities. His 2002 paper expands on earlier work (Ippolito 1997) that argues that having a low discount rate makes both saving and staying more attractive, so

---

[1] *For example,as in the standard textbook by Ehrenberg and Smith (1996, p. 247).*

[2] See, for example, the review in Gustman, Mitchell, and Steinmeier (1994).

pensions are one method of attracting those with low discount rates who may also have higher productivity. He presents evidence that those with characteristics that might be correlated with a low discount rate are more likely to have a pension, and are also more likely to have high performance ratings.

An alternative explanation for low quit rates under pension plans is that firms with pensions have higher total compensation than firms without, and that the difference in compensation accounts for lower turnover (Gustman and Steinmeier 1995; Even and Macpherson 2001). Gustman and Steinmeier (1995) point out that compensation differences would help explain some other puzzles as well—why the reduction in turnover associated with pensions is largest for young workers, for whom the associated pension losses are small; and why the reduction appears to occur primarily through fewer layoffs rather than through fewer quits.

If benefits play an important role in firms' compensation strategies, there ought to be measurable effects on firm outcomes such as productivity, firm growth, and survival. Such effects may come about indirectly through changes in the recruitment and retention of labor. But benefits may also affect productivity more directly by altering employees' incentives to invest in firm-specific knowledge or by reducing turnover and training costs (Even and Macpherson 2001). There is little existing empirical evidence on the relationship between benefits offering and productivity. One exception is work by Dorsey, Cornwell, and Macpherson (1998) using Compustat data to estimate effects of DB plans on productivity using a production function framework. They find evidence of higher labor productivity in firms with DB plans, but the evidence on overall productivity effects is mixed. In the next section, we describe the empirical work and regressions we have done to investigate the role of benefits.

B. Schematic framework for our empirical work

Our starting point is to posit that productivity is a function of a firm's human capital stock (HC) and other inputs (Z).

(1) $$\ln Y_{it} = f(HC_{it}, Z_{it}) + \epsilon_{it}$$

We assume that the composition of compensation affects productivity through its effects on the human capital stock. A traditional representation of the evolution of a capital stock is useful in considering the mechanisms through which this might happen:

(2) $$HC_{it} = (1-\delta_{it})\, HC_{i,t-1} + I_{it}$$

The investment in human capital happens through accessions (new hires) and on-the-job investment of current employees. Depreciation occurs both through employee separations and through deterioration or obsolescence of employees' skills. Because we cannot measure on-the-job investment or the deterioration of skills, we focus on how compensation practices affect accessions and separations. However, we do have information on the human capital stock over time—net employment growth, churning, and workforce characteristics like the percentage of workers with high (or low) HC. Therefore, we are able to run a series of regressions to examine differences in how the human capital stock evolves over time for benefit- and non-benefit-providing employers. We first estimate differences in the amount of turnover and net growth, and then look at changes in the composition of the human capital stock.

We then come back to equation (1), and estimate the relationship between output and changes in HC by running a series of productivity regressions. Our ability to measure the other inputs, Z, is quite limited. Outside of manufacturing, we have no direct measures of other inputs, so we rely on controls for industry, location, and size to capture some of these effects. We are in

somewhat better shape in manufacturing where we can at least measure capital-labor ratios and the use of materials, so we present some of our productivity results for manufacturing alone. Finally, using the evidence we develop on the relationship between a firm's human capital stock, productivity, and benefits, we look at what relationship fringe benefit compensation has to a longer run firm outcome: the likelihood of failure. We estimates hazards of firm death to examine how changes in the human capital stock, productivity, and fringe benefit compensation are related to firm survival. Below, before presenting our estimates, we first describe the construction and characteristics of our data.

III. Data

We combine data from several sources to construct a very rich database. It consists of business microdata on whether a business provided benefits, detailed benefit provisions, workforce composition, turnover, the distribution of worker earnings, and labor productivity. Much of this data is also longitudinal, allowing us to measure changes in benefits offerings, workforce characteristics, and firm survival and growth.

A. Dataset Construction

The database combines information from five sources:

- Firm reports on benefit plans offered to employees (the Internal Revenue Service/Department of Labor Form 5500 file);
- The Census Bureau's Business Register (BR);
- Unemployment Insurance (UI) wage record data from seven states;
- The Census Numident file; and

- The Economic Census.

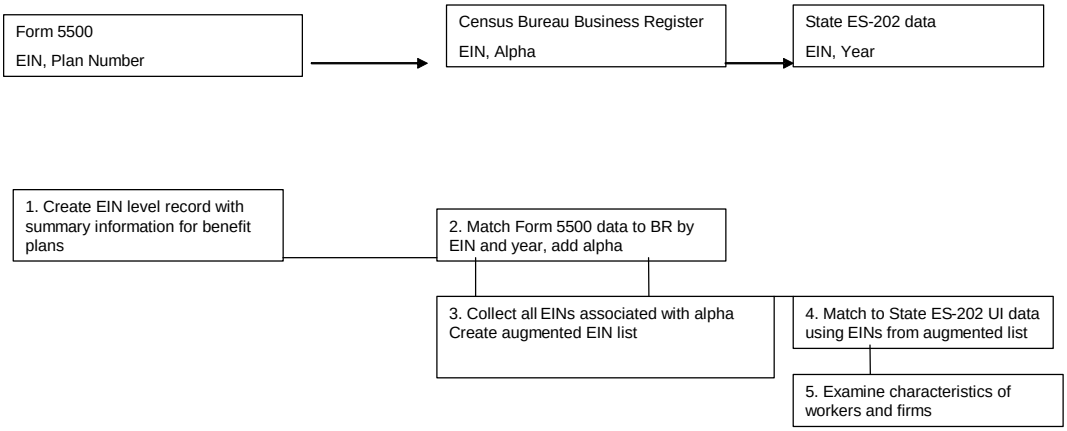
Benefit information comes from Form 5500 annual reports on employee benefit plans files by the plan sponsor (usually the employer). These public filings are required under ERISA for most types of tax-preferred benefits, with some exemptions for small health plans. Here we use data on plans that end in 1997 and 2001, drawing from the 1996/1997 and 2000/2001 data files. The Form 5500 collects information about employer-provided pensions (defined benefit and various types of defined contribution plans), 'welfare' plans (health, life, supplemental unemployment, and disability insurance plans) and 'fringe benefit' plans (cafeteria or flexible benefit plans and educational assistance plans).[3] In addition to variables describing plan features, the data also include name, address, and a federal Employer Identification Number (EIN) for the plan sponsor. EINs are also used in a wide variety of other employer tax filings, including those underlying the Census Bureau's business list and the UI wage record data.

Figure 1 describes how the dataset is constructed. The 5500 file is first integrated with Census's Business Register (BR) using sponsor EINs. The BR is a list of all private establishments with paid employment that is constructed from a variety of administrative and survey sources, but its backbone is quarterly employment tax filings that include EINs.[4] Census uses the quinquennial economic censuses and the annual Company Organization Survey in constructing the BR to break out different business locations that may be filed under a single EIN. Many large firms file use more than one EIN, so these survey sources, in combination with administrative data, also identify EINs that are affiliated through parent-subsidiary relationships.

[3] See appendix Table A1 for a listing of the benefit plan types and the associated frequencies among 1997 plans in the 5500 files.

[4] The BR was historically known as the Standard Statistical Establishment List or SSEL. An establishment is defined as a single physical location where business is conducted or where services or industrial operations are performed.

Figure 1: Schemata for Construction of Database



We do an initial match of the list of 5500 EINs to the BR. If a 5500 EIN matches to part of a multi-location firm, we use information on company structure from the BR to identify any other EINs (and affiliated establishments) that belong to the same company. One difficult question is whether a particular benefit is in fact offered at all establishments belonging to a company. Here, we treat all parts of a company as offering benefits if at least one EIN belonging to that company matches to the 5500 file.

Our next step is to bring in the UI data. These data are extensively described elsewhere (Burgess, Lane and Stevens, 2000), but we note several salient characteristics here. First, they include longitudinal data on both firms and workers from the mid-1990s to 2003, which permits an analysis of the dynamics of employment flows, workforce change, and firm entry and exit over this period. Second, because earnings data are available for individual workers at each of their employing firms, it is possible to analyze both earnings and employment outcomes for workers in each business. Finally, the data are almost universal in nature, capturing some 98% of employment in each state for which the data are collected. The results presented here include data for seven states.

Although the UI wage record data are very rich in terms of sample size and coverage, they lack demographic information on workers. Limited demographic information is obtained by matching the UI records with internal administrative records (the Census Numident file) that have information on date of birth, place of birth, race and sex for all workers. About 96 percent of the records in each state's UI wage data can be matched to this source.[5]

In addition, we make use of human capital measures constructed by other LEHD researchers. LEHD staff (as described in Abowd, Lengermann, and McKinney 2002, henceforth ALM) have estimated fixed effects for individual firms and workers based on the following wage equation:

$$\ln (w_{ijt}) = x_{it}\beta + \theta_i + \psi_{j(i,t)} + \varepsilon_{ijt} \quad (3)$$

where j(i,t) indexes the firm j for which worker i works at time t. Ln (w_{ijt}) represents the log of full-time earnings, so the fixed effects are in terms of log earnings differences. For each worker i, this decomposition provides a measure of the fixed, portable component of their skill (θ_i), and for each firm j, it provides a measure of the fixed premium (or discount) that the firm pays after accounting for worker skills ($\psi_{j(i,t)}$).

In our empirical results we use the following as a measure of general human capital:

$$h_{it} = x_{it}\beta + \theta_i \quad (4)$$

where x_{it} consists of race, gender, and quarters of work experience. As described in ALM, a seven-state distribution of h_{it} was created and individual workers were classified as according to their location in this distribution. Summary level statistics for firms were created by calculating

[5] See Staff of the LEHD Program (2002) for further discussion.

the percentage of workers at each firm that belonged to each quartile of the overall human-capital distribution. In this version of the paper, we have these measures for 1997 only.

Finally, we bring in measures of labor productivity based on data from the 1997 Economic Census (EC). We measure labor productivity as the logarithm of sales per employee deviated from the 2-digit industry mean. For multi-unit firms, we aggregate establishment-level data from the EC to the state-EIN-2 digit SIC level before matching to the 5500/UI data. For each multi-unit firm we define a primary SIC by aggregating payroll across establishments within a state that have the same 2 digit SIC code, and then taking the SIC code associated with the largest aggregated payroll.[6]

B. Data Coverage Issues – 5500/Business Register Match

In the results that follow, we use the presence of a matching record in the 5500 file as an indicator that a firm offers benefits and then use additional information from the file to determine what sorts of benefits are offered. Whether these are reasonably accurate measures depends first on the filing requirements for the Form 5500—do all plans in fact appear in that file?—and secondly on our success in matching employers to the file if the plan they offer is in fact in it. We briefly describe these issues here; they are more fully documented in Decressin et al (2005).

Filing requirements differ somewhat for pensions and other types of plans (welfare or fringe benefit plans). For pensions, only a few specialized types of plans are exempt from the requirement to file.[7] However, welfare and fringe plans with fewer than 100 participants are

[6] Because data are not yet available from the 2002 Economic Census, we do not have longitudinal data on productivity.

[7] Simplified Employee Pension (SEP) plans are exempt, as are Savings Incentive Match Plans for Employees (SIMPLE) if they take the form of an IRA (but not SIMPLE 401(k) plans). Both plans can be used only by employers with at most 100 eligible employees. SEP plans do not

exempt if they are either unfunded (that is, the employer pays the costs out of general funds) and/or fully insured through an insurance provider (for example a Blue Cross/Blue Shield company). Thus most small health plans are probably not included in the 5500 file. Because we focus here on benefits in general, the coverage gap is more narrowly for small health plans offered by employers who do not offer pensions. In some results we restrict ourselves to looking only at pension availability, which appears to be fairly well measured.

For most plans, employer and sponsor are one and the same, and integration of 5500 data with the BR is straightforward. However, for plans that involve multiple employers the sponsor EIN generally belongs to an entity other than one of the participating employers. For example, a trade union might sponsor a Taft-Hartley pension plan for unionized electricians working for many different employers. Given that we cannot identify which employers are involved with our current resources, we drop those plans in what follows.

Some employers offer more than one benefit plan, so we summarize plan level information associated with the same EIN before matching to the BR.[8] Ninety-seven percent of the 731,609 EINs in our 1997 – Form 5500 extract can be found on the 1997 BR. Limiting our analysis to records in the BR that meet our criteria for being active and in-scope gives us a match rate of 90 % for the 5500 EINs in 1997 and 89 % for the EINs in 2001.[9] The fraction of firms on the BR that match to a plan in the 5500 file is much lower. As Table 1a and 1b illustrate, in

---

allow for employee contributions, and employer contributions must be a fixed percentage of pay up to a maximum. Church plans are also exempt.

[8] Thirty percent of EINs in 1997 are associated with two or more plans.

[9] The BR records that we exclude from matching either do not report any payroll for the current year or have codes that indicate that they should be outside the scope of our investigation (e.g. they are government-owned entities, which are not required to file Form 5500, or represent a trust rather than an employer). The 11% of EINs in 1997 that match to these sorts of BR records might match to adjacent years of the BR, or may provide information on what sorts of plans we do not accurately match—both possibilities we plan to investigate in future work. Extensive documentation of the matching exercise is provided in Decressin et al. (2003).

1997, only 11% (9.4 % in 2001) of the 5.7 million businesses in the 1997 Census Business Register have a match to a 5500 form, but the vast majority of companies that do not match to the Form 5500 data are in fact very small. As Tables 1a and 1b show, the match rates in 2001 are similar to the ones in 1997, but usually a little lower. [10] Therefore, in the following, most statistics are only presented for 1997.

The low overall match rate simply reflects the predominance of firms with few employees in the overall count of firms. Of the non-matches in 1997, 54% have 5 or fewer employees, and an additional 23% have between 6 and 25 employees. Large firms (>=100 employees) account for only 0.5% of all non-matches compared to 13% of all matches. Larger firms are more likely to offer benefits and are also more likely to be required to file Form 5500 given that they offer plans. Thus it is encouraging that the majority of large firms in the Business Register can be matched to a Form 5500 filing. Because of filing exemptions and difficulties in matching, we expect coverage to be incomplete for small firms and in industries with large numbers of Taft-Hartley plans. For this reason, in some of what follows we present results for manufacturing alone (which has little Taft-Hartley coverage) or for the sample of firms with at least 100 employees.

[10] The data for the 1997 match did receive a much bigger data cleaning effort than the 2001 data and this might have caused better match numbers for 1997.

Table 2a

Business Register Match Rates to 1997 5500 Data

Number of employees	Single Unit Firms		Multi-Unit Firms		All Firms	
	Number	Match rate	Number	Match rate	Number	Match rate
Missing or 0[11]	955,116	1.5%	2,880	16.6%	957,996	1.5%
1 – 4	2,624,082	4.1%	7,728	15.4%	2,631,810	4.1%
5 – 99	1,918,184	19.5%	139,724	47.2%	2,057,908	21.3%
100 – 999	44,708	62.3%	44,166	78.5%	88,874	70.4%
1000 +	1,130	74.3%	7,074	92.6%	8,204	90.1%
Total	5,543,220	9.5%	201,572	54.0%	5,744,792	11.0%

Table 2b

Business Register Match Rates to 2001 5500 Data

Number of employees	Single Unit Firms		Multi-Unit Firms		All Firms	
	Number	Match rate	Number	Match rate	Number	Match rate
Missing or 0	929,468	1.3%	3,117	18.7%	932,585	1.37%
1 – 4	2,686,090	3.3%	6,052	15.5%	2,692,142	3.36%
5 – 99	2,051,445	16.6%	101,799	43.0%	2,153,244	17.81%
100 – 999	53,590	54.9%	40,807	74.4%	94,397	63.32%
1000 +	1,495	62.1%	7,312	90.1%	8,807	85.35%
Total	5,722,088	8.2%	159,087	51.7%	5,881,175	9.42%

If we weight these match rates by employment (see Tables A2a and A2b), firms in 1997 that match to the 5500 file employ 66% and firms in 2001 about 64 % of all workers (70 million

[11] Employment data on the BR come primarily from filings of IRS Form 941, which is used to report quarterly withholding of payroll and income taxes. Businesses are also asked to report employment on these forms, but the employment data are not as complete as the payroll data. We include only firms with positive payroll in the table (and the match), but some of these firms do not report any employment. This could be because the employment question asks about a particular week in the quarter and the firm had no employees on the payroll that week, or it may be that firms neglected to report employment, which is not directly tied to the tax liability. Employment data used in the estimation section is taken from the UI data.

out of the 106 million in the 1997 workforce). Among multi-units the match rate is even higher: 90% of workers in 1997 are employed by matching firms (89% in 2001), compared with 36% for single-unit firms (32% in 2001).

Table 3 gives the distribution of type of plans matched among firms that match to at least one plan in 1997. A very large share of firms with some sort of matched benefit offer a pension plan, regardless of size. This probably reflects the fact that coverage of benefits by Form 5500 filings is most complete for pensions. The most notable size effect is for health plans, for which the percent offering a health plan is substantially larger for firms with greater than 100 employees. This appears to reflect in part the exemption from filing for health plans with fewer than 100 enrollees.

Table 3
Types of Plans Found for Matched Employers, by Firm Size - 1997

Number of employees	Pension	Health	Other fringe
1 – 50	87%	2%	24%
51 – 100	85%	7%	52%
101 – 250	86%	28%	55%
251 – 750	88%	57%	59%
750 +	92%	80%	72%
Total	87%	7%	30%

Comparing benefit coverage rates implied by our matched data to national survey estimates suggests that we do quite well in matching pension coverage but that we understate health coverage by even more than we would have expected. In our data for 1997, 61 percent of employees work for businesses that offer pension benefits, while 34 percent work for businesses that offer health benefits. BLS survey estimates from 2003 indicate that 57 percent of employees have access to retirement benefits. This figure excludes employees who have not met minimum

length of service requirements and so would be expected to be somewhat below our estimate, which implicitly includes them.[12]

In contrast, a 1997 survey estimated that 86 percent of employees work for establishments that offer health benefits—more than twice our figure.[13] We expect to understate health coverage somewhat given that certain small health plans are not required to file, but the difference seems too large for that to be the only problem. At the same time, we seem to find too much coverage under plans classified by sponsors as 'Fringe benefit' plans on the Form 5500. This should include only Section 125 cafeteria plans (flexible benefit, reimbursement, and premium conversion plans) and non-job-related education benefit plans (under Section 127 of the tax code). We find that 36 percent of employees in 1997 work for firms offering plans classified in this way, while 1999 survey estimates imply that 28 percent of employees have access to Section 125 plans and only 10 percent have access to non-work related educational assistance (and presumably there is considerable overlap in those types of benefits). Because we think that some health insurance plans may appear in the 5500 files as 'Fringe benefit' plans, we focus our estimates on the more general question of whether an employer offers some form of fringe benefits, rather than a particular type of benefit plan.

[12] It is difficult to put together a comparable total coverage number for pension benefits for either 1997 or 2001 for a couple of reasons. Prior to 1999, the BLS survey that collected data for benefits estimates (the Employee Benefit Survey) surveyed small and medium/large employers in alternating years. Beginning in 1999, BLS publishes estimates for all private employers, but access numbers are not available until 2003. The 2003 estimates are available at http://www.bls.gov/ncs/ebs/sp/ebsm0002.pdf.

[13] See www.meps.ahrq.gov/MEPSDATA/ic/1997/Tables_I/TIB2.pdf.

C. Sample Characteristics

While we match the 5500 data to Census's Business Register as a whole, most of our empirical work is based on the subset of those data for which we also have LEHD data. Before proceeding with our results, we briefly describe the differences in samples. While the 5500/BR data exists for all 51 states the UI data restricts us to look at 7 states. Thus we have data for parts of firms that operate across multiple states, and no data for firms that operate only in other states, which leaves us as much as 1.6 million observations in 1997 and 1.2 million observations of firms that operate in 1997 and in 2001 ("Continuers").[14] As explained in ALM, human-capital summary statistics are only created for firms with at least 5 employees, due to the difficulty of applying kernel density estimation techniques for calculating distributions to firms of very small sizes. Our regressions all make use of these wage decompositions, so we further restrict our sample to firms having at least 5 employees. This reduces the sample for 1997 to almost 400,000 and for the 1997/2001 Continuers sample to a little more than 300,000. In addition, we do some of our productivity analyses on the subset of firms that also appear in the Annual Sample of Manufacturing (ASM) from which we derive measures of capital intensity (sample size of 10,537 for 1997).

Table 4a presents 1997 sample statistics for the 7-state 5500/BR/UI Data and the sample that also includes HC estimates. Given that more than 50 % of firms in the US have less than 5 employees, the reduction in sample size from column 1 to 2 is dramatic. As expected, the sample without the small firms has on average older firms and a higher percentage of benefit-offering firms. The fraction of multi-unit firms is also higher.

[14] The unit of observation is generally a firm/state record; that is, a multi-unit firm that operates in several of the states for which we have data will have more than one record.

Table 4 a
Characteristics of Alternative Samples - 1997

	Data required	
Sample characteristics 1997	5500/BR/UI Data	5500/BR/UI Data and HC estimates
Sample size	1,578,885	396,265
Firm size: <5 employees	56.2 %	---
5-99 employees	41.1 %	92.1 %
100-999 employees	2.5 %	7.3 %
1000+ employees	0.2 %	0.6 %
Multi-unit firm	3.3 %	7.7 %
Age of firm: < 5 years old	32.0 %	22.1 %
5 to < 10 years old	19.9 %	21.4 %
10 to < 15 years old	13.7 %	17.4 %
15 to < 20 years old	9.0 %	13.8 %
>= 20 years old	14.3 %	25.2 %
Offer benefits in 1997	15.1 %	31.5 %
Offer benefits in 2001	11.6 %	24.6 %
Offer benefits in 1997 and 2001	9.68 %	21.1 %
Relative labor productivity	---	0.037
Mean firm effect	---	-0.109
Churning rate	---	0.329

Note: The observations are on a firm/state level.

The sample of the 1997/2001 Continuers is described through Table 4b. The statistics are fairly similar to Table 4a. Except that the sample sizes are smaller. The final sample for Continuers with HC includes still a little more than 300,000 observations. In the last three rows summary statistics of relative labor productivity, the mean firm effect and the churning rate are shown.

The average firm labor productivity and mean firm effect for the sample of the 1997/2001 Continuers (Table 4b) is larger than for sample that includes all the observations in 1997 (Table 4a). If this still holds true when adjusting for other firm characteristics will be explored later in the regressions. The last row gives mean churning rates, which measure the rate of accessions

and separations that occur at a firm over one quarter, above and beyond those needed to allow for the firm's net growth or shrinkage over that period.[15] Churning rates seem to be similar for the two samples. Table A3 of the Appendix shows further firm characteristics – firm characteristics by benefit offer for 1997.

Table 4 b
Characteristics of Alternative Samples – 1997- 2001 Continuers

	Data required	
Sample characteristics	5500/BR/UI Data	5500/BR/UI Data and HC estimates
Sample size	1,196,541	305,358
Firm size **2001**: <5 employees	48.9 %	7.5 %
5-99 employees	47.4 %	83.6 %
100-999 employees	3.4 %	8.2 %
1000+ employees	0.3 %	0.7 %
Multi-unit firm, **2001**	2.6 %	6.4 %
Age of firm in 1997: < 5 years old	28.3 %	19.0 %
5 to < 10 years old	21.0 %	20.9 %
10 to < 15 years old	15.5 %	18.0 %
15 to < 20 years old	10.6 %	14.9 %
>= 20 years old	17.0 %	27.4%
Offer benefits in 1997	18.1 %	34.2 %
Offer benefits in 2001	16.6 %	30.9 %
Offer benefits in 1997 and 2001	13.8 %	26.4 %
Relative labor productivity (1997)	---	0.074
Mean firm effect (1997)	---	-0.099
Churning rate **2001**	---	0.328

Note: The observations are on a firm/state level.

IV. Results

[15] The formula used is (|A+S| - |E-B|) / ((B+E)/2), where A=accessions, S=separations,

A. Evolution of the Human Capital Stock

A firm that grows by one employee over a quarter may do so by simply hiring one more employee, or by hiring five new employees and letting four employees (new or old) go. The latter is likely to be more costly, but also makes possible more dramatic changes in the total skills embodied in the firm's workforce—for better or worse. While we do not do a formal decomposition, we do break our analysis into three parts: net growth (the one added employee), churning (the total of 8=5+4-1 extra employees who came or left in the second example above those needed to increase the number by 1), and changes in the composition of the workforce that may occur as employees come and go. With each of these components, our focus is on how they are related to benefit offering.

a. Churning regressions

Existing work, based primarily on household data, has established that there is a strong negative association between rates of employee turnover and benefits. We present churning regressions here in part to confirm that this is true in our firm-based data as well, but also because our data allow us to address several unanswered questions. One advantage we have is that including the firm wage premium can give us some sense for whether benefits are associated with lower turnover simply because benefits raise total compensation, by providing us with a sense of how large the wage effects are when we control for benefit offering. We also have richer measures of worker skill and more accurate measures of employer characteristics than are typically available from household survey data.

B=employment at the beginning of the quarter, and E=employment at the end of the quarter.

Table 5
Churning Regressions: 1st quarter of 2001

Independent Variables	(1)	(2)	(3)	(4)
Offers benefits in 2001	-.092	-.036	-.049	.002
	(.013)	(.027)	(.013)	(.027)
Offered benefits in 1997		-.055		-.022
		(.021)		(.021)
Offers benefits in both years		-.024		-.044
		(.034)		(.034)
Firm effect	-.202	-.196	-.182	-.179
	(.016)	(.016)	(.017)	(.017)
Multi-unit	-.016	-.015	-.027	-.024
	(.024)	(.025)	(.025)	(.025)
log(Employment)	.079	.081	.068	.069
	(.005)	(.005)	(.005)	(.005)
Firm age 5 - <10	-.053	-.050	-.046	-.044
	(.017)	(.017)	(.017)	(.017)
Firm age 10 - <15	-.063	-.058	-.049	-.046
	(.018)	(.018)	(.018)	(.018)
Firm age 15 - <20	-.103	-.096	-.085	-.081
	(.019)	(.019)	(.019)	(.019)
Firm age 20+	-.132	-.123	-.119	-.113
	(.017)	(.017)	(.017)	(.017)
% in lowest HC quartile			.234	.236
			(.041)	(.041)
% in highest HC quartile			-.184	-.179
			(.039)	(.040)
% female			-.134	-.132
			(.023)	(.023)
% foreign born			-.309	-.310
			(.035)	(.035)
% white, non-Hispanic			-.273	-.273
			(.030)	(.030)
% prime age			-.108	-.106
			(.035)	(.035)
R-squared	.003	.003	.004	.004

NotesSample is all firms continuing from 1997 to 2001. : N=305,358. Dependent variable is the churning rate for the first quarter of 2001, as defined in footnote 13. The regressions also include controls for state and one-digit industry.

Table 5 presents the results from our analysis of churning rates for the first quarter of 2001.[16] Column (1) includes a dummy for whether or not the firm offered benefits in 2001 along with controls for the following firm characteristics: the wage premium or firm effect (ψ), size, age, industry, and state. In column (2) we add dummy variables detailing whether benefits were also offered in 1997, while columns (3) and (4) repeat those two specifications with the addition of worker human capital and demographic characteristics.

In all specifications, benefits in general are negatively related to churning rates. In column (1), firms that currently offer benefits have about a 9 percent lower churning rate. In column (2), it is clear that the strongest effects are for firms that have benefits in both 1997 and 2001, but that even firms that had benefits in 1997 but dropped them before 2001 have about a 5.5 lower churning rate than those that do not offer benefits in either year. While firms that added benefits between 1997 and 2001 have a lower average churning rate by about 3.5 percent, that difference is not significant.

Adding human capital and demographic characteristics in column (3) substantially reduces the size of the simple benefit coefficient, though it remains negative and significant. Thus a substantial part of the negative association between benefits and churning is accounted for by the workforce characteristics of firms that offer benefits. Both the demographic and the human capital variables substantial reduce the benefits effect. In specifications not presented here, we find that adding only the demographic variables reduces the coefficient on benefits in column (1) from -.092 to -.074, while adding the human capital measures as well reduces it to -.049 (see column (3)). Having larger shares of female, foreign-born, white, and prime-age workers are all associated with reduced churning rates. Having workers with higher levels of

[16] We have estimated analogous regressions using churning measures from the 1st quarter of

human capital is also associated with significantly lower churning rates, with effects of similar magnitude for the bottom and top quartiles. When we include both worker characteristics and the more detailed specification for benefits dummies in column (4), none of the individual benefits coefficients are significant. While neither adding nor dropping benefits is associated with a significant difference in turnover, if we sum the three benefits coefficients to get the estimated difference between firms that have benefits in both years and those that have them in neither, that difference remains negative and significantly different from zero: the difference is -.064, with a standard error of .015.

The ratio of the benefits coefficient to the firm wage effect coefficient can give a sort of back-of-the-envelope feel for whether the higher level of total compensation could account for the benefit effects that we find. The log of total compensation is approximately equal to the log of wage compensation plus the share of compensation in the form of benefits.[17] If benefits reduce turnover simply by increasing total compensation, and if the value of benefits compensation among firms that offer benefits is roughly proportional to wage compensation, then the ratio of the benefits coefficient to the log wage coefficient should be about the size of the ratio of benefits to wages.[18] The ratio of the mean difference associated with benefits to the firm effect coefficient varies from .27 in column (3) to .59 in column (2) (using continuous-benefit firms). These ratios seem a bit large to equal the ratio of the value of benefits to wages, but not so large that we could rule out a pure compensation effect.

1997, and get very similar results so we have not presented them here.

[17] That is, $C = W + DB = W(1+b)$, where C, W, and DB represent the dollar value of total compensation, wage compensation, and benefits, and $b = DB/W$. In logs, $\log C = \log W + \log(1+b) \approx \log W + b$, if b is small.

[18] We include a benefits dummy B_i, while if it is simply the value of total compensation that matters, we would like to include b_i = the ratio DB/W. If b_i does not vary much across firms, then we could approximate $b_i = b * B_i$ and the coefficient on benefits should be about the size of b times the coefficient on wages and the ratio of those coefficients would be about b.

b. Firm growth

In Table 6 we examine how firm growth is related to benefit provision. The sample consists of firms that were in existence in both 1997 and 2001. We regress the log difference in employment on benefits dummies, while controlling for characteristics of the firm and its workforce. In column (1) we simply control for whether a firm offers benefits in 1997, while in (2) we add controls for whether or not benefits are offered in 2001, and the interaction of those benefit dummy variables, leaving firms that offered benefits in neither year as the omitted category.

Overall, the continuers sample has a negative growth rate: employment shrinks by about 4 percentage points over the period. Our regression results in column (1) show that firms that offer benefits in 1997 grew more over the subsequent period than those that did not, conditional on surviving to 2001. In column (2) we differentiate between firms based on their benefit offerings in both 1997 and 2001. The sum of the three dummy coefficients gives the difference in growth rates between the two largest groups—those that offered benefits in both years versus those that offered them in neither. Firms that offered benefits in both years grew substantially faster than those that offered them in neither: their growth rates were about 12 percentage points greater than the omitted category and that difference is significant. Changes in benefits are also correlated with firm growth, though it seems more likely that firms' choices to change their benefits were motivated by their growth experience than the converse. Firms that dropped benefits between 1997 and 2001 had growth rates that were on average about 4 percentage points lower than those of firms that did not offer benefits in either year. Firms that added benefits had

Table 6
Firm Growth Regressions

Independent Variables	(1)	(2)
Offers benefits in 1997	.047	-.038
	(.003)	(.004)
Offers benefits in 2001		.274
		(.005)
Offers benefits in both years		-.122
		(.007)
Firm effect	.099	.076
	(.003)	(.003)
% in lowest HC quartile	-.151	-.132
	(.008)	(.008)
% in highest HC quartile	.038	.013
	(.008)	(.008)
Churning (1997 Q1)	-.021	-.022
	(.001)	(.001)
Multi-unit	-.205	-.211
	(.005)	(.005)
100-999 Employees	.004	-.011
	(.005)	(.005)
1000+ Employees	-.040	-.049
	(.018)	(.018)
Firm age 5-<10	-.069	-.066
	(.003)	(.003)
Firm age 10-<15	-.092	-.090
	(.004)	(.004)
Firm age 15-<20	-.113	-.113
	(.004)	(.004)
Firm age 20+	-.117	-.119
	(.003)	(.004)
R-squared	.028	.040

Notes: N= 296,857. Sample is all firms continuing from 1997 to 2001. Dependent variable is the log difference in employment : ln(Emp2001)-ln(Emp1997). Its mean is -.04. The regressions also include controls for state, one digit industry, and worker demographic characteristics in 1997.

growth rates that were about 30 percentage points higher than those for firms that offered benefits in neither year.

The results make clear that older firms and larger firms, unsurprisingly, grow more slowly. Firms with high churning rates also tend to grow more slowly. One might expect that, other characteristics constant, firms that are growing quickly would have high churning rates, as increasing the number of employees requires increasing the proportion with low tenure, who would tend to have higher turnover rates. The negative coefficient suggests that this is not the predominate effect.

The coefficients on the human capital measures indicate that employing many less-skilled workers is associated with lower growth rates. The coefficient on the upper quartile measure is also consistent with a positive relationship between average human capital and firm growth, but the coefficients are much smaller. The firm effect has a strong positive relationship with growth rates—firms that paid 10 percent more than the average had about 1 percentage point higher growth in column (1).

c. Changes in worker characteristics

In earlier work, we have shown that in the cross-section in these data offering benefits is generally positively correlated with demographic characteristics associated with higher pay: prime-age, native born, white, male workers are on average more likely to work for firms that offer benefits. The story is a bit more complicated for gender than the other characteristics—while women are less likely to work for benefit providing firms, this is largely due to a positive correlation between benefits and the firm component of pay combined with a negative

Table 7A
Changes in Workforce Demographic Characteristics: 1997-2001

Independent Variables	Change in % Aged 25-55		Change in % Female	
Offers benefits in 1997	-.0047	-.0055	-.0032	-.0030
	(.0007)	(.0012)	(.0006)	(.0001)
Offered benefits in 2001		.0049		-.0016
		(.0015)		(.0012)
Offers benefits in both years		-.0031		.0011
		(.0019)		(.0016)
Firm effect	.0022	.0018	.0002	.0003
	(.0009)	(.0009)	(.0007)	(.0007)
Multi-unit	-.0016	-.0016	-.0029	-.0029
	(.0014)	(.0014)	(.0011)	(.0011)
log(Employment)	.0065	.0064	.0002	.0003
	(.0003)	(.0003)	(.0003)	(.0003)
Δlog(Employment)	-.0078	-.0080	.0101	.0101
	(.0005)	(.0005)	(.0004)	(.0004)
Firm age 5 - <10	-.0037	-.0037	-.0025	-.0025
	(.0009)	(.0009)	(.0008)	(.0008)
Firm age 10 - <15	-.0118	-.0118	-.0035	-.0035
	(.0010)	(.0010)	(.0008)	(.0008)
Firm age 15 - <20	-.0177	-.0178	-.0061	-.0061
	(.0011)	(.0011)	(.0009)	(.0009)
Firm age 20+	-.0136	-.0137	-.0034	-.0034
	(.0009)	(.0009)	(.0008)	(.0008)
Dependent variable mean	-.0310			.0069
R-squared	.005	.005	.004	.004

Notes: Sample is all firms continuing from 1997 to 2001. N=305,358. Dependent variable is the change in the percent of the workforce accounted for by the designated group. The regressions also include controls for state and one-digit industry.

association between percent female and the firm effect Ψ. Once the firm effect (Ψ) is controlled for, women are more likely to work for benefit providing firms.

As Tables 7a and 7b illustrate, the relationship between benefits in 1997 and changes in demographic characteristics tends to be of the opposite sign from the relationship in levels. One

explanation for this would be a general pattern of reversion to the mean. While firms that provided benefits in 1997 had an above average representation of prime-age workers, they on average had a small decline in share prime-age between 1997 and 2001. Similarly, benefit providing firms employed an above average share of women (given their firm premium), but the share of women was on average falling over this period relative to firms that did not offer benefits in 1997. The share of foreign-born rose slightly for these same firms but the change in the percentage of white, non-Hispanics was insignificant. In all cases the magnitudes of the changes are very small, less than half a percent.

The second column for each demographic group includes dummies categorizing the firm's benefit offerings in both 1997 and 2001. Firms that had continuous benefit offerings have all three dummy variables (benefits-in-1997, benefits-in-2001, benefits-both-years) equal to 1. Firms that dropped coverage between 1997 and 2001 have only the benefits-in-1997 dummy equal to 1 while firms that added benefits between 1997 and 2001 have only the benefits-in-2001 dummy equal to 1. Hence the sum of the coefficients on all three dummies gives the mean difference between "continuous benefit" firms and "never-benefit" firms. The coefficient on the benefits-in-1997 dummy gives the mean change in demographic characteristics for "dropping-benefit" firms relative to "never-benefit" firms, while the coefficient on the 2001 benefits dummy gives the same mean difference for "adding-benefit" firms.

The results show that "dropping-benefit" firms saw their shares of prime age, female, and white, non-Hispanic workers decline and their shares of foreign-born workers increase. Those changes were generally small, but still significant. "Adding-benefit" firms increased their shares of prime age workers but lost women relative to men and had insignificant changes in the number of white, non-Hispanics relative to Hispanics and non-whites. At the same time, their

Table 7B
Changes in Workforce Demographic Characteristics: 1997-2001

Independent Variables	Change in % Foreign-Born		Change in % White, non-Hispanic	
Offers benefits in 1997	.0033	.0029	-.0006	-.0035
	(.0005)	(.0008)	(.0006)	(.0010)
Offered benefits in 2001		.0016		.0007
		(.0010)		(.0012)
Offers benefits in both years		-.0008		.0034
		(.0013)		(.0016)
Firm effect	.0065	.0064	-.0044	-.0046
	(.0006)	(.0006)	(.0007)	(.0007)
Multi-unit	.0010	.0010	-.00001	-.0001
	(.0009)	(.0009)	(.0011)	(.0011)
log(Employment)	.0021	.0021	-.0043	-.0043
	(.0002)	(.0002)	(.0003)	(.0003)
Δlog(Employment)	.0031	.0030	-.0302	-.0303
	(.0003)	(.0003)	(.0004)	(.0004)
Firm age 5 - <10	-.0018	-.0018	.0004	.0004
	(.0006)	(.0006)	(.0008)	(.0008)
Firm age 10 - <15	-.0028	-.0028	.0013	.0013
	(.0007)	(.0007)	(.0008)	(.0008)
Firm age 15 - <20	-.0028	-.0029	.0018	.0017
	(.0007)	(.0007)	(.0009)	(.0009)
Firm age 20+	-.0037	-.0037	.0029	.0028
	(.0006)	(.0006)	(.0008)	(.0008)
Dependent variable mean	.008		-.030	
R-squared	.003	.003	.020	.021

Notes: Sample is all firms continuing from 1997 to 2001. N=305,358. Dependent variable is the change in the percent of the workforce accounted for by the designated group. The regressions also include controls for state and one-digit industry.

share of foreign-born rose. "Continuous-benefit" firms increased their shares of foreign born, decreased their shares of prime-age and female workers, and had a very small (possibly insignificant) increase in their share of white, non-Hispanic workers.

In summary, relative to "never-benefit" firms, all benefit offering types of firms lost women relative to men and increased foreign-born relative to native-born. Having a new or continuing benefit in 2001 held steady the percentage of non-minority workers. And adding benefits seemed to attract more prime age workers. One might postulate that firms added benefits in order to attract workers with particular skills that were correlated with age. It is also possible that over time all firms have seen an increase in their percentage of foreign-born workers but as immigrants have become more integrated into the U.S. economy, they have shifted towards higher paying and benefit offering jobs. Hence firms that continue benefit offerings have the highest increase in percentage of foreign born workers (.0037). However it does not appear that the same type of shift has happened for minorities or women. In fact firms with continuous benefits lost the highest percentage of females (-.0035). Continuing or new benefits were associated with an increase of about the same magnitude in percentage white, non-Hispanic workers (.0007, .0006) while dropping benefits increased the number of minorities.

B. Effects on Productivity

At this point, we do not have changes in productivity to use to directly examine the relationship between productivity growth and benefit offering, so we instead look at the cross sectional relationship. In Table 8, the dependent variable is the log of labor productivity deviated from a 2-digit industry- specific mean. The unit of observation is generally a firm/state record; that is, a multi-unit firm that operates in several of the states for which we have data will have more than one record. Some of the variables included are defined for the firm as a whole (whether or not benefits are offered, firm size, multi-unit status, and firm age), while the others

Table 8
Productivity Differentials Associated with Benefit Offering

Independent variables	(1)	(2)	(3)	(4)	(5)
Offers benefits	0.326	0.260	0.150	0.046	0.049
	(.003)	(.003)	(.003)	(.014)	(.014)
Firm effect (**ψ**)			0.838	1.020	0.829
			(.003)	(.032)	(.031)
Percent of workers in lowest quartile of HC distribution		-0.550	-0.630	-0.793	-0.618
		(0.008)	(.008)	(.059)	(.056)
Percent of workers in highest quartile of HC distribution		0.843	0.943	0.528	0.409
		(0.008)	(.008)	(.053)	(.050)
Churning measure			-0.041	-0.086	-0.085
			(.001)	(.021)	(.020)
Percent prime age	0.806	0.589	0.244	0.409	0.331
	(.007)	(.007)	(.007)	(.062)	(.059)
Percent female	-0.370	-0.155	0.045	-0.099	-0.029
	(.006)	(.006)	(.005)	(.043)	(.041)
Percent foreign born	0.316	0.279	0.221	-0.296	-0.241
	(.007)	(.007)	(.007)	(.046)	(.043)
Percent white	0.389	0.194	0.130	-0.060	-0.063
	(.006)	(0.006)	(.006)	(.044)	(.042)
Log(capital intensity)					0.191
					(.006)
Sample	All	All	All	ASM	ASM
N	396,582	396,582	396,582	10,536	10,382
R-squared	0.135	0.192	0.308	0.306	0.379

Notes: The dependent variable in all columns is the log of labor productivity minus the average log productivity for a firm's 2-digit SIC industry. All columns also include two-digit SIC industry dummies, controls for firm size, firm age, multi-unit status, and state.

are generally measured within state.[19] Our primary interest is in the coefficient on the benefits indicator, which is positive and significant in each of our specifications.[20] Because the

[19] The level of aggregation is important only for multi-unit firms that have diverse operations within a state. Because of the computational resources needed to estimate the wage decomposition, our decisions about how to handle aggregation issues are in part driven by the availability of estimates originally generated for other projects. The labor productivity and capital measures are calculated at a state/EIN/2-digit SIC level, and then a single 2-digit SIC record is selected (if more than one exists) by taking the record with the highest payroll. The

dependent variable is a log difference, the coefficient on this variable in column 1 indicates that the productivity of firms that offer benefits is on average .326 log points (or roughly 39%) higher than that of non-benefit-offering firms with similar characteristics.

In column (2), we add controls for the firm's distribution of worker human capital. The first human capital variable gives the percent of the workforce with a worker fixed-effect in the bottom quartile of the distribution; the second gives the percent in the top quartile. Both of these variables have large, significant coefficients of the expected sign—productivity rises with the fraction of workers in the more skilled parts of the distribution. Including these controls reduces the benefits coefficient by about .07 log points, indicating that about a fifth of the association between productivity and benefits found in the first column is explained by this fairly simple characterization of worker human capital. Note that we also include controls for average worker demographics in each specification. The coefficients on gender, race and worker age are all of the expected sign except in a few cases in which the coefficients are insignificant.[21] The coefficient on the percent foreign born is somewhat surprisingly large and positive in the overall sample, but large and negative in manufacturing.

In the third column, we add the firm effect and a measure of workforce churning as additional controls. Across specifications, the churning measure has a small negative coefficient

---

demographic and churning variables were handled similarly, except that the original measures were calculated at a state/EIN level. The human capital and firm effect variables are calculated at the state/EIN/2 digit SIC level. For these measures we use the observation with the highest employment because payroll is not available in these files.

[20] We recognize that there is substantial endogeneity in several of the right hand variables we use. The results are to be interpreted simply as establishing correlations rather than causality.

[21] In all columns we control for differences in productivity associated with industry, firm size, firm age and state but do not report the coefficients. The firm size indicators (100<=employment<=999, and employment>=1000) have insignificant coefficients in the overall specification, but are positive, significant, and increasing with size in the manufacturing subsample. Firms that are more than 5 years old have about 5 percent higher productivity in the

that is usually significant, but whether or not it is included has little effect on the benefits coefficient. Adding the firm effect, however, reduces the benefits coefficient substantially. While firms that offer benefits have higher productivity, they also have compensation policies that pay what appear to be equivalent workers more than they receive in other jobs, and this component of pay has a very strong positive relationship to productivity, even when controlling for workforce composition.[22]

The fourth and fifth columns present results for the subset of our overall sample that is included in the 1997 Annual Survey of Manufactures. This sub sample is of interest because we can construct measures of capital that are not available outside manufacturing.[23] Column 4 includes the same controls as column 3—it is included to illustrate changes in coefficients that are simply a result of the change in sample. The benefits coefficient is smaller in manufacturing, but in general the results do not look radically different. Adding our measure of capital—the log of capital per worker, based on the book value of capital divided by employment—has only a small effect on the benefits coefficient. Interestingly, it does reduce the size of the coefficients on the human capital, firm effect, and most demographic variables, so greater capital intensity does appear to account for some of the positive association found between worker skill and productivity.

---

overall sample, and about 10-15 percent higher productivity in manufacturing, but there differences between age groups among those older than 5 are generally not significant.

[22] The order in which we introduce the human capital and firm effect controls has little impact on the portion of the reduction in the benefits coefficient that we attribute to the different controls.

[23] We can construct capital measures for a larger sample of manufacturing firms by also including those that are in the 1997 Economic Census of Manufacturing (CM) but not in the ASM, which adds a lot of smaller firms. However, the ASM sample is asked more detailed capital questions, and imputation is used for some components of capital in non-ASM cases. We have run the same sets of regressions for both manufacturing samples, and while the coefficients are somewhat different, the general conclusions we draw are not.

C. Hazard estimates of firm failure

Do firms that currently offer benefits have higher future survival rates, conditioning on other observable characteristics? We address this question using our complete sample of firms in existence in 1997 and exploiting their rates of failure over the 1997-2001 period A firm is measured as having failed if it stops filing the UI records that underlie our human capital estimates. We use a Cox proportional hazard model to estimate the probability of a firm failing in the years after 1997, conditional on surviving until 1997, and include a dummy variable for having offered benefits in 1997 to examine this relationship.[24] In addition to benefits, in all specifications we also include controls for firm age as of 1997, industry, state, multi-unit status, and firm size.

We present estimates for two different samples in Tables 9A and 9B. In Table 9A, we estimate the model for all businesses, while in 9B we restrict our sample to firms with at least 100 employees. Recall that for some types of benefits (primarily health plans) sponsors are not required to file a Form 5500 if the plan has fewer than 100 enrollees, and thus we measure benefits coverage less accurately for smaller firms, which are excluded in these columns. The specifications (2), (3), and (4) for each sample differ from (1) in that we progressively add the human capital quartile measures, the firm effect (ψ), and then labor productivity. In the last specification we include an interaction between the human capital measures to examine how variance in human capital factors into this relationship.

[24] Due to using a conditional probability function, the Cox proportional hazard method controls for left truncation/delayed entry (firms being observed in 1997, but that were already in business before). Only observations from 1997 and onward are used in calculating the log-likelihood function.

Table 9A
Hazard Estimates of the Relationship between Firm Death and Benefit Offering: All Firms

Independent variables	(1)	(2)	(3)	(4)	(5)
Offers benefit in 1997	-.342	-.281	-.274	-.251	-.246
	(.008)	(.008)	(.008)	(.008)	(.008)
100-999 Employees	.186	.148	.147	.137	.134
	(.014)	(.014)	(.014)	(.014)	(.014)
1000+ Employees	.281	.257	.258	.256	.254
	(.052)	(.052)	(.052)	(.052)	(.052)
Multi-unit firm	-.018	-.029	-.029	-.026	-.022
	(.014)	(.014)	(.014)	(.014)	(.014)
Firm age 5-<10	-.469	-.469	-.470	-.468	-.468
	(.012)	(.012)	(.012)	(.012)	(.012)
Firm age 10-<15	-.925	-.922	-.923	-.922	-.921
	(.019)	(.019)	(.019)	(.019)	(.019)
Firm age 15-<20	-1.453	-1.447	-1.447	-1.451	-1.448
	(.027)	(.027)	(.027)	(.027)	(.027)
Firm age 20+	-1.802	-1.800	-1.800	-1.800	-1.801
	(.034)	(.034)	(.034)	(.034)	(.034)
% in lowest HC quartile		.158	.153	.058	.242
		(.020)	(.020)	(.020)	(.021)
% in highest HC quartile		-.583	-.584	-.449	-.134
		(.024)	(.024)	(.024)	(.027)
% in lowest HC quartile * % in highest HC quartile					-2.558
					(.108)
Firm effect			-.042	.082	.066
			(.009)	(.009)	(.009)
Labor productivity				-.178	-.177
				(.005)	(.005)
Number of obs (EIN-years)	377136	377136	377136	377136	377136
Number of failures	103266	103266	103266	103266	103266

In all specifications in both tables, we find a significant negative relationship between the provision of benefits and the likelihood of post-1997 firm failure. Unsurprisingly, firm age also has a large and consistently negative association with the likelihood of failure. With controls for age, we actually find a slightly positive effect of firm size on failure, though it becomes insignificant when we drop small firms from our sample.

Table 9B
Hazard Estimates of the Relationship between Firm Death and Benefit Offering: Firms with >100 Employees

Independent variables	(1)	(2)	(3)	(4)	(5)
Offers benefit in 1997	-.375	-.387	-.401	-.396	-.395
	(.027)	(.028)	(.028)	(.028)	(.028)
1000+ Employees	.038	.033	.028	.031	.031
	(.054)	(.054)	(.054)	(.054)	(.054)
Multi-unit firm	.018	.021	.024	.034	.034
	(.028)	(.028)	(.028)	(.028)	(.028)
Firm age 5-<10	-.420	-.422	-.419	-.411	-.411
	(.064)	(.064)	(.064)	(.064)	(.064)
Firm age 10-<15	-.820	-.822	-.818	-.808	-.808
	(.092)	(.092)	(.092)	(.092)	(.092)
Firm age 15-<20	-1.540	-1.544	-.1541	-1.531	-1.532
	(.121)	(.121)	(.121)	(.121)	(.121)
Firm age 20+	-1.735	-1.740	-1.738	-1.728	-1.729
	(.132)	(.132)	(.132)	(.132)	(.132)
% in lowest HC quartile		-.050	.233	.123	.149
		(.108)	(.118)	(.120)	(.122)
% in highest HC quartile		.157	.118	.198	.249
		(.130)	(.130)	(.131)	(.141)
% in lowest HC quartile * % in highest HC quartile					-.747
					(.738)
Firm effect			.323	.464	.451
			(.059)	(.065)	(.067)
Labor productivity				-.124	-.123
				(.020)	(.020)
Number of obs (EIN-years)	23859				
Number of failures	6230				

The human capital measures do not have such consistent effects. In the overall sample, firms with more skilled workers generally have higher survival rates, though adding productivity as a control reduces the size somewhat. However, in the sample with only larger firms, the effects are generally not significant and the coefficients vary somewhat The coefficient on the interaction effect is large and highly significant in the full sample. One interpretation of this interaction effect is that variance in worker skill is associated with lower failure rates: while firms with a greater representation of less skilled workers tend to have higher failure rates, that is

not true if they also have a significant share of higher skilled workers. For example, the implied effect of increasing the share of less skilled workers by .10 is to increase failure rates by .024 if there are no higher skilled workers, but to decrease rates by -.040 if the share of higher skilled workers is .25. This pattern does not show up in the results for firms with more than 100 employees, suggesting that this is predominantly a small firm effect.

The firm effect, which captures firm pay differentials, has a significant negative coefficient in the overall sample when productivity is not included, but has a strong positive effect for all other specifications in which it is included. Interestingly, the difference in the sign of that coefficient between Tables 9A and 9B suggests that it is only among small firms that those with higher average pay have high enough labor productivity that they are less likely to fail. For both samples, controlling for labor productivity results in a large positive coefficient on the firm effect: holding productivity and workforce characteristics constant, higher average pay is associated with higher rates of failure. Reassuringly, labor productivity has a strong negative effect on the probability of failure wherever we include it.

V. Summary

Using Form 5500 data combined with LEHD integrated UI data for 1997-2001, we find that firms that offered benefits have lower turnover rates and grow faster than the average non-benefit-offering firm. This is true even after controlling for firm differences in wage compensation. While controlling for workforce human capital characteristics reduces the estimated effects, there remain significant differences associated with offering benefits. Firms that add benefits over this period have particularly high rates of employment growth, suggesting

that significant employment growth may be a factor in the decision to offer benefits for firms that do not already do so. There also seem to be systematic differences associated with benefit offering in the demographic characteristics of a firm's workers, and the way in which those characteristics evolve over time, though the importance of those changes to firm outcomes are harder to gauge. The availability of more recent measures of the human capital distribution of a firm's workers would make our examination of changes in workforce characteristics more interesting.

In our analysis of productivity differences across firms, we find that both benefits and the firm-specific component of pay are positively related to productivity. We also find that firms that offer benefits are less likely to fail–even after controlling for all other observable characteristics–than are firms that do not offer benefits. Many interpretations could be put on this. One is that of endogeneity—firms that are more likely to die (either due to current financial problems, or perhaps because they are an inherently more risky business) are less likely to offer benefits. This could either be as a way to cut down on current costs, or because workers value benefits less when the risk of future default is higher.

REFERENCES

Abowd, John M., Paul A. Lengermann, Kevin L. McKinney. 2002. "The Measurement of Human Capital in the U.S. Economy." LEHD Technical Paper No. TP-2002-09, U.S. Census Bureau.

Abowd, John M., John Haltiwanger, Ron Jarmin, Julia Lane, Paul Lengermann, Kristin McCue, Kevin McKinney, Kristin Sandusky. 2002. "The Relationship between Human Capital, Productivity, and Market Value: Building up from Micro Evidence." LEHD Technical Paper No. TP-2002-14, U.S. Census Bureau.

Bulow, Jeremy I. and Lawrence H. Summers. 1986. "A Theory of Dual Labor Markets with Application to Industrial Policy, Discrimination, and Keynesian Unemployment." *Journal of Labor Economics*, 4(3, part 1):376-414.

Burgess, Simon, Julia Lane, and David Stevens. 2000. "Job Flows, Worker Flows and Churning." *Journal of Labor Economics*, 18(3):473-502.

Currie, Janet and Brigitte C. Madrian. 1999. "Health, Health Insurance, and the Labor Market." In *Handbook of Labor Economics, Volume 3*, O. Ashenfelter and D. Card, eds. Elsevier Science.

Decressin, Anja, Julia Lane, Kristin McCue, and Martha Stinson. 2003a. Employer-Provided Benefit Plans, Workforce Composition, and Firm Outcomes. *Technical Paper TP-2003-06*, LEHD, U.S. Census Bureau.

Decressin, Anja, Kristin McCue, and Martha Stinson. 2003. Describing the Form 5500-Business Register Match. *Technical Paper TP-2005-01*, LEHD, U.S. Census Bureau.

Dickens, William T. and Kevin Lang. 1985. "A Test of Dual Labor Market Theory." *American Economic Review*, 75(4): 792-805.

Dorsey, Stuart, Christopher Cornwell, and David Macpherson. 1998. *Pensions and Productivity.* W.E.Upjohn Institute.

Ehrenberg, Ronald and Robert Smith. 1996, 6th edition. *Modern Labor Economics: Theory and Public Policy*. Reading, MA: Addison-Wesley.

Even, William E. and David A. Macpherson. 1996. "Employer Size and Labor Turnover: The Role of Pensions." *Industrial and Labor Relations Review* 49(4):707-728.

Even, William E. and David A. Macpherson. 2001. "Benefits and Productivity." Pension Research Council Working Paper 2001-16.

Even, William E. and David A. Macpherson. 2003. "Determinants and Effects of Employer Matching Contributions in 401(k) Plans." Mimeo. Florida State University.

Gustman, Alan L., Olivia S. Mitchell, and Thomas L. Steinmeier. 1994. "The Role of Pensions in the Labor Market: A Survey of the Literature." *Industrial and Labor Relations Review* 47(3):417-438.

Gustman, Alan L. and Thomas L. Steinmeier. 1993. "Pension Portability and Labor Mobility: Evidence from the SIPP." *Journal of Public Economics* 50(2): 299-323.

Gustman, Alan L. and Thomas L. Steinmeier. 1995. *Pension Incentives and Job Mobility*. Kalamazoo, Michigan: Upjohn Institute for Employment Research.

Ippolito, Richard A. 1994. "Pensions and Indenture Premia." *Journal of Human Resources*, 29(3): 795-812.

Ippolito, Richard A. 1997. *Pension plans and employee performance: Evidence, analysis and policy*. Chicago: University of Chicago Press.

Ippolito, Richard A. 2002. "Stayers as 'Workers' and 'Savers': Toward Reconciling the Pension-Quit Literature." *Journal of Human Resources*, 37(2): 275-308.

Montgomery, Edward, and Kathryn Shaw. 1992. "Pensions and Wage Premia." NBER Working Paper No. 3985.

Staff of the LEHD Program (2002). The Longitudinal Employer-Household Dynamics Program: Employment Dynamics Estimates Project versions 2.2 and 2.3. *Technical Paper TP-2002-05-rev1*, LEHD, U.S. Census Bureau.

U.S. Department of Labor, Pension and Welfare Benefits Administration. Abstract of 1997 Form 5500 Annual Reports. *Private Pension Plan Bulletin* No. 10, Winter 2001, Washington, DC.

Weinstein, Harriet and William J. Wiatrowski. 1999. "Multiemployer Pension Plans." *Compensation and Working Conditions*, Spring 1999: 19-23.

APPENDIX

Table A1

Distribution of 5500 Plan Records by Exclusive Type

Exclusive benefit plan types	Number	Percent
Defined benefit plan	64,313	6.00%
Defined contribution plan	657,324	61.30%
Other pension plan	24,916	2.30%
Health plan	65,333	6.10%
Fringe benefit plan	208,469	19.40%
Welfare and fringe benefit plan	42,851	4.00%
Welfare and pension benefit plan	2,915	0.30%
No info on plan benefit type	5,899	0.60%
Total	1,072,020	100.00%

Table A2a

Business Register Match Rates, Weighted by Employment - 1997

Number of employees	Single Unit Firms		Multi-Unit Firms		All Firms	
Firm Size	Total Number of Employees in Firm Size Group	Match rate	Total Number of Employees in Firm Size Group	Match rate	Total Number of Employees in Firm Size Group	Match rate
1 – 4	5,500,708	5.2%	22,244	16.2%	5,522,952	5.2%
5 - 99	28,665,996	29.5%	4,590,771	57.1%	33,256,767	33.3%
100 - 999	8,987,671	64.1%	12,237,687	82.0%	21,225,358	74.4%
1000 +	2,366,799	69.5%	43,297,297	95.5%	45,664,096	94.1%
Total	45,521,174	35.5%	60,147,999	89.8%	105,669,173	66.4%

Table A2b

Business Register Match Rates, Weighted by Employment - 2001

Number of employees	Single Unit Firms		Multi-Unit Firms		All Firms	
Firm Size	Total Number of Employees in Firm Size Group	Match rate	Total Number of Employees in Firm Size Group	Match rate	Total Number of Employees in Firm Size Group	Match rate
1 – 4	5,604,584	4.2%	17,668	16.0%	5,622,252	4.2%
5 - 99	31,793,403	25.3%	3,560,992	51.7%	35,354,395	27.9%
100 - 999	10,855,284	56.9%	11,596,094	78.1%	22,451,378	67.9%
1000 +	3,829,941	53.1%	51,039,833	94.5%	54,869,774	91.6%
Total	52,083,212	31.6%	66,214,587	89.3%	118,297,799	63.9%

Table A3
Firm Characteristics by Benefit Offer- 1997

	Benefit-Providing Firms	Non-Benefit-Providing Firms
Firm size		
Number of establishments	2.3	1.3
Multi-unit	13.1%	5.2 %
Firm size class 2 (5-99)	83.8 %	96.0 %
Firm size class 3 (100-999)	14.9 %	3.8 %
Firm size class 4 (1000+)	1.3 %	0.3 %
Industry		
Mining	0.4 %	0.4 %
Construction	5.2 %	4.3 %
Manufacturing	14.5 %	9.7 %
Transportation	4.3 %	5.0 %
Wholesale trade	13.7 %	7.7 %
Retail trade	10.7 %	29.1 %
Finance	8.7 %	6.3 %
Services	42.5 %	37.5 %
Relative labor productivity	0.293	-0.081
Mean firm effect	0.064	-0.188
Churning rate	0.220	0.379

Notes: Firm age is defined as the age of the oldest establishment owned by the firm. It is based on the matched BR/5500 sample. Other figures are for the sample matched to the UI data as well, which is a subset of the overall BR/5500 sample.