AN EMPIRICAL ANALYSIS OF PENSIONS FOR THE LABOR MARKET

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Empirical research of pensions and its role in the labor market has been limiting and has led to inconclusive and sometimes contradictory results. What is needed to have a better understanding of the role of pensions is better data that are longitudinal and national, include worker and firm information, and provide information that helps deal with endogeneity between certain variables. This dissertation discusses such a new data set and discusses the empirical uses of the data when investigating the role of pensions on firm productivity. This dissertation comprises of two chapters. Each chapter is discussed below.

Chapter 1, "Results from Integrating the Form 5500 Pension Information with the U.S. Census Business Register and the Longitudinal Employer-Household Dynamics State Data" discusses the process in creating a new, unique data set which is longitudinal and includes information about private firms, their employees, and the different pensions that they offer. This data has firm and pension information for all private employers in the United States for years 1994 through 2001 and added employee information for firms that exist in twelve states over the same period. This data set is shown to be far superior to any currently available data set.

Chapter 2, "Do Changes in Deferred Compensation Lead to Changes in Productivity?" empirically examines the effects on firm productivity when a firm terminates a defined benefit plan and replaces it with a defined contribution plan. The empirical analysis was done using the data set discussed in Chapter 1. The empirical results show that when performing two-step estimations and comparing

one group of firms that kept their defined benefit plans to another group of firms that converted their pension plans, the group that converted experienced a reduction in productivity between the years 1995 and 2000. There is some evidence that this result occurred because workers no longer had the incentive to remain with the firm once the defined benefit plan was replaced, and as a result, workers were leaving the firm before gaining firm-specific skills. However, more work needs to be done to determine if the reduction in employee retention is truly the cause.

BIOGRAPHICAL SKETCH

Tomeka Hill was born to the parents of Cecil and Gloria Hill. She was born on February 3, 1973 and raised in Greenwood, SC where she graduated with honors from Greenwood High School in 1991. Upon graduation, she began her studies at Duke University and graduated with a B.S. in mathematics in 1995. Wanting a stronger mathematics background, she immediately left Duke University after graduation and began a Master's program at American University, finishing her M.S. in Statistics in 1997. She worked for one year as an associate mathematician with ANSER in Arlington, VA and then started working as a research associate at Watson Wyatt in Bethesda, MD where she worked for almost four years. While working at Watson Wyatt, she began researching retirement practices and benefits policy. Wanting to learn more about pensions, personal savings, and personal investing, she decided to enter the Ph.D. program in economics at Cornell University in Ithaca, NY. While still a student at Cornell, she moved back to the Washington, DC area and is now working as a student intern at the U.S. Census Bureau. After graduating with her Ph.D., Tomeka will return to Watson Wyatt and begin working as a senior research economist.

To my parents, Cecil and Gloria, and my brother, Warren.

ACKNOWLEDGEMENTS

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Chapter 1
Results from Integrating the Form 5500 Pension Information with the U.S. Census Business Register and the Longitudinal Employer-Household Dynamics State Data

Over the past three decades, there has been much research on pensions and their implications in the labor market. Because of changes in labor force demographics, new pension laws and firms' financial pressures, the expectations about the effects of pensions on workers and firms have changed dramatically. Many policy makers and economists are currently trying to determine what is the pensions' role in personnel policy and how their role has changed over time, but have found that this is difficult to answer. The culprit for this is limitations in current data. Data limitations including the lack of data specifics and endogeneity issues between variables have restricted new developments in pension research.

What is needed to help researchers better understand the relationship between pensions and labor market activity is longitudinal data combining company-side information with employee information. In this paper, I introduce such a data set. With this new wealth of information now available, this unique data set is ideal for any researcher who wants to answer certain research questions like how do pensions attract certain workers and discourage shirking, and how do pensions affect compensation and employment outcomes. This data set can also be used to distinguish theories that emphasize firms' motivations for pensions.

In this paper, I discuss how this data set is created when integrating administrative data combining firm data, pension data and employee data into one file. The three administrative files used are the Form 5500, the U.S. Census Business Register and U.S. Census Longitudinal Employer-Household Dynamics (LEHD)

state data. This new data set that is created is longitudinal covering years 1994 to 2001, and it includes most of the private firms in the United States with added information about workers from twelve states. The twelve states are California, Florida, Idaho, Illinois, Maryland, Minnesota, Missouri, Montana, North Carolina, Oregon, Washington and Wisconsin. The data set is on the firm level and has information on what type of pension coverage is offered, the actuarial and financial information of the pensions, and variables which provide descriptive information including, for instance, industry classification, total sales, total number of workers employed by the firm within each state, the age distribution of the workers, and the sex and race composition of the workers.

This paper is organized as follows: In the second section, I provide background information on the Form 5500, U.S. Census Business Register and LEHD state data. The third section discusses how the pension information from the Form 5500 is cleaned and then used. The fourth section discusses the integration in two stages. The first stage is the integration of the pension information from the Form 5500 to firm level information from the U.S. Census Business Register creating a national longitudinal data set. The second stage is adding the employee information from firms that exist in twelve states to the Form 5500-Business Register merged file. In the fifth section, I compare my results on pension coverage to publicly released reports and statistics generated from public-use files. I then compare pension plan offers by firm and coverage rates from the national data set I created to pension plan offers by firm and coverage rates in the twelve-state subset that includes the worker information. In the sixth section I discuss reasons for some non-matches. The seventh section has concluding remarks.

1.1 Background Information on Administrative Data Sets

In this section I discuss in more detail the Form 5500, the U.S. Census Business Register and the LEHD state data. Each administrative file provides unique information that enhances and complements one another and makes the overall data set that is created from these three files much more useful. I discuss the Form 5500 first, followed by the U.S. Census Business Register and then end with the LEHD state data.

1.1.1 Form 5500

All benefit information comes from the Form 5500 and is provided by the Department of Labor (DOL) and the Internal Revenue Services (IRS). The Form 5500 details information about all pension, health, dental, life insurance, education attainment and adoption assistance benefit plans sponsored by each firm and stems from the enactment of the Employee Retirement Income Security Act (ERISA) in 1974. For-profit firms, non-profit organizations, local and state government employers are included in the Form 5500. Information about benefits at the federal government is not included. The benefit information is on the plan level and includes identifying information about the firms including company name and Employer Identification Number (EIN), statistics on participants, a balance sheet, a statement of income and expense, and other information about the operation of the plans. The Form 5500 also has schedule forms, which provide supplemental information about the plans including actuarial, insurance, and trustee information.

I focus on the pension information in the Form 5500, although using the health information is suitable when looking at health coverage (Refer to Decressin, Hill and Lane (2005)). Not all pension plans are included in the Form 5500 data. Some pension plans are not in the Form 5500 file because some firms may not be

obligated to file. The following are the plans that are exempt from filing. (1) Pension plans that are unfunded and the benefits go only to a select group of management of highly compensated employees. (2) Pension plans maintained outside the United States if they are qualified foreign plans. (3) Simplified Employee Pensions (SEP) which are pension plans that meet certain minimum qualifications regarding eligibility and employer contributions. (4) Savings Incentive Match Plans for Employees (SIMPLE) of Small Employers. (5) Pension plans that are church plans. (6) Pension plans that cover residents of Puerto Rico, the U.S. Virgin Islands, Guam, Wake Island, or American Samoa.

Prior to 1999, the Form 5500 consisted of three forms, the F form, which was filed annually by benefits providers with more than 100 participants in a plan, and the C and R forms, which were filed by providers with less than 100 participants. The C form was filed one out of every three years and the shorter R form was filed two out of every three years. In 1999, the Form 5500 form changed so that now all benefit providers fill out only one revised form annually. This new form is not as detailed as the previous forms. Only the general plan information and the number of plan participants are provided. However, the information that was available on the previous basic Form 5500 is now provided on the attached Schedule H for the new Form 5500. This attachment includes four separate sections: (1) Asset and Liability Statements, (2) Income and Expense Statement, (3) Accountant's Opinion, and (4) Transactions During Plan Year. The questions that are contained on the Schedule H are virtually the same as those included on the basic Form 5500 from the previous years. Thus, using the Schedule H with the basic Form 5500 makes it possible to track plans in the same way as in previous years.

Actuarial information for defined benefit pension plans is collected on another attachment, the Schedule B, for all years. This attachment contains actuarial

asset and liability statements, and contributions made to defined benefit plans by the employer and employees. The Schedule B, used with the basic Form 5500 and Schedule H for the later years, helps provide liabilities and funded status for each pension plan.

1.1.2   U.S. Census Business Register

The U. S. Census Business Register is a file that is maintained by the U.S. Census Bureau and contains information about all multi-establishment and single-establishment employer firms in the United States. This file is a list of all establishments that have tax return records at the IRS. In the single-unit file, the establishments are listed on an EIN level. In the multi-unit file, the establishments are listed on an enterprise level. The establishments on the multi-unit file belonging to the same firm will have the same EIN, and the EINs that are affiliated with an enterprise will have the same alpha number. The minimum information for each organizational unit of the company includes the company name and EIN, industry code, geographical code, legal form of organization, employment size, total payroll, age of establishment, imputed total sales[1], and other economic variables. The Business Register includes both part-time and full-time workers. All public administrative establishments are excluded. Thus, government businesses on all levels are not available.

1.1.3   Longitudinal Employer-Household Dynamics (LEHD) State Data

The LEHD state data, collected by the U.S. Census, are administrative information constructed primarily from quarterly Unemployment Insurance (UI) system wage reports and provided by the state governments. Every state in the United States

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[1]Approximately half of sales are missing on the single-unit file and approximately 90 percent of sales are missing on the multi-unit file in each year. I multiply-imputed the total sales on an establishment level and then sum the results to an EIN level. I make no distinction between a single unit establishment and a multi-unit establishment when imputing the sales information.

through its Employment Security Agency collects quarterly earnings and employment information to manage its unemployment compensation program. The characteristics of the UI wage vary slightly from state to state, but the UI coverage is broad and comparable from state to state. Using these records, LEHD creates a database that provides longitudinal information on workers and the matches to their employers. The LEHD data includes approximately 96% of private, non-farm and salary workers. The coverage of agricultural and federal government workers is less comprehensive. Self-employed individuals and independent contractors are also not covered. Although the identifiers in the administrative records are subject to some error, researchers have invested substantial resources in editing the identifiers and making them internally consistent. More information can be found in Abowd and Vilhuber (2002).

Basic demographic information (date of birth, foreign-born status, sex, race, education imputation) is integrated into the UI records via the person identifier link for almost all workers in the data. The non-match rate is approximately 4%. The quarterly earnings listed are a measure of total compensation, including gross wages and salary, bonuses, stock options, tips and gratuities and the value of meals and lodging when these are supplied. There are currently forty-three states and the District of Columbia that are partners with LEHD and provide information to be used in the LEHD program.

The LEHD state data, the Form 5500 and the U.S. Census Business Register have very useful information, but are limiting when used solely to research benefits. Although the LEHD data describes the employees' work history within the state, it is limiting in that is contains little information about the firm on a national level. The Form 5500 provides information identifying firms that offer pensions and which types. However, the list of firms identified is incomplete because the

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Form 5500 lists only one sponsoring firm for each plan even though several affiliates pool their resources to provide benefits for their employees. The U.S. Business Register has no information about the characteristics of the firms' workforce and contains no information about benefits. Therefore, the integration of all three files is required to research the unanswered questions about pension benefits. However, before the integration, much work was needed to clean the Form 5500.

1.2 Preparing the Form 5500

It is important to note that a considerable amount of time was used in cleaning and preparing the Form 5500 because the data as provided was very messy, incomplete, and filled with obviously erroneous information. I along with several researchers in LEHD worked together to provide a clean version of the Form 5500. This section provides more detail on how the Form 5500 was cleaned and discusses the improved information.

1.2.1 Edits to Form 5500 on Plan Level

When gathering pension records from the Form 5500, I use file years 1993-2001. Some of the information in the Form 5500 was missing or clearly incorrect, so edits are made. Only plans that have a marked indicator for pension plans are used. If the words 'defined benefit', 'defined contribution' or 'pension' or some variant of these words are found in the plan name and the features are indeed pension features, but the indicator shows it is not a pension plan, the indicator was changed. Many records appear more than once in the annual files. All duplicates of pension records with identical Employer Identification Numbers (EINs), plan numbers, plan end dates, and number of participants are deleted within each file year. If more than one plan have identical EINs, plan numbers and plan end dates, but different employee participation counts, only plans with the largest

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participation count are kept. Plans with no active participants are kept because I am unable to determine if the number of active participants is actually zero or just missing. Plans that are indicated as being maintained by a multiemployer or a union are not used. To control for different reporting dates between the Form 5500 and Business Register, plan end year dates are used instead of file year dates. The plans' end year dates are from 1994 to 2001.

Table 1.1 lists all the pension, welfare, fringe benefits (i.e. adoption assistance and education attainment plans) and undetermined plans found in the Form 5500 data set by year. The pension plans cover a majority of plans filed with a sharp increase from 72% to 87% from 1994 to 2001. However, the overall number of plans increases and then drops from 972,180 to 828,144.

Table 1.1: Form 5500 Plans by Benefit Type for Plan-End Years 1994-2001

Plan End Year	Pension Plans	Welfare Plans	Fringe Benefit Plans	Undetermined	Total
1994	700,783	111,213	153,438	6,746	972,180
(row percentage)	72.08%	11.44%	15.78%	0.69%	100.00%
1995	712,372	109,588	174,128	7,116	1,003,204
	71.01%	10.92%	17.36%	0.71%	100.00%
1996	727,425	108,658	190,803	7,185	1,034,071
	70.35%	10.51%	18.45%	0.69%	100.00%
1997	746,554	108,184	208,815	8,469	1,072,022
	69.64%	10.09%	19.48%	0.79%	100.00%
1998	740,837	101,666	215,358	11,339	1,069,200
	69.29%	9.51%	20.14%	1.06%	100.00%
1999	523,198	57,348	46,885	19,453	646,884
	80.88%	8.87%	7.25%	3.01%	100.00%
2000	671,798	79,404	358	19,182	770,742
	87.16%	10.30%	0.05%	2.49%	100.00%
2001	719,914	88,084	225	19,921	828,144
	86.93%	10.64%	0.03%	2.41%	100.00%

Because the layout of the Form 5500 form changed in 1999, questions about pension type also changed. To determine the different types of pensions that were offered for file years 1993-1998, the pension benefit features found in Question 6C are used. For file years 1999-2001, pension features found in Question 8A are used. There are actually three types of pension plans identified on the Form 5500.

They are defined benefit plans, defined contribution plans, and 'other' defined benefits. 'Other' defined pension plans are defined differently after 1999 on the revised form[2]. There are some pension plans that are identified as a pension plan but the type of plan was undetermined. The number of undetermined pension plans is insignificant in each year and are included with the "other" plans.

Table 1.2: Pension Plans by Type Found in Form 5500

Plan End Year	Defined Benefit Plans	Defined Contribution Plans	"Other" or Unclassified Pension Plans	Total
1994	80,424	603,214	17,145	700,783
(Row percentage)	11.48%	86.08%	2.45%	100.00%
1995	73,938	617,168	21,266	712,372
	10.38%	86.64%	2.99%	100.00%
1996	69,273	635,039	23,113	727,425
	9.52%	87.30%	3.18%	100.00%
1997	64,313	657,325	24,916	746,554
	8.61%	88.05%	3.34%	100.00%
1998	58,163	655,992	26,682	740,837
	7.85%	88.55%	3.60%	100.00%
1999	34,255	481,431	7,505	523,191
	6.55%	92.02%	1.43%	100.00%
2000	46,357	620,360	5,078	671,795
	6.90%	92.34%	0.76%	100.00%
2001	47,753	668,079	4,082	719,914
	6.63%	92.80%	0.57%	100.00%

Table 1.2 lists the number of pension plans found that are defined benefit, defined contribution, and "other" or undetermined pension plans. As shown, the number of defined benefit plans dropped sharply by 41% drop. However, the number of defined contribution plans increased by approximately 11%. Because the number of overall plans dropped, particularly after 1999, one could conclude

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[2]Prior to 1999, 'other' pension plans include (1) defined benefit plans with benefits based partly on balance of separate account of participant, (2) annuity arrangements of certain exempt organizations, (3) custodial accounts for regulated investment company stock, (4) pension plans utilizing individual retirement accounts (IRAs) or annuities are the sole funding vehicle for providing benefits. In 1999 and afterwards, 'other' pension plans are defined as (1) Non-U.S. plans, (2) Plans covering self-employed individuals, (3) Unqualified plans, (4) Master plans, (5) Prototype plans, (6) Plans in which the plan sponsors received services of leased employees during the plan year, (6) One-participant plans (7) Plans in which the plan sponsors are members of a controlled group.

than many defined benefit pension plans have merged with other plans or were dropped by the firm during this time period. However, to have more clarity as to whether pension plans merged or were dropped over the time period, I determine if some plans are simply missing from the file.

1.2.2 Identifying Missing Pension Plans in Form 5500 Data

To find pension plans that are missing on the Form 5500 annual files, I designed an algorithm to identify them. To simplify identifying missing pension plans, I only focus on plans identified as either a defined benefit plan or a defined contribution plan. The plans identified as "other" or undetermined are discarded and are no longer used in the integration process. To find the missing pension plans, I look at three consecutive plan end years by EIN and plan number. I create a subset of all records that have EINs and plan numbers that matched in the previous first year and in the subsequent third year, but did not exist in the current second year. I then determine if these plans are also identified as either a defined benefit plan or a defined contribution plan in both the first and third years. If there is a match, then the plan is identified as a missing plan and is added to the file for the second current year. All the financial, actuarial and employment coverage information for the missing plans is calculated as simply the average of the actuarial, financial and employment coverage information from plans in the first and third years.

Table 1.3: Number of Missing Pension Plans Found in Form 5500 by Year

Plan End Year	Defined Benefit Plans	Defined Contribution Plans	Total
1994	618	7,051	7,669
(Row Percentages)	8.06%	91.94%	100.00%
1995	1,280	11,890	13,170
	9.72%	90.28%	100.00%
1996	995	13,121	14,116
	7.05%	92.95%	100.00%
1997	757	11,776	12,533
	6.04%	93.96%	100.00%
1998	1,323	16,743	18,066
	7.32%	92.68%	100.00%
1999	12,268	129,778	142,046
	8.64%	91.36%	100.00%
2000	2,093	34,060	36,153
	5.79%	94.21%	100.00%
2001	547	3,941	4,488
	12.19%	87.81%	100.00%

Table 1.3 lists the number of missing pension plans that are found by year. The number of missing plans found is small for most years except in 1999 where the number of missing plans increased the number of pension plans by over 21%. The reason why a large number of missing plans in 1999 are found may be because in 1999 it became mandatory for all providers to fill out the Form 5500 with the new layout. Some employers may not have known that. Also, some records sent to the Department of Labor were lost in 1999.

Table 1.4 lists all the defined benefit plans and defined contribution plans, which will be integrated to the Business Register and are the total of the pension plans shown in Table 1.2 and the missing plans found in Table 1.3. From 1994 to 2001 the number of defined benefit plans decreased by 40% and the number of defined contribution plan increased by 10%. Again, because there is such a large drop in defined benefit pensions, and a relatively small increase in defined contribution plans, it appears more strongly that many of the defined benefit plans either merged with other pension plans or they were dropped by the firm.

Table 1.4: Listed and Missing Pension Plans from Form 5500 File
To Be Used for Integration

Plan End Year	Defined Benefit Plans	Defined Contribution Plans	Total
1994	81,042	610,265	691,307
(Row Percentages)	11.72%	88.28%	100.00%
1995	75,218	629,058	704,276
	10.68%	89.32%	100.00%
1996	70,268	648,160	718,428
	9.78%	90.22%	100.00%
1997	65,070	669,101	734,171
	8.86%	91.14%	100.00%
1998	59,486	672,735	732,221
	8.12%	91.88%	100.00%
1999	46,523	611,209	657,732
	7.07%	92.93%	100.00%
2000	48,450	654,420	702,870
	6.89%	93.11%	100.00%
2001	48,300	672,020	720,320
	6.71%	93.29%	100.00%

1.2.3 Discussion of Pension Financial Information from Form 5500

To have a better understanding of the financial aspects of the defined pension plans over the eight-year period, I use the liability and asset information provided on the Schedule B attachment to calculate the defined benefit pension funding on the plan level. Pension funding is a way for a firm to assign an expected cost of a defined benefit pension plan to the years of service that give rise to that cost. Current liability is used to determine the expected cost of the pension plan. Current liability is the sum of (1) the value of benefits for retirees, (2) the value of benefits for employees who have left the firm with vested pension rights, but have not yet retired, (3) the value of vested benefits accrued to date for active employees and (4) the value of nonvested benefits for active employees.

When current liability is compared to the actuarial value of assets in the defined benefit pension plan, the funding status of a defined benefit plan is determined. Table 1.5 lists the median funding ratios for defined benefit plans for all years.

The funding ratio is defined as the current assets divided by the current liability under OBRA '87 rule[3]. The defined benefit plans have more assets than liabilities in most years. There is an increase in assets for the defined benefit plans in the late nineties, which is probably due to the boom in the stock market in the 1990's. However, by year 2000 the funding ratios drop although they still remain above one. In 2001, the assets fall below liabilities.

Table 1.5: Median Funding Ratios (Assets/Current Liability) for All Defined Benefit Plans on Plan Level

Plan End Year	Defined Benefit Plans on Plan Level
1994	1.21
1995	1.106
1996	1.146
1997	1.145
1998	1.163
1999	1.121
2000	1.06
2001	0.988

1.2.4 Aggregation of Pension Information from the Form 5500 to EIN level

Although, looking at pensions and their financial status on a plan level tells an interesting story, looking at plans on an EIN level, gives more detail on what types of plans are offered to the employees collectively. This is a better way of looking at the pension coverage rates and the overall financial status of the pension plans. If one only looks at pensions on the plan level, one would be misled about how well firms are managing their pension plans because many firms have more than one plan and each are designed for a particular subset within its labor force. For example, General Motors had five active pension plans in 1997. General Motors has designed separate plans for its salaried, unionized workers and salaried, non-

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[3]The Omnibus Budget Reconciliation Act of 1987 contained provisions that affected the minimum funding standards.

unionized workers as well as for its hourly, unionized workers and hourly, non-unionized workers. Each plan sponsored by General Motors varies by its asset performance, participant coverage and funding. To fully understand how pension plans are handled at General Motors as well as other firms, it is important to look at the pension information on an aggregate EIN level.

Table 1.6: Number of EINs That Offer Defined Benefit Plans Only, Defined Contribution Plans Only, and Defined Benefit and Defined Contribution Plans Based on Form 5500

Plan End Year	EINs with Defined Benefit Plans Only	EINs with Defined Contribution Plans Only	EINs with Defined Benefit and Defined Contribution Plans	Total EINs
1994	47,216	495,044	24,446	566,706
(row Percentage)	8.33%	87.35%	4.31%	100.00%
1995	42,943	514,188	23,542	580,673
	7.40%	88.55%	4.05%	100.00%
1996	39,651	532,148	22,438	594,237
	6.67%	89.55%	3.78%	100.00%
1997	35,673	556,269	21,795	613,737
	5.81%	90.64%	3.55%	100.00%
1998	32,467	564,726	20,263	617,456
	5.26%	91.46%	3.28%	100.00%
1999	26,464	521,401	14,916	562,781
	4.70%	92.65%	2.65%	100.00%
2000	26,891	551,737	16,286	594,914
	4.52%	92.74%	2.74%	100.00%
2001	25,980	564,031	16,729	606,740
	4.28%	92.96%	2.76%	100.00%

Table 1.6 lists the number of EINs that offer only a defined benefit plan, only a defined contribution plan or offered both by year. Just like on the plan level, the number of EINs offering only defined benefit pension plans has dropped tremendously, approximately 45% over an eight-year span. However, the number of firms offering only a defined contribution plan increased by 14%. The number of firms offering both defined pension plans and defined contribution plans is only a small subset of firms overall. However, the number of firms that do offer both types of plans decreases throughout the eight-year span by 32%.

1.2.5 Discussion of Pension Financial Information from the Form 5500 on EIN level

To have a better understanding of the overall financial performance of the firms' pensions, I aggregate the actuarial and financial information to an EIN level. I use the combined total financial information to determine the financial cost or funding status of the pensions for each firm. For the defined benefit plans, I used the aggregate value of current assets in the pension fund and aggregate current liability under OBRA '87 rule found in Schedule B. Table 1.7 shows the median funding status for all firms or EINs offering a defined benefit plan for years 1994 to 2001. The average funding ratios slightly increase and then decrease over this time period. In 2001, the median funding ratio falls below one.

Table 1.7: Median Funding Ratios (Assets/Current Liability) for All Defined Benefit Plans on EIN Level

Plan End Year	Defined Benefit Plans on EIN Level
1994	1.226
1995	1.130
1996	1.161
1997	1.161
1998	1.174
1999	1.131
2000	1.070
2001	0.997

Thus, after spending considerable time editing and correcting, this clean version of the Form 5500 aggregated to an EIN level provides much more accurate information about the overall financial status of pensions, the total number of pension plans offered and a limited view of how many firms offer pensions. Unfortunately, as stated earlier, the Form 5500 only lists one EIN per record although several affiliates may provide the same pension coverage. Thus, the number of firms offering pensions is underestimated when using the Form 5500 alone. However, using the U.S. Census Business Register, which provides a list of all private firms

in the United States and whether these firms are affiliates within an enterprise, becomes very important. The next step is to integrate the pension information from the Form 5500 to the firm information from the U.S. Business Register and the worker information from the LEHD data so that a more accurate assessment on which firms are offering pensions and who is covered is determined.

1.3 Integration Process

The integration of the Form 5500, U.S. Census Business Register and the LEHD state data occurs in two stages. First, I integrate the pension information from the Form 5500 with the firm information from the Business Register. After this first stage of the integration, I am able to provide detailed information about which firms offer certain types of pensions, the pensions' financial status as well as the firm characteristics including firm age, total number of employees nationally, total payroll nationally, total imputed sales and revenue nationally, and industry classification on an EIN level. This data set includes most private firms in the United States. The second stage of the integration is linking the LEHD state information about the workers from twelve states onto the Form 5500-Busines Register data set created in the first stage. This second stage provides additional information about some of the firms' workers including race and sex group percentages, age profile of the workers, the percentage of workers with at least a college degree, the percentage of workers who are foreign-born, and the average annual earning on an EIN-state level. This section discusses in detail both stages of the integration.

1.3.1 First Stage of Integration: Integrating the Form 5500 Pension Data with the U.S. Census Business Register Data

Once the Form 5500 file is cleaned and aggregated to an EIN level, I integrate the information with the U.S. Census Business Register's single-unit and multi-unit establishment files. I first integrate the pension information with the Business Reg-

ister's single-unit file by using the EINs and keep the establishments that match. Only the establishments that are listed as active and have a positive payroll as listed on the U.S. Census Business Register are kept. Since the EINs are unique on this file, the integration to the single-unit establishment file is straightforward.

However, integrating the Form 5500 to the multi-unit establishment file is more complicated. I integrate the pension information with the Business Register's multi-unit establishments using the EINs and keep the establishments that match. I then split the matches found on the multi-unit files into two groups. The multi-unit establishments that match to the Form 5500 EINs and are listed as active and have a positive payroll on the U.S. Census Business Register are placed in the Valid Group. The multi-unit establishments that match to EINs on the Form 5500, but are listed as out-of-business, sold, duplicate, predecessor of another EIN, an administrative EIN, or have zero payroll on the U.S. Business Register are listed as the Invalid Group. At this point, I know which firms from the Form 5500 have a match on the Business Register. However, I do not know if these firms have affiliates. The next task is to find the affiliates of these EINs because I presume that the affiliates to these EIN matches also provide the same pension plan coverage.

To find affiliates of firms that are listed in the Form 5500, I use the alpha number variable. All establishments with different EINs, but identical alpha numbers belong to the same enterprise. For the Valid Group, after I use the alpha number to find all affiliates, I keep only the establishments that are active and have a positive payroll, capturing different EINs within an enterprise. Thus, the EIN listed on the Form 5500 and the active affiliates to this firm are identified as offering the same pension coverage to all of their employees.

As for the EINs in the Invalid group, although the firms in this group are listed

on the Form 5500 and are listed as inactive on the U.S. Business Register, some of these firms have affiliates within the same enterprise that are active. I use the alpha number to find all the affiliates within an enterprise and keep only the establishment of firms that are active and have a positive payroll. Hence, the establishments in the invalid group that has the same EIN listed on the Form 5500 are dropped. But, the affiliates of these firms are kept and are assumed to offer pensions that were reported on the Form 5500. Sometimes, all establishments within an enterprise are listed as not active. Thus, all the establishments within an enterprise are dropped in its entirety and there are no matches. Having an enterprise that is entirely inactive but still has an affiliate EIN listed on the Form 5500 is not uncommon because by law, an enterprise is still obligated to file a Form 5500 if the pension still has positive assets in a pension fund or if retirees are still receiving pensions.

1.3.2 Discussion of Results from the First Integration: Pension Coverage on EIN Level

Once I have found the establishment matches in each file, I aggregate the establishment matches and non-matches to an EIN level. Table 1.8 shows the Form 5500 EINs that have a match to the U.S. Business Register. For each year, at least 95% of the EINs are found in the Business Register. Table 1.9 has the numbers of EINs in the U.S. Business Register single-unit file that match to an EIN in the Form 5500 file for all years. The number of EINs that matched are very small, approximately 8% for all years. However, although this is a low match rate, this is actually not surprising. Most of the single-unit firms tend to have a small number of employees, and small firms are less likely to offer pensions when compared to larger firms. In fact, approximately 55% of the single-unit files have less than 100

employees[4]. Table 1.10 shows the number of EINs in the U.S. Business Register multi-unit files that either match to an EIN in the Form 5500 file or are affiliates. The match rate is approximately 57%. Since approximately 93% of the multi-unit EINs have 100 employees or more[5], it is understandable that the match rate is much higher.

Table 1.8: EINs from the Form 5500 That Are Found in the U.S. Census Business Register

Plan End Year	Form 5500 EINs	Single Unit Matches Through Valid EINs	Multi-Unit Matches Through Valid EINs	Multi-Unit Matches Through Invalid EINs	Total Matches to Form 5500
1994	566,706	420,454	97,562	30,936	548,952
		74.19%	17.22%	5.46%	96.87%
1995	580,673	432,318	98,498	33,366	564,182
		74.45%	16.96%	5.75%	97.16%
1996	594,237	451,069	91,384	16,196	558,649
		75.91%	15.38%	2.73%	94.01%
1997	613,737	444,381	106,386	32,205	582,972
		72.41%	17.33%	5.25%	94.99%
1998	617,456	454,601	105,210	33,742	593,553
		73.62%	17.04%	5.46%	96.13%
1999	562,781	416,745	93,893	30,671	541,309
		74.05%	16.68%	5.45%	96.18%
2000	594,914	440,039	94,674	33,663	568,376
		73.97%	15.91%	5.66%	95.54%
2001	606,740	450,446	86,626	36,964	574,036
		74.24%	14.28%	6.09%	94.61%

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[4]Refer to Appendix A for details on firm size determined by the number of employees.

[5]Refer to Appendix A for details on firm size determined by the number of employees

Table 1.9: EIN Matches and Non-Matches from the Single-Unit Files of the U.S. Census Business Register

Plan End Year	Single-Unit Valid Matches	Single-Unit Non-Matches	Total
1994	420,454	5,048,596	5,469,050
(Row Percentages)	7.69%	92.31%	100.00%
1995	432,318	5,127,876	5,560,194
	7.78%	92.22%	100.00%
1996	451,069	5,229,483	5,680,552
	7.94%	92.06%	100.00%
1997	444,381	5,180,346	5,624,727
	7.90%	92.10%	100.00%
1998	454,601	5,266,618	5,721,219
	7.95%	92.05%	100.00%
1999	416,745	5,341,109	5,757,854
	7.24%	92.76%	100.00%
2000	440,039	5,359,645	5,799,684
	7.59%	92.41%	100.00%
2001	450,446	5,349,611	5,800,057
	7.77%	92.23%	100.00%

Table 1.10: EINs Matches or Affiliates and Non-Matches from the Multi-Unit Files of the U.S. Census Business Register

Plan End Year	Valid Multi-Unit EINs Found Through Valid EINs	Valid Multi-Unit EINs Found Through Invalid EINs	No Matches	Total
1994	166,564	2,735	151,139	320,438
(row percentages)	51.98%	0.85%	47.17%	100.00%
1995	168,181	2,743	147,280	318,204
	52.85%	0.86%	46.28%	100.00%
1996	158,461	4,736	115,120	278,317
	56.94%	1.70%	41.36%	100.00%
1997	172,820	3,049	126,557	302,426
	57.14%	1.01%	41.85%	100.00%
1998	175,607	3,467	127,247	306,321
	57.33%	1.13%	41.54%	100.00%
1999	167,015	3,393	136,156	306,564
	54.48%	1.11%	44.41%	100.00%
2000	163,740	6,430	132,618	302,788
	54.08%	2.12%	37.58%	93.78%
2001	156,553	6,316	100,992	263,861
	59.33%	2.39%	38.27%	100.00%

I next determine exactly how many firms offer only defined benefit plans, how many offer only defined contribution plans and how many offer both types of plans to their employees. To avoid redundancy I report statistics for the year 1997 only. Table 1.11 shows the numbers of single-unit and multi-unit firms that offer defined

benefit plans, defined contribution plans, or both in year 1997. It is not surprising that an overwhelmingly large proportion of single-unit firms offer more defined contribution plans than defined benefit plans. Again, these firms are typically smaller and the administrative costs of defined contribution plans are much less. Approximately 96% of all single-unit firms offer only defined contribution plan. Interestingly, multi-unit firms also offer predominantly defined contribution plans, but they also offer most of the joint plans. Approximately 79% of joint defined benefit and defined contribution plans offered are offered by multi-unit firms.

Table 1.11: Different Pension Types Offered by Single-Unit and Multi-Unit Firms in Year 1997

	Single-Unit EINs	Multi-Units EINs Through Valid Match	Multi-Unit EINs through Invalid Match	Total
DB Plans Offered Only	**24,314**	**6,129**	**97**	**30,540**
(Row Percentages)	79.61%	20.07%	0.32%	100.00%
(Column Percentages)	5.47%	3.55%	3.18%	4.92%
DC Plans Offered Only	**409,962**	**125,647**	**2,401**	**538,010**
	76.20%	23.35%	0.45%	100.00%
	92.25%	72.70%	78.75%	86.74%
DB and DC plans Offered	**10,105**	**41,044**	**551**	**51,700**
	19.55%	79.39%	1.07%	100.00%
	2.27%	23.75%	18.07%	8.34%
Total	**444,381**	**172,820**	**3,049**	**620,250**
	71.65%	27.86%	0.49%	100.00%
	100.00%	100.00%	100.00%	100.00%

I then determine if there are distinct trends in pension coverage. In Table 1.12, I look at the number of firms that offer only defined benefit plans, the number of firms that only offer defined contribution plans and the number of firms that offer both, and determine if the types of pension benefit coverage change over the eight-year time period. From 1994 to 2001, the number of firms offering defined benefit plans decreases every year. The number of firms offering only defined benefit plans drops by 50% and the number of firms offering both types of plans drops by 25%. The number of firms offering only defined contribution plans increase by 12%. The

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overall number of plans increases slightly by 4%.

Table 1.12: Different Pension Plans Offered by Single-Unit and Multi-Unit Firms for Years 1994-2001

Plan End Year	Defined Benefit Plans Only	Defined contribution Plans Only	Defined Benefit Plans and Defined Contribution Plans	Total
1994	42,748	488,017	58,988	589,753
(Row Percentages)	7.25%	82.75%	10.00%	100.00%
1995	38,594	507,951	56,697	603,242
	6.40%	84.20%	9.40%	100.00%
1996	34,959	526,927	52,380	614,266
	5.69%	85.78%	8.53%	100.00%
1997	30,540	538,010	51,700	620,250
	4.92%	86.74%	8.34%	100.00%
1998	28,331	555,922	49,422	633,675
	4.47%	87.73%	7.80%	100.00%
1999	22,844	521,015	43,294	587,153
	3.89%	88.74%	7.37%	100.00%
2000	23,202	544,401	42,606	610,209
	3.80%	89.22%	6.98%	100.00%
2001	21,459	547,789	44,064	613,312
	3.50%	89.32%	7.18%	100.00%

Thus, there seems to be an expected pattern of firms shifting away from defined benefit plans and toward defined contribution plans. This does not take into consideration the number of firms that have frozen the pension accruals in their defined benefit pension plans or those that have grandfathered their defined benefit plans. It is important to remember that firms with frozen and grandfathered plans are in the same category as the firms with active pension plans because they have currently employed workers under the plans.

1.3.3 Pension Coverage on Employment Level

After looking at firms' pension offerings and identifying trends, I next determine how many employees had pension coverage over the eight-year period. I use the total number of employees provided on the U.S. Census Business Register data to determine how many workers are eligible for certain type of pension plan coverage. Table 1.13 shows the total number of employees working for firms in the single-unit files that matched to an EIN in the Form 5500 file for all years. Approximately

20% of workers who work for single-unit firms are eligible for some form of pension plan. Table 1.14 shows the total number of employees working for firms in the multi-unit files that either match to an EIN in the Form 5500 files or are affiliates after using EINs and alphas to integrate for all years. The number of workers eligible for a pension plan is much higher. Approximately 86% of the employees are eligible. I then combine the single-unit and multi-unit workers to create a more accurate depiction of the pension eligibility rate on a national level. Table 1.15 shows the total number of employees from the single-unit and multi-unit files who are eligible for a pension plan. When combining both lists, the number of workers eligible is slightly more than half of the workforce for all years.

Table 1.13: Total Number of People Employed in Single-Unit EINs
That Are Matches and Non-Matches to the Form 5500

Plan End Year	Single-Unit Valid Matches	Single-Unit Non-Matches	Total
1994	10,922,480	49,660,848	60,583,328
(Row Percentages)	18.03%	81.97%	100.00%
1995	12,002,470	51,543,226	63,545,696
	18.89%	81.11%	100.00%
1996	13,029,905	52,847,315	65,877,220
	19.78%	80.22%	100.00%
1997	12,636,415	50,921,653	63,558,068
	19.88%	80.12%	100.00%
1998	13,208,475	53,466,360	66,674,835
	19.81%	80.19%	100.00%
1999	13,234,085	54,081,805	67,315,890
	19.66%	80.34%	100.00%
2000	14,607,905	54,696,012	69,303,917
	21.08%	78.92%	100.00%
2001	15,443,406	53,386,953	68,830,359
	22.44%	77.56%	100.00%

Table 1.14: Total Number of People Employed in Multi-Unit EINs and Affiliates that are Matches and Non-Matches to the Form 5500

Plan End Year	Valid Multi-Unit Employment Found Through Valid EINs	Valid Multi-Unit Employment Found Through Invalid EINs	No Matches	Total
1994	45,722,588	683,786	7,964,215	54,370,589
(row percentages)	84.09%	1.26%	14.65%	100.00%
1995	50,883,293	787,415	8,253,496	59,924,204
	84.91%	1.31%	13.77%	100.00%
1996	48,524,345	931,159	7,383,275	56,838,779
	85.37%	1.64%	12.99%	100.00%
1997	51,569,284	847,733	8,731,048	61,148,065
	84.34%	1.39%	14.28%	100.00%
1998	55,274,593	1,027,975	9,391,358	65,693,926
	84.14%	1.56%	14.30%	100.00%
1999	53,421,568	1,284,964	9,956,303	64,662,835
	82.62%	1.99%	15.40%	100.00%
2000	55,574,990	1,141,437	8,884,169	65,600,596
	84.72%	1.74%	13.54%	100.00%
2001	57,871,266	1,505,692	8,084,129	67,461,087
	85.78%	2.23%	11.98%	100.00%

Table 1.15: Total Number of Employees Working for Business Register EINs Matching and Not Matching to the Form 5500

	Matches to Form 5500 File	Non-Matches to Form 5500 File	Total
1994	57,328,854	57,625,063	114,953,917
(Row Percentages)	49.87%	50.13%	100.00%
1995	63,673,178	59,793,967	123,467,145
	51.57%	48.43%	100.00%
1996	62,485,409	60,230,590	122,715,999
	50.92%	49.08%	100.00%
1997	65,053,432	59,645,798	124,699,230
	52.17%	47.83%	100.00%
1998	69,511,043	62,857,718	132,368,761
	52.51%	47.49%	100.00%
1999	67,940,617	64,038,108	131,978,725
	51.48%	48.52%	100.00%
2000	71,324,332	63,579,571	134,903,903
	52.87%	47.13%	100.00%
2001	74,820,364	61,471,082	136,291,446
	54.90%	45.10%	100.00%

Table 1.16: Total Employees by Pension Type Offered by Multi-Unit and Single-Unit Firms in 1997

	Single-Unit EINs	Multi-Units EINs Through Valid Match	Multi-Unit EINs through Invalid Match	Total
DB Plans Offered Only	**816,416**	**1,627,614**	**29,231**	**2,473,261**
(Row Percentages)	33.01%	65.81%	1.18%	100.00%
(Column Percentages)	6.46%	3.16%	3.45%	3.80%
DC Plans Offered Only	**11,144,389**	**22,560,243**	**509,717**	**34,214,349**
	32.57%	65.94%	1.49%	100.00%
	88.19%	43.75%	60.13%	52.59%
DB and DC plans Offered	**675,610**	**27,381,427**	**308,785**	**28,365,822**
	2.38%	96.53%	1.09%	100.00%
	5.35%	53.10%	36.42%	43.60%
Total	**12,636,415**	**51,569,284**	**847,733**	**65,053,432**
	19.42%	79.27%	1.30%	100.00%
	100.00%	100.00%	100.00%	100.00%

I also determine what types of pensions the workers are eligible for. To avoid redundancy, statistics from 1997 are discussed. Table 1.16 shows the coverage rates by pension types for employees working for the single-unit and multi-unit firms in year 1997. Most of the workers in single-unit files are only eligible for defined contribution plans. Approximately 88% of employees working in a single-unit firm have only a defined contribution plan. Most of the employees working for multi-unit firms also are only eligible for only defined contribution plans with approximately 44% of the workers. However, a large percentage of workers from multi-unit firms receive eligibility for both types of plans, approximately 53%.

Table 1.17: Total Number of Employees Working for Business Register EINs That Offer Different Pension Types

Plan End Year	Defined Benefit Plans Only	Defined contribution Plans Only	Defined Benefit Plans and Defined Contribution Plans	Total
1994	3,154,344	26,767,088	27,407,422	57,328,854
(Row Percentages)	5.50%	46.69%	47.81%	100.00%
1995	3,613,841	30,905,729	29,153,608	63,673,178
	5.68%	48.54%	45.79%	100.00%
1996	2,637,699	31,280,973	28,566,737	62,485,409
	4.22%	50.06%	45.72%	100.00%
1997	2,473,261	34,214,349	28,365,822	65,053,432
	3.80%	52.59%	43.60%	100.00%
1998	2,387,525	38,266,686	28,856,832	69,511,043
	3.43%	55.05%	41.51%	100.00%
1999	1,719,400	38,875,932	27,345,285	67,940,617
	2.53%	57.22%	40.25%	100.00%
2000	1,670,404	42,464,331	27,189,597	71,324,332
	2.34%	59.54%	38.12%	100.00%
2001	1,536,401	42,511,564	30,772,399	74,820,364
	2.05%	56.82%	41.13%	100.00%

I next determine if there are trends in pension coverage by employment. Table 1.17 looks at the number of workers eligible for certain types of pensions over the eight-year period. The number of workers eligible for only defined contribution plans increases by 59% from 1994 to 2001. The number of workers eligible for defined benefit plans decreases by 51% over the same period. Interestingly, although a small percentage of firms offer both a defined contribution and defined benefit plan, they are the largest employers. The number of employees eligible for both types of plans remains fairly constant over the eight-year period even though there was a slight dip in overall population coverage from 1995 to 2001. It seems that the employees of firms which offer only defined benefit plans seem to be most likely affected by the conversion of pensions.

1.3.4 Second Stage of Integration: Integrating LEHD Data to Form 5500-Business Register Data Set

Using the Form 5500-U.S. Census Business Register data set created in the first stage is very informative because using the data set can identify which firms are

offering pensions and what types, in addition to providing descriptive information about the firms. Unfortunately, the Form 5500-Business Register data set is lacking important information about the employees. I now discuss how information describing the workers' race, sex, education attainment status, foreign-born status, age, and annual earnings as well as other firm statistics provided in the LEHD data is integrated into the Form 5500-Business Register data set.

The LEHD state data is an employee-level file, therefore the employer-level statistics are calculated and are percentages and averages describing the workforce for each firm within the state. Once I calculate the descriptive statistics about the workers on the firm or EIN level, I use the EINs to link this information to the Form 5500-U.S. Business Register data set.

There are several variables I chose to describe each firm's workforce. Using the date of birth information that is provided, I determine the percentage of workers that are considered the older workers by calculating the percentage of workers who are over the age forty-five. I also calculate the percentage of workers by race within a firm. The race variable identifies a worker as either white, black, Hispanic (and not black), or a member of 'other race' (Native American, Indian descent, Asian, other). I use the foreign-born indicator on the data set to determine the percentage of the firm's workers who are foreign-born. A sex identification variable exists on the LEHD data which is used to calculate the percentages of the workers who are male or female within each firm. Since all workers who earn at least one dollar are listed on the LEHD data set, I also calculate the average annual earnings of the workers for each firm within the state.

The only statistic that is not calculated by simply using a variable on the LEHD data set is education attainment. Education attainment is multiply-imputed for each worker by researchers in LEHD. Using the education imputation, I determine

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the percentage of workers in a firm with at least a college degree.

Unfortunately, not all of the forty-three state partners provide UI records for workers prior to the year 2000. One limitation of the LEHD data is that only twelve states provide data that go back to the mid-1990's. These twelve states are California, Florida, Idaho, Illinois, Maryland, Minnesota, Missouri, Montana, North Carolina, Oregon, Washington and Wisconsin. Using these states provides information about workers for 320,000 EINs and they employ approximately 23 million people. However, the advantage of having a longitudinal structure of this data set is that more states can be added in the future when later years of the Form 5500 become available.

Tables 1.18 and 1.19 show the descriptive statistics for firms that exist in these twelve states and offer pensions in 1997. To avoid redundancy, only data from the year 1997 are discussed. As seen in the tables, most of the EINs in the LEHD data that match are in California and employ most of the workers. Approximately, 25% of the EINs in the LEHD data are in California and 28% of the workers are in California. The smallest state that is represented from these twelve states is Montana. Only 1.25% of EINs are from this state and these firms employee approximately 1% of the total workers.

The percentage of employees with at least a college degree varies quite a bit among the twelve states. The state with the largest percentage of college-educated workers is Maryland with 45.4% while the state with the lowest percentage of workers is Wisconsin with 26.5%. Also, the state with the most diverse workforce is California with an average percentage of firms' employees who are white is 70.5%. The lease diverse is Montana in which the average percentage of the firms' employees who are white is 94.6%. The average annual earnings vary quite a bit as well. The state that has the highest annual earnings with an average of $50,112.34

is California, and the state with the lowest annual earnings is Montana, which has the average annual earnings of $31,565.43.

In Tables 1.18 and 1.19, I also have the average number of establishments with the same EIN within the twelve states separately. This number is low, averaging between one and two establishments within a state. Thus, it is not surprisingly that most of the firms that offer pensions within the twelve states are single establishments. Also, the average numbers of employees within a firm varies quite a bit as well. The state that has the largest average number of employees within a firm is Florida with approximately 86 employees per EIN. The state that has the smallest average of workers in one firm is Montana with approximately 35 employees.

Table 1.18: Descriptive Statistics of LEHD State Data that Matched to the Form 5500-U.S. Business Register Data Set in 1997

	California	Florida	Idaho	Illinois	Maryland	Minnesota
Average Number of Establishments (Standard Deviation)	**1.823** 10.428	**2.378** 50.038	**1.588** 3.252	**1.403** 5.396	**1.498** 4.89	**1.809** 6.018
Average Percentage of Workers age 45-99	**34.80%** 0.269	**37.88%** 0.291	**34.40%** 0.305	**35.30%** 0.278	**34.20%** 0.287	**32.00%** 0.272
Average Percentage of Foreign-Born Workers	**20.90%** 0.243	**14.30%** 0.224	**3.50%** 0.106	**9.60%** 0.172	**8.70%** 0.169	**3.40%** 0.099
Average Percentage of White Workers	**70.50%** 0.272	**81.60%** 0.229	**92.90%** 0.146	**84.20%** 0.215	**79.20%** 0.252	**93.10%** 0.134
Average Percentage of Black Workers	**3.23%** 0.084	**5.79%** 0.12	**0.40%** 0.147	**5.10%** 0.122	**12.40%** 0.199	**1.40%** 0.054
Average Percentage of Hispanic Workers	**11.30%** 0.166	**7.40%** 0.153	**2.10%** 0.068	**3.90%** 0.096	**1.50%** 0.062	**0.60%** 0.03
Average Percentage of 'Other Race' Workers	**11.20%** 0.188	**2.30%** 0.079	**1.90%** 0.077	**3.30%** 0.101	**3.30%** 0.106	**1.80%** 0.069
Average Percentage of Female Workers	**45.50%** 0.317	**44.20%** 0.332	**38.90%** 0.351	**41.30%** 0.32	**42.70%** 0.336	**38.60%** 0.321
Average Percentage of College-Educated Workers	**41.50%** 0.257	**38.00%** 0.271	**30.00%** 0.269	**37.60%** 0.266	**45.40%** 0.273	**34.00%** 0.268
Average Annual Earnings Within State	**50,112.34** 114384	**40,335.69** 33604	**41,244.19** 451804	**47,984.98** 57418	**39,317.76** 27903	**41,612.09** 52713
Average Total Workers Employed Within State	**81.373** 681.577	**86.124** 913.873	**46.891** 222.972	**71.741** 471.55	**58.513** 262.387	**69.39** 408.387
Total Number of EINs Within State	**81,466**	**40,206**	**5,145**	**48,262**	**21,078**	**22,249**
Total Number of Workers Within State	**6,583,213**	**3,368,736**	**239,815**	**3,438,882**	**1,130,111**	**1,441,004**

Table 1.19: Descriptive Statistics of LEHD State Data that Matched to the Form 5500-U.S. Business Register Data Set in 1997-Continued

	Missouri	Montana	North Carolina	Oregon	Washington	Wisconsin
Average Number of Establishments (Standard Deviation)	**1.75** 5.362	**1.455** 2.552	**2.043** 9.248	**1.504** 3.97	**1.532** 6.883	**1.552** 3.807
Average Percentage of Workers age 45-99	**34.80%** 0.274	**36.00%** 0.302	**34.10%** 0.283	**35.10%** 0.286	**32.30%** 0.284	**32.90%** 0.265
Average Percentage of Foreign-Born Workers	**3.00%** 0.099	**2.10%** 0.079	**3.90%** 0.111	**6.40%** 0.143	**8.30%** 0.16	**3.00%** 0.098
Average Percentage of White Workers	**90.50%** 0.17	**94.60%** 0.125	**85.00%** 0.206	**90.20%** 0.165	**88.30%** 0.179	**92.20%** 0.146
Average Percentage of Black Workers	**4.90%** 0.123	**0.30%** 0.031	**9.50%** 0.164	**1.00%** 0.047	**1.70%** 0.056	**2.20%** 0.146
Average Percentage of Hispanic Workers	**0.70%** 0.034	**0.60%** 0.04	**0.90%** 0.04	**2.10%** 0.069	**1.90%** 0.064	**0.90%** 0.041
Average Percentage of 'Other Race' Workers	**1.50%** 0.067	**1.80%** 0.069	**1.70%** 0.069	**3.20%** 0.093	**5.00%** 0.064	**1.40%** 0.062
Average Percentage of Female Workers	**39.50%** 0.332	**40.40%** 0.353	**40.00%** 0.335	**40.10%** 0.337	**41.50%** 0.35	**39.70%** 0.033
Average Percentage of College-Educated Workers	**34.30%** 0.274	**35.70%** 0.278	**35.50%** 0.28	**33.00%** 0.27	**36.50%** 0.275	**26.50%** 0.238
Average Annual Earnings Within State	**40,669.17** 46796	**31,565.43** 33126	**40,955.14** 38129	**39,204.62** 60164	**38,812.30** 48905	**36,982.78** 47248
Average Total Workers Employed Within State	**71.842** 396.549	**35.693** 122.472	**85.592** 502.196	**55.938** 286.889	**63.722** 689.012	**73.258** 311.404
Total Number of EINs Within State	**20,207**	**4,026**	**25,467**	**14,726**	**20,991**	**21,856**
Total Number of Workers Within State	**1,445,965**	**141,248**	**2,158,982**	**819,974**	**1,330,447**	**1,592,374**

Thus, using the LEHD data provides more details about the workers and provides some variation in the types of workers that are offered pensions. This information along with the pension information and the firm information makes this data set one of the most comprehensive data sets available which can be used to help understand the roles of pensions in the firm.

1.4 Comparisons to Public Use Files and Government-Provided Statistics

To understand how good this new data set is in representing pension coverage and pension effects on firms and workers in the United States, I make four comparisons. I first compare the coverage rates from the Form 5500-U.S. Census Business Register data set with coverage rates generated from the Current Population Survey (CPS) Annual Demographic files for years 1994 to 2001. I then compare trends in the number of defined benefit plans offered by firms in the same eight-year period with the number of defined benefit plans insured by the Pension Benefits Guaranty Corporation (PBGC). I then use the information from the CPS Annual Demographic files and the Social Security Administration's Detailed Earnings Records (DER) to determine if there are any mismatches between what employees say about their pension coverage and participation verses if their employers file a Form 5500. I finally determine if using information on EINs found only in the twelve states is adequate in discussing employee pension coverage by comparing the pension offerings in the national data set I created with those in the twelve-state subset.

1.4.1 Comparisons of Trends

I first compare coverage rates from the Form 5500-Business Register data set to coverage and participation rates that are estimated using the CPS Annual Demographic Files which is the March supplemental file. The estimates used for comparison are from years 1994-2001 and are based on answers from respondents who work in the private sector. These data sets are comparable because in both data sets all employees are age fifteen and older and work for firms that are part of the private sector. The question I use from the CPS to determine coverage rates is

"Other than Social Security, did the employer or union that [the respondent] worked for in 1997 have a pension plan for any of the employees?"

0: Not in Universe

1: Yes

2: No.

The question I used to determine participation rates is the follow-up question

"Was [the respondent] included in that plan?" (Given that the respondent said yes to the previous question?)

0: Not in Universe

1: Yes

2: No

Table 1.20 shows that the coverage rates found in the Form 5500-Business Register file are very close to those found in the CPS.

Table 1.20: Comparison of Coverage Rate Estimates from the CPS with Coverage Rate Estimates from the Form 5500-Business Register

	Coverage Rates Found in CPS for All Workers in Private Firrms	Coverage Rates Estimated Using the Form 5500 and Business Register for All Workers
1994	47.61%	49.87%
1995	50.82%	51.57%
1996	49.57%	50.92%
1997	53.91%	52.17%
1998	52.80%	52.51%
1999	50.49%	51.48%
2000	53.96%	52.87%
2001	53.26%	54.90%

I also compare the number of defined benefit plans found in the Form 5500 over the eight-year period to the number of defined benefit plans insured by the Pension Benefits Guaranty Corporation (PBGC). The PBGC protects the pensions of workers in private defined benefit pension plans. The PBGC insures most single-employer plans but excludes insuring plans offered by professional service firms

with less than twenty-six employees, by church groups and by federal, state or local governments. When comparing the number of defined benefit plans insured by PBGC to the number of the defined benefit plans found in the Form 5500-U.S. Census Bureau over the eight-year period, there is a parallel trend in the reduction in the number of defined benefit plans. Previously, I stated that the number of defined benefit plans offered by the firms in the Form 5500 declined by 41% from 1994 to 2001 and the number of EINs in the Form 5500-Business Register data that offer defined benefit plans dropped by 40% in the same period. Similarly, the number of defined benefit plans insured by the PBGC dropped by 41%. Table 1.21 compares the numbers.

Table 1.21 Comparisons of Number of DB Plans in Form 5500-Business Register File, Number of EINs Offering DB Plans from Form 5500-Business Register File and DB Plans Insured by the PBGC

Plan End Year	DB Plans Found in Form 5500-Business Register File	EINs offering DB Plans Found in Form 5500-Business Register File	Single-Employer DB Plans Insured by PBGC
1994	81,042	71,662	57,010
1995	75,218	66,485	53,589
1996	70,268	62,089	48,748
1997	65,070	57,468	43,902
1998	59,486	52,730	41,462
1999	46,523	41,380	37,536
2000	48,450	43,177	35,373
2001	48,300	42,709	32,954

1.4.2 Discussion of Mismatches Between Self-Reports and Administrative Files

Even though the comparisons of trends discussed earlier show that the coverage rates reported on the CPS and the rates calculated from the Form 5500–Business Register are close, it is important to determine if on an individual basis, the data set correctly identifies who is eligible. To determine this, I make additional comparisons using estimates I calculate using the responses from the CPS Annual

Demographic files for years 1994-2001. Using Social Security Administration's Detailed Earnings Records (DER) file available in LEHD, I am able to determine a work history for most of the CPS workers who respond to questions about the jobs. With this added information, I compare whether the CPS responses about pensions are consistent to results I have in my data set. I first compare what respondents say about their dominant or primary employers offering pensions to whether their employers filed a Form 5500 form with the IRS and DOL or not. Again, the variable used to represent pension eligibility corresponds to the response to the CPS question:

"Other than Social Security, did the employer or union that [the respondent] worked for in 1997 have a pension plan for any of the employees?"

0: Not in Universe

1: Yes

2: No

The variable used to represent pension plan participation corresponds to the response to the follow-up CPS question discussed earlier:

"Was [the respondent] included in that plan?" (Given that the respondent said yes to the previous question?)

0: Not in Universe

1: Yes

2: No

I use only CPS respondents identified as full-time employees working in the private sector.

Table 1.22: CPS Responses Regarding Whether the Dominant Employer Provided Pensions in 1997

Worker Resonse to CPS	The Firm has a Pension Plan in the Form 5500		
	Yes	No	Total
Yes, my employer provides a pension plan	**30,543**	**7,578**	**38,121**
(Row Percentage)	80.12%	19.88%	100.00%
(Column Percentage)	76.78%	35.64%	62.45%
(Cell Percentages)	50.04%	12.42%	
No, my employer does not provide a pension plan	**9,236**	**13,682**	**22,918**
	40.30%	59.70%	100.00%
	23.22%	64.36%	37.55%
	15.13%	22.42%	
Total	**39,779**	**21,260**	**61,039**
	65.17%	34.83%	100.00%
	100.00%	100.00%	100.00%

Total 1.23: CPS Responses Regarding Whether the Worker Is Included in the Dominant Employer's Pension Plan in 1997

Worker Resonse to CPS	The Firm has a Pension Plan in the Form 5500		
	Yes	No	Total
Yes, I am included in a pension plan through my employer	**25,034**	**5,563**	**30,597**
(Row Percentage)	81.82%	18.18%	100.00%
(Column Percentage)	81.96%	73.40%	80.26%
(Cell Percentages)	65.67%	14.59%	
No, I am not included in a pension plan through my employer	**5,509**	**2,016**	**7,525**
	73.21%	26.79%	100.00%
	18.04%	26.60%	19.74%
	14.45%	5.29%	
Total	**30,543**	**7,579**	**38,122**
	80.12%	19.88%	100.00%
	100.00%	100.00%	100.00%

Table 1.22 shows the results of comparing the responses to whether the employer offering a pension plan to whether the primary employer filed a pension plan with the Form 5500 for year 1997. Most of these workers in the CPS responded correctly that their employer provided a pension plan or not. However, 12.42% of

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the workers in the CPS said their employer offers a pension plan, but the employer is not found in the Business Register and 15.13% of workers said their employer does not offer a pension plan, but the employer is found in the Form 5500. Table 1.23 shows the results of comparing whether the workers participate in a pension plan to whether their primary employer filed a pension plan with the Form 5500 for year 1997. Approximately 66% of the workers responded in the CPS to having employer-sponsored pension work for an employer found in the Form 5500. However, approximately 15% of the workers responded to having a pension plan, but the employer is not found in the Form 5500.

Thus, it seems that comparing administrative data to self-reports lead to some discord between what respondents say and verses what firms report. However, many researchers have noted that some workers do not fully understand their own pension plan eligibility and participation rules in their firms. This is a common problem among firms when communicating their benefit package to their employees. Therefore, one should not simply dismiss this new data set because the pension coverage outcomes are different than those calculated using CPS responses. It may be that some workers are reporting their pension eligibility and coverage erroneously.

1.4.3   National Data Set Verses Twelve State Data Set

As mentioned above, the biggest limitation with the LEHD data is that most states provide data beginning in year 2000 or later, so only twelve states are used to include worker characteristics. These twelve states represent 34.86% of the U.S. Population. To determine if using a subset of EINs which include employee information is still appropriate for analyses even though it includes firms from only twelve states, I compare the percentage of firms that offer different pension plans and pension coverage rates from the Form 5500-Business Register data to

the percentage of firms that offer different pension plans and pension coverage rates from the twelve-state subset. Table 1.24 shows the number of firms and employees with only a defined benefit plan, the number of firms with only a defined contribution plans, and the number of firms with both pension plans from the Form 5500-Business Register data and from the twelve-state subset. In Table 1.24, the percentage of firms that offer only a defined benefit plan in the national data set is close to the percentage of firms that offer defined benefit plans in the twelve-state data set. However, the percentage of firms that offer both a defined benefit plan and a defined contribution plan is half the percentage of firms offering both plans and exist in only the twelve states. The percentage of people who are eligible for a defined contribution plan is slightly higher for firms within the twelve states than the workers in the national data set. However, the workers who are eligible for only a defined benefit plan or both types of plans is slightly smaller for the workers in firms that exist in the twelve states than those that are employed in the national data set.

Table 1.24: Comparison of the National Data Set to the 12-State Data Set That Includes Employee Information

	Firms from National Set Created in First Integration		Unique Firms from 12 States Created in Second Integration	
	Firms	Employees	Number of Firms	Employees
Defined Benefit Plans Only	30,540	2,473,261	11,343	651,557
(Column Percentages)	4.92%	3.80%	3.52%	2.75%
Defined Contribution Plans Only	538,010	34,214,349	258,689	13,791,171
	86.74%	52.59%	80.32%	58.21%
Defined Benefit Plans and Defined Contribution Plans	51,700	28,365,822	52,048	9,248,021
	8.34%	43.60%	16.16%	39.04%
Total	620,250	65,053,432	322,080	23,690,749
	100.00%	100.00%	100.00%	100.00%

Although the pension coverage estimates is slightly different, I believe the data set is still a good source to be used for studying the role of pensions in the firms.

The twelve-state data set is appropriate because although this sample uses data from twelve states that covers 34.86% of the population, this data set includes much more information about the employees of these firms. This added information will become very useful when determining if certain types of workers respond differently when offered certain types of pensions or not.

1.5 Reasons for Non-Matches when Integrating the Data

Although the Form 5500-Business Register-LEHD data set provides good estimates for pension eligibility, it does not include all private firms. There are some EINs on the Form 5500 that are not matched to any EINs in the U.S. Business Register, and there are EINs in the U.S. Census Business Register which are commonly known to have a pension plan, but are not listed on the Form 5500 file. It is important to look at the information provided in the Form 5500 and the U.S. Business Register to fully understand why some firms are not identified as having a pension plan.

1.5.1 Reasons Why Form 5500 EINs Are Not Found on the Business Register

When trying to identify firms that offer pensions using the Form 5500, there are limitations to what is available on the Form 5500 file. One reason why some firms are not part of this data set is because the firm is listed under a different EIN on the Business Register. It is not unusual for a firm to change its EIN. Because of timing differences between when the Form 5500 is filed and when the firm's tax return is filed, this may create some problems. Another reason why there is no match is because the EIN on the Form 5500 may be coded incorrectly. The Form 5500 data as provided is very messy. Unfortunately, without more specific information there is no way, other than with an EIN, to determine if these firms are the same as the some of ones listed on the U.S. Business Register. Another reason why a firm on the Form 5500 may not be found in the Business Register is

because the EIN listed on the Form 5500 is an administrative EIN. Administrative EINs are not considered active EINs and are dropped. A final reason why some EINs on the Form 5500 file are not found on the Business Register is because they are public administrative firms. Public administrative firms are excluded from the U.S. Census Business Register.

1.5.2 Reasons Why Business Register EINs Are Not Found in the Form 5500

Although the U.S. Census Business Register is very useful, some of the EINs listed on the file may not have a match. As a result, there are firms that are not identified as offering a pension plan even though they do provide one. The primary reason why some EINs from the Business Register do not have a match is because, as stated before, some of the firms are not obligated to file a Form 5500 form to the IRS and DOL. Some firms are exempt from filing their pension plan specifications if the plans are, for example, SIMPLE or SEP plans. This is quite a problem for some of the small firms which typically offer SEP and SIMPLE plans.

Thus, even though this data set is much more comprehensive on what types of firms are offering pensions and what types are workers are eligible for these pensions, the data set still does not have all firms that offer pension plans to its workers. However, the integration of the Form 5500 to the Business Register is very successful with approximately 95% of the EINs from the Form 5500 matching. This data set along with the information about employees located in the twelve states from the LEHD data provides much more information than any previously used data sets.

1.6   Conclusions

This paper discusses a new data set that is created by integrating information from the Form 5500, the U.S. Census Business Register and the LEHD state data. This

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data set includes all private firms in the U.S. and is longitudinal covering years 1994 to 2001. It is much more complete than any other data set because not only does it have a list of firms that offer pensions, it also includes the company structure and descriptive statistics about the firms' workforce such as age and sex profiles as well as firm characteristics like sales information and industry classification.

The results of the integration show that in 1997, 4.92% of firms offer a defined benefit plan, 86.74% offer only a defined contribution plan, and 8.34% offer both. The employee coverage rates are also quite interesting. A large percentage of employees are eligible for both a defined benefit plan and a defined contribution plan. As discussed, there is a trend demonstrating that the number of firms offering defined benefit plans is dropping. There number of firms offering defined contribution plans, however, is increasing.

There are several limitations to this data set. One limitation in this data set is that there is little information about the pensions themselves. There is no information about accrual rates or eligibility requirements. There is also no information about changes in the pension formulas. The data set may also erroneously imply that the employees that work for a firm which offers both a defined benefit plan and a defined contribution plan are eligible for both. In actuality, it is possible that only one part of the firm's workforce is eligible for a defined benefit plans and the other part is eligible for only the defined contribution plan. Also, the total number of employees includes part-time and leased workers, so the total number of workers eligible for a pension plan may be overstated. Overall, however, after comparing this data set with other pension coverage and participation estimates from other sources, this data set clearly can be used for further research about pensions. This data set provides which firms are offering pensions and what types of workers are eligible for them.

1.7 Appendix A

Table 1.25: Single-Unit EINs by Firm Size for Year 1994

	Singl- Unit Valid Matches	Single-Unit Non Matches	Total
No Employees	**10,653**	**952,607**	**963,260**
(Row Percentages)	1.11%	98.89%	100.00%
(Column Percentages)	2.53%	18.87%	17.61%
1-4 Employees	**106,888**	**2,448,469**	**2,555,357**
	4.18%	95.82%	100.00%
	25.42%	48.50%	46.72%
5-24 Employees	**207,017**	**1,397,070**	**1,604,087**
	12.91%	87.09%	100.00%
	49.24%	27.67%	29.33%
25-99 Employees	**77,976**	**208,953**	**286,929**
	27.18%	72.82%	100.00%
	18.55%	4.14%	5.25%
100-499 Employees	**16,490**	**34,827**	**51,317**
	32.13%	67.87%	100.00%
	3.92%	0.69%	0.94%
500-999 Employees	**892**	**3,746**	**4,638**
	19.23%	80.77%	100.00%
	0.21%	0.07%	0.08%
1000-2499 Employees	**439**	**1,998**	**2,437**
	18.01%	81.99%	100.00%
	0.10%	0.04%	0.04%
2500 or More Employees	**99**	**926**	**1,025**
	9.66%	90.34%	100.00%
	0.02%	0.02%	0.02%
Total	**420,454**	**5,048,596**	**5,469,050**
	7.69%	92.31%	100.00%
	100.00%	100.00%	100.00%

Table 1.26: Single-Unit EINs by Firm Size for Year 1995

	Singl- Unit Valid Matches	Single-Unit Non Matches	Total
No Employees	10,954	939,805	950,759
(Row Percentages)	1.15%	98.85%	100.00%
(Column Percentages)	2.53%	18.33%	17.10%
1-4 Employees	104,153	2,496,195	2,600,348
	4.01%	95.99%	100.00%
	24.09%	48.68%	46.77%
5-24 Employees	211,039	1,431,896	1,642,935
	12.85%	87.15%	100.00%
	48.82%	27.92%	29.55%
25-99 Employees	85,998	217,126	303,124
	28.37%	71.63%	100.00%
	19.89%	4.23%	5.45%
100-499 Employees	18,618	36,019	54,637
	34.08%	65.92%	100.00%
	4.31%	0.70%	0.98%
500-999 Employees	965	3,867	4,832
	19.97%	80.03%	100.00%
	0.22%	0.08%	0.09%
1000-2499 Employees	476	2,032	2,508
	18.98%	81.02%	100.00%
	0.11%	0.04%	0.05%
2500 or More Employees	115	936	1,051
	10.94%	89.06%	100.00%
	0.03%	0.02%	0.02%
Total	432,318	5,127,876	5,560,194
	7.78%	92.22%	100.00%
	100.00%	100.00%	100.00%

Table 1.27: Single-Unit EINs by Firm Size for Year 1996

	Singl- Unit Valid Matches	Single-Unit Non Matches	Total
No Employees	11,465	948,928	960,393
(Row Percentages)	1.19%	98.81%	100.00%
(Column Percentages)	2.54%	18.15%	16.91%
1-4 Employees	101,896	2,547,559	2,649,455
	3.85%	96.15%	100.00%
	22.59%	48.72%	46.64%
5-24 Employees	219,738	1,467,237	1,686,975
	13.03%	86.97%	100.00%
	48.71%	28.06%	29.70%
25-99 Employees	95,490	222,186	317,676
	30.06%	69.94%	100.00%
	21.17%	4.25%	5.59%
100-499 Employees	20,786	36,624	57,410
	36.21%	63.79%	100.00%
	4.61%	0.70%	1.01%
500-999 Employees	1,077	3,963	5,040
	21.37%	78.63%	100.00%
	0.24%	0.08%	0.09%
1000-2499 Employees	499	2,066	2,565
	19.45%	80.55%	100.00%
	0.11%	0.04%	0.05%
2500 or More Employees	118	920	1,038
	11.37%	88.63%	100.00%
	0.03%	0.02%	0.02%
Total	451,069	5,229,483	5,680,552
	7.94%	92.06%	100.00%
	100.00%	100.00%	100.00%

Table 1.28: Single-Unit EINs by Firm Size for Year 1997

	Singl- Unit Valid Matches	Single-Unit Non Matches	Total
No Employees	12,024	945,134	957,158
(Row Percentages)	1.26%	98.74%	100.00%
(Column Percentages)	2.71%	18.24%	17.02%
1-4 Employees	99,329	2,544,468	2,643,797
	3.76%	96.24%	100.00%
	22.35%	49.12%	47.00%
5-24 Employees	216,429	1,440,204	1,656,633
	13.06%	86.94%	100.00%
	48.70%	27.80%	29.45%
25-99 Employees	94,533	208,890	303,423
	31.16%	68.84%	100.00%
	21.27%	4.03%	5.39%
100-499 Employees	20,469	34,722	55,191
	37.09%	62.91%	100.00%
	4.61%	0.67%	0.98%
500-999 Employees	1,049	3,908	4,957
	21.16%	78.84%	100.00%
	0.24%	0.08%	0.09%
1000-2499 Employees	448	2,099	2,547
	17.59%	82.41%	100.00%
	0.10%	0.04%	0.05%
2500 or More Employees	100	921	1,021
	9.79%	90.21%	100.00%
	0.02%	0.02%	0.02%
Total	444,381	5,180,346	5,624,727
	7.90%	92.10%	100.00%
	100.00%	100.00%	100.00%

Table 1.29: Single-Unit EINs by Firm Size for Year 1998

	Singl- Unit Valid Matches	Single-Unit Non Matches	Total
No Employees	12,028	933,170	945,198
(Row Percentages)	0.01	0.99	1.00
(Column Percentages)	0.03	0.18	0.17
1-4 Employees	96,999	2,596,522	2,693,521
	0.04	0.96	1.00
	0.21	0.49	0.47
5-24 Employees	221,571	1,477,716	1,699,287
	0.13	0.87	1.00
	0.49	0.28	0.30
25-99 Employees	101,129	216,257	317,386
	0.32	0.68	1.00
	0.22	0.04	0.06
100-499 Employees	21,290	35,787	57,077
	0.37	0.63	1.00
	0.05	0.01	0.01
500-999 Employees	1,037	4,039	5,076
	0.20	0.80	1.00
	0.00	0.00	0.00
1000-2499 Employees	441	2,149	2,590
	0.17	0.83	1.00
	0.00	0.00	0.00
2500 or More Employees	106	976	1,082
	0.10	0.90	1.00
	0.00	0.00	0.00
Total	454,601	5,266,616	5,721,217
	0.08	0.92	1.00
	1.00	1.00	1.00

Table 1.30: Single-Unit EINs by Firm Size for Year 1999

	Singl- Unit Valid Matches	Single-Unit Non Matches	Total
No Employees	10,218	929,919	940,137
(Row Percentages)	1.09%	98.91%	100.00%
(Column Percentages)	2.45%	17.41%	16.33%
1-4 Employees	83,415	2,626,954	2,710,369
	3.08%	96.92%	100.00%
	20.02%	49.18%	47.07%
5-24 Employees	202,877	1,511,098	1,713,975
	11.84%	88.16%	100.00%
	48.68%	28.29%	29.77%
25-99 Employees	97,062	228,769	325,831
	29.79%	70.21%	100.00%
	23.29%	4.28%	5.66%
100-499 Employees	21,338	37,165	58,503
	36.47%	63.53%	100.00%
	5.12%	0.70%	1.02%
500-999 Employees	1,188	4,078	5,266
	22.56%	77.44%	100.00%
	0.29%	0.08%	0.09%
1000-2499 Employees	522	2,131	2,653
	19.68%	80.32%	100.00%
	0.13%	0.04%	0.05%
2500 or More Employees	125	995	1,120
	11.16%	88.84%	100.00%
	0.03%	0.02%	0.02%
Total	416,745	5,341,109	5,757,854
	7.24%	92.76%	100.00%
	100.00%	100.00%	100.00%

Table 1.31: Single-Unit EINs by Firm Size for Year 2000

	Singl- Unit Valid Matches	Single-Unit Non Matches	Total
No Employees	11,891	939,983	951,874
(Row Percentages)	1.25%	98.75%	100.00%
(Column Percentages)	2.70%	17.54%	16.41%
1-4 Employees	85,864	2,610,172	2,696,036
	3.18%	96.82%	100.00%
	19.51%	48.70%	46.49%
5-24 Employees	212,052	1,528,217	1,740,269
	12.19%	87.81%	100.00%
	48.19%	28.51%	30.01%
25-99 Employees	103,835	236,274	340,109
	30.53%	69.47%	100.00%
	23.60%	4.41%	5.86%
100-499 Employees	24,231	37,649	61,880
	39.16%	60.84%	100.00%
	5.51%	0.70%	1.07%
500-999 Employees	1,395	4,164	5,559
	25.09%	74.91%	100.00%
	0.32%	0.08%	0.10%
1000-2499 Employees	620	2,155	2,775
	22.34%	77.66%	100.00%
	0.14%	0.04%	0.05%
2500 or More Employees	151	1,031	1,182
	12.77%	87.23%	100.00%
	0.03%	0.02%	0.02%
Total	440,039	5,359,645	5,799,684
	7.59%	92.41%	100.00%
	100.00%	100.00%	100.00%

Table 1.32: Single-Unit EINs by Firm Size for Year 2001

	Singl- Unit Valid Matches	Single-Unit Non Matches	Total
No Employees	**11,495**	**920,271**	**931,766**
(Row Percentages)	1.23%	98.77%	100.00%
(Column Percentages)	2.55%	17.20%	16.06%
1-4 Employees	**84,782**	**2,618,831**	**2,703,613**
	3.14%	96.86%	100.00%
	18.82%	48.95%	46.61%
5-24 Employees	**217,130**	**1,527,940**	**1,745,070**
	12.44%	87.56%	100.00%
	48.20%	28.56%	30.09%
25-99 Employees	**108,996**	**237,261**	**346,257**
	31.48%	68.52%	100.00%
	24.20%	4.44%	5.97%
100-499 Employees	**25,752**	**37,871**	**63,623**
	40.48%	59.52%	100.00%
	5.72%	0.71%	1.10%
500-999 Employees	**1,451**	**4,180**	**5,631**
	25.77%	74.23%	100.00%
	0.32%	0.08%	0.10%
1000-2499 Employees	**678**	**2,202**	**2880**
	23.54%	76.46%	100.00%
	0.15%	0.04%	0.05%
2500 or More Employees	**162**	**1,055**	**1217**
	13.31%	86.69%	100.00%
	0.04%	0.02%	0.02%
Total	**450,446**	**5,349,611**	**5,800,057**
	7.77%	92.23%	100.00%
	100.00%	100.00%	100.00%

Table 1.33: Multi-Unit EINs by Firm Size for Year 1994

	Multi-Unit Alphas Through Valid EINs	Multi-Unit Alphas Through Invalid	No Matches	Total
No Employees	958	85	11,364	12,407
(Row Percentages)	7.72%	0.69%	91.59%	100.00%
(Column Percentages)	1.12%	9.74%	9.17%	5.91%
1-4 Employees	1,515	38	10,236	11,789
	12.85%	0.32%	86.83%	100.00%
	1.78%	4.35%	8.26%	5.61%
5-24 Employees	19,112	100	53,226	72,438
	26.38%	0.14%	73.48%	100.00%
	22.42%	11.45%	42.97%	34.49%
25-99 Employees	31,653	188	34,370	66,211
	47.81%	0.28%	51.91%	100.00%
	37.13%	21.53%	27.74%	31.53%
100-499 Employees	22,348	265	12,591	35,204
	63.48%	0.75%	35.77%	100.00%
	26.21%	30.36%	10.16%	16.76%
500-999 Employees	4,126	74	1,239	5,439
	75.86%	1.36%	22.78%	100.00%
	4.84%	8.48%	1.00%	2.59%
1000-2499 Employees	2,991	66	614	3,671
	81.48%	1.80%	16.73%	100.00%
	3.51%	7.56%	0.50%	1.75%
2500 or More Employees	2,556	57	240	2,853
	89.59%	2.00%	8.41%	100.00%
	3.00%	6.53%	0.19%	1.36%
Total	85,259	873	123,880	210,012
	40.60%	0.42%	58.99%	100.00%
	100.00%	100.00%	100.00%	100.00%

Table 1.34: Multi-Unit EINs by Firm Size for Year 1995

	Multi-Unit Alphas Through Valid EINs	Multi-Unit Alphas Through Invalid	No Matches	Total
No Employees	1,324	112	15,184	16,620
(Row Percentages)	7.97%	0.67%	91.36%	100.00%
(Column Percentages)	1.53%	12.57%	12.54%	7.97%
1-4 Employees	1,578	37	10,459	12,074
	13.07%	0.31%	86.62%	100.00%
	1.83%	4.15%	8.64%	5.79%
5-24 Employees	18,755	95	49,354	68,204
	27.50%	0.14%	72.36%	100.00%
	21.69%	10.66%	40.76%	32.72%
25-99 Employees	31,827	168	32,012	64,007
	49.72%	0.26%	50.01%	100.00%
	36.81%	18.86%	26.44%	30.71%
100-499 Employees	23,001	258	11,970	35,229
	65.29%	0.73%	33.98%	100.00%
	26.60%	28.96%	9.88%	16.90%
500-999 Employees	4,225	90	1,219	5,534
	76.35%	1.63%	22.03%	100.00%
	4.89%	10.10%	1.01%	2.65%
1000-2499 Employees	3,081	67	620	3,768
	81.77%	1.78%	16.45%	100.00%
	3.56%	7.52%	0.51%	1.81%
2500 or More Employees	2,668	64	276	3,008
	88.70%	2.13%	9.18%	100.00%
	3.09%	7.18%	0.23%	1.44%
Total	86,459	891	121,094	208,444
	41.48%	0.43%	58.09%	100.00%
	100.00%	100.00%	100.00%	100.00%

Table 1.35: Multi-Unit EINs by Firm Size for Year 1996

	Multi-Unit Alphas Through Valid EINs	Multi-Unit Alphas Through Invalid	No Matches	Total
No Employees	1,062	29	6,534	7,625
(Row Percentages)	13.93%	0.38%	85.69%	100.00%
(Column Percentages)	1.34%	5.26%	7.20%	4.47%
1-4 Employees	1,122	13	6,478	7,613
	14.74%	0.17%	85.09%	100.00%
	1.42%	2.36%	7.14%	4.46%
5-24 Employees	15,314	35	37,690	53,039
	28.87%	0.07%	71.06%	100.00%
	19.32%	6.35%	41.54%	31.10%
25-99 Employees	29,580	81	27,244	56,905
	51.98%	0.14%	47.88%	100.00%
	37.31%	14.70%	30.03%	33.36%
100-499 Employees	22,105	221	10,745	33,071
	66.84%	0.67%	32.49%	100.00%
	27.88%	40.11%	11.84%	19.39%
500-999 Employees	4,216	64	1,160	5,440
	77.50%	1.18%	21.32%	100.00%
	5.32%	11.62%	1.28%	3.19%
1000-2499 Employees	3,180	60	592	3,832
	82.99%	1.57%	15.45%	100.00%
	4.01%	10.89%	0.65%	2.25%
2500 or More Employees	2,699	48	282	3,029
	89.11%	1.58%	9.31%	100.00%
	3.40%	8.71%	0.31%	1.78%
Total	79,278	551	90,725	170,554
	46.48%	0.32%	53.19%	100.00%
	100.00%	100.00%	100.00%	100.00%

Table 1.36: Multi-Unit EINs by Firm Size for Year 1997

	Multi-Unit Alphas Through Valid EINs	Multi-Unit Alphas Through Invalid	No Matches	Total
No Employees	405	36	2,444	2,885
(Row Percentages)	14.04%	1.25%	84.71%	100.00%
(Column Percentages)	0.43%	3.57%	2.29%	1.43%
1-4 Employees	1,072	51	6,600	7,723
	13.88%	0.66%	85.46%	100.00%
	1.14%	5.06%	6.18%	3.83%
5-24 Employees	19,347	125	48,190	67,662
	28.59%	0.18%	71.22%	100.00%
	20.61%	12.40%	45.11%	33.54%
25-99 Employees	37,067	269	34,752	72,088
	51.42%	0.37%	48.21%	100.00%
	39.48%	26.69%	32.53%	35.73%
100-499 Employees	25,253	338	12,630	38,221
	66.07%	0.88%	33.04%	100.00%
	26.90%	33.53%	11.82%	18.95%
500-999 Employees	4,629	72	1,302	6,003
	77.11%	1.20%	21.69%	100.00%
	4.93%	7.14%	1.22%	2.98%
1000-2499 Employees	3,300	64	613	3,977
	82.98%	1.61%	15.41%	100.00%
	3.51%	6.35%	0.57%	1.97%
2500 or More Employees	2,815	53	303	3,171
	88.77%	1.67%	9.56%	100.00%
	3.00%	5.26%	0.28%	1.57%
Total	93,888	1,008	106,834	201,730
	46.54%	0.50%	52.96%	100.00%
	100.00%	100.00%	100.00%	100.00%

Table 1.37: Multi-Unit EINs by Firm Size for Year 1998

	Multi-Unit Alphas Through Valid EINs	Multi-Unit Alphas Through Invalid	No Matches	Total
No Employees	**979**	**63**	**5,708**	**6,750**
(Row Percentages)	14.50%	0.93%	84.56%	100.00%
(Column Percentages)	1.06%	6.46%	5.36%	3.37%
1-4 Employees	**1,255**	**41**	**6,851**	**8,147**
	15.40%	0.50%	84.09%	100.00%
	1.35%	4.21%	6.44%	4.07%
5-24 Employees	**18,457**	**119**	**45,055**	**63,631**
	29.01%	0.19%	70.81%	100.00%
	19.91%	12.21%	42.33%	31.79%
25-99 Employees	**36,370**	**214**	**33,728**	**70,312**
	51.73%	0.30%	47.97%	100.00%
	39.22%	21.95%	31.69%	35.13%
100-499 Employees	**24,968**	**314**	**12,746**	**38,028**
	65.66%	0.83%	33.52%	100.00%
	26.93%	32.21%	11.97%	19.00%
500-999 Employees	**4,538**	**88**	**1,335**	**5,961**
	76.13%	1.48%	22.40%	100.00%
	4.89%	9.03%	1.25%	2.98%
1000-2499 Employees	**3,299**	**70**	**686**	**4,055**
	81.36%	1.73%	16.92%	100.00%
	3.56%	7.18%	0.64%	2.03%
2500 or More Employees	**2,858**	**66**	**335**	**3,259**
	87.70%	2.03%	10.28%	100.00%
	3.08%	6.77%	0.31%	1.63%
Total	**92,724**	**975**	**106,444**	**200,143**
	46.33%	0.49%	53.18%	100.00%
	100.00%	100.00%	100.00%	100.00%

Table 1.38: Multi-Unit EINs by Firm Size for Year 1999

	Multi-Unit Alphas Through Valid EINs	Multi-Unit Alphas Through Invalid	No Matches	Total
No Employees	**1,464**	**74**	**12,299**	**13,837**
(Row Percentages)	10.58%	0.53%	88.88%	100.00%
(Column Percentages)	1.72%	7.65%	10.81%	6.93%
1-4 Employees	**1,133**	**44**	**7,449**	**8,626**
	13.13%	0.51%	86.36%	100.00%
	1.33%	4.55%	6.55%	4.32%
5-24 Employees	**16,034**	**69**	**44,048**	**60,151**
	26.66%	0.11%	73.23%	100.00%
	18.88%	7.14%	38.72%	30.12%
25-99 Employees	**32,468**	**197**	**33,928**	**66,593**
	48.76%	0.30%	50.95%	100.00%
	38.22%	20.37%	29.82%	33.35%
100-499 Employees	**23,335**	**325**	**13,421**	**37,081**
	62.93%	0.88%	36.19%	100.00%
	27.47%	33.61%	11.80%	18.57%
500-999 Employees	**4,415**	**93**	**1,474**	**5,982**
	73.80%	1.55%	24.64%	100.00%
	5.20%	9.62%	1.30%	3.00%
1000-2499 Employees	**3,242**	**86**	**749**	**4,077**
	79.52%	2.11%	18.37%	100.00%
	3.82%	8.89%	0.66%	2.04%
2500 or More Employees	**2,849**	**79**	**405**	**3,333**
	85.48%	2.37%	12.15%	100.00%
	3.35%	8.17%	0.36%	1.67%
Total	**84,940**	**967**	**113,773**	**199,680**
	42.54%	0.48%	56.98%	100.00%
	100.00%	100.00%	100.00%	100.00%

Table 1.39: Multi-Unit EINs by Firm Size for Year 2000

	Multi-Unit Alphas Through Valid EINs	Multi-Unit Alphas Through Invalid	No Matches	Total
No Employees	1,793	79	16,242	18,114
(Row Percentages)	9.90%	0.44%	89.67%	100.00%
(Column Percentages)	2.10%	7.70%	14.63%	9.18%
1-4 Employees	1,139	40	7,446	8,625
	13.21%	0.46%	86.33%	100.00%
	1.34%	3.90%	6.71%	4.37%
5-24 Employees	15,468	87	41,126	56,681
	27.29%	0.15%	72.56%	100.00%
	18.14%	8.48%	37.03%	28.72%
25-99 Employees	31,851	199	31,548	63,598
	50.08%	0.31%	49.61%	100.00%
	37.34%	19.40%	28.41%	32.22%
100-499 Employees	24,138	348	12,311	36,797
	65.60%	0.95%	33.46%	100.00%
	28.30%	33.92%	11.09%	18.64%
500-999 Employees	4,616	106	1,342	6,064
	76.12%	1.75%	22.13%	100.00%
	5.41%	10.33%	1.21%	3.07%
1000-2499 Employees	3,274	82	697	4,053
	80.78%	2.02%	17.20%	100.00%
	3.84%	7.99%	0.63%	2.05%
2500 or More Employees	3,010	85	335	3,430
	87.76%	2.48%	9.77%	100.00%
	3.53%	8.28%	0.30%	1.74%
Total	85,289	1,026	111,047	197,362
	43.21%	0.52%	56.27%	100.00%
	100.00%	100.00%	100.00%	100.00%

Table 1.40: Multi-Unit EINs by Firm Size for Year 2001

	Multi-Unit Alphas Through Valid EINs	Multi-Unit Alphas Through Invalid	No Matches	Total
No Employees	**550**	**25**	**2,549**	**3,124**
(Row Percentages)	17.61%	0.80%	81.59%	100.00%
(Column Percentages)	0.71%	2.67%	3.16%	1.96%
1-4 Employees	**890**	**16**	**5,145**	**6,051**
	14.71%	0.26%	85.03%	100.00%
	1.15%	1.71%	6.37%	3.80%
5-24 Employees	**12,943**	**53**	**32,664**	**45,660**
	28.35%	0.12%	71.54%	100.00%
	16.69%	5.67%	40.46%	28.68%
25-99 Employees	**28,820**	**200**	**27,136**	**56,156**
	51.32%	0.36%	48.32%	100.00%
	37.17%	21.39%	33.61%	35.27%
100-499 Employees	**23,559**	**343**	**10,969**	**34,871**
	67.56%	0.98%	31.46%	100.00%
	30.38%	36.68%	13.59%	21.90%
500-999 Employees	**4,572**	**112**	**1,298**	**5,982**
	76.43%	1.87%	21.70%	100.00%
	5.90%	11.98%	1.61%	3.76%
1000-2499 Employees	**3,252**	**90**	**654**	**3,996**
	81.38%	2.25%	16.37%	100.00%
	4.19%	9.63%	0.81%	2.51%
2500 or More Employees	**2,960**	**96**	**324**	**3,380**
	87.57%	2.84%	9.59%	100.00%
	3.82%	10.27%	0.40%	2.12%
Total	**77,546**	**935**	**80,739**	**159,220**
	48.70%	0.59%	50.71%	100.00%
	100.00%	100.00%	100.00%	100.00%

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Chapter 2

Do Changes in Deferred Compensation Lead to Changes in Productivity?

2.1   Introduction

One important theory in personnel economics discusses the effects of pensions on employee behavior and productivity. How do certain compensation packages simultaneously allocate productivity gains and discourage layoffs and quits? How do compensation and benefits provide incentives to attract quality workers? How sensitive is worker behavior to pensions and what specific changes in behavior are elicited when pensions change? Although there is much research on these questions, there are no conclusive answers. This is because of the lack of data. There are many theoretical models that demonstrate that pensions play an important role in enhancing productivity and lowering turnover. However, empirical evidence on how exactly pensions affect productivity and turnover is debatable.

The relationship between pensions and productivity is undetermined for one main reason. Most data used in this research prevent economists from directly testing the theory. Since pensions and productivity are considered endogenous, instrumental variables must be used. However, appropriate instrumental variables are unavailable in most data sets. Thus, the best any researcher can do is to indirectly test the theory by showing some association between pensions and productivity and between pensions and employee behavior.

In this paper, I contribute significantly to this research by being the first to directly test how pensions affect productivity and employee behavior. I do this by creating a new data set in which I integrate administrative files from three different sources: the Form 5500, U.S. Business Register, and the Longitudinal Employer-Household Dynamics (LEHD) program. This unique data set provides detailed,

longitudinal information about the firms including their pension benefit structure and demographic information about their workers. In addition to whether or not a firm offers a certain type of pension, this data set also has other variables associated with pensions that can be used as instruments. In this paper, I use a subset of this data set to tackle the issue of how changing pensions affect productivity and employee behavior. Particularly, I examine how workers' behavior, worker attraction and retention, and productivity change after a firm changes its pension from a defined benefit plan to a defined contribution plan.

Thus, this paper is two fold. The first objective is to introduce the new longitudinal data set in which the unit of observation is the firm and contains information about the firm's industry classification, imputed total sales, employment size, firm age and pension benefits as well as the characteristics of a firm's employees including their wages, turnover rates, age, education attainment, gender and race. The second objective is to determine if converting defined benefit plans to defined contribution plans affect productivity in the firm. The paper is organized as follows. The second section provides background information on pensions. The third section discusses the reasons why firms convert their defined benefit plan to defined contribution plan. The fourth section discusses the discrepancies in previous research on how providing defined benefit plans affect productivity. The fifth section discusses my theoretical model on how defined benefit plans are used as incentives and replacing these plans with defined contribution plans affect productivity. The sixth section describes in more detail the new longitudinal data set I created using the Form 5500 information, Unites States Business Register and LEHD data. The seventh section discusses the empirical results. The eighth section has concluding remarks. The ninth section has ideas for future research.

2.2 Overview

Pensions are a very complicated part of a worker's compensation. Before investigating the effects of pensions on productivity and employee behavior, it is important to understand what exactly are pensions. This section discusses the two main types of pensions, the demand- and supply-sides of pensions, and how pensions are funded.

2.2.1 Definition of Pensions

Pension benefits are a form of compensation that a worker receives after she retires from a firm. The pension benefit is provided as either a defined benefit plan, which is a form of deferred compensation or as a defined contribution plan which is considered an immediate payment. The decision for a firm to offer a defined benefit plan, a defined contribution plan, both or neither is determined when a firm examines the role of pensions as part of its personnel policy.

The two types of pension plans are calculated very differently. In a defined benefit plan, a firm promises to pay a calculated benefit that usually depends on the employee's salary, age and length of service. Because a firm must provide specific benefit amounts, the firm is at risk with respect to the investment performance of the pension fund, the age of the participating employees, the age which the employees plan to retire, their salary progression over the years, turnover probabilities and other plan experience. To provide an example of how a defined benefit pension is calculated, suppose, for example, a worker reaches the retirement age of sixty-five making $75,000. She put in twenty-five years of service before retiring. If, for example, the defined benefit formula is one percent of final pay for every year of service, then the worker is guaranteed every year until death $18,750 dollars (0.01 x 25 x 75,000).

Under a defined contribution plan, the firm and/or the employees contribute

to individual accounts. Each employee ultimately receives a benefit equal in value to the vested account balance. The value of the account depends on the investment performance and the contributions made by the firm and the employee. The benefits are not guaranteed, leaving the employees at risk of poor investment performance and inflation. Typical examples of a defined contribution plan are a 401(k) plan and a 403(b) plan. A 401(k) plan is offered typically by employers in the private sector. A 403(b) plan is offered to employees who work in public schools and certain tax-exempt organizations. In both of these types of defined contribution plans, a worker chooses how to allocate her money into different fund options in the plan.

Although it varies by the firm, the most common funds offered in a defined contribution plan are an aggressive fund, an international fund, a conservative fund, and a stock ownership fund. An aggressive fund is comprised of stocks with greater-than-average potential for growth. Such stocks may include start-up companies, smaller companies or companies in high-risk industries. As a result, these funds have a high degree of risk and a high potential for return. An international fund only has stocks from countries outside the United States. Investors in these funds take on a higher degree of additional risk, since international issues contain risks not present with domestic issues, such as currency exchange rate fluctuations and different economic conditions, governmental regulations and accounting standards. The risks and potential rewards for investing in an international fund are also very high. A conservative fund is designed to provide consistent, predictable growth over the long term. This option is generally considered low risk and is guaranteed by the issuing insurance company, but fixed interest rates and rising inflation can erode its earning power. The stock ownership fund allows employees to acquire an ownership interest in the company. This is popular among publicly

traded firms. A typical example of how a worker would allocate her money into different funds would be to put twenty-five percent of her money in an aggressive fund, fifteen percent of her money in an international fund, thirty-five percent of her money in a conservative fund, and twenty-five percent of her money in a stock ownership fund.

The defined benefit plan and the defined contribution plan also have different vesting rules or a minimum tenure requirement. In most defined contribution plans, a worker is not required to work for a certain number of years at the firm in order to keep everything in her account. The worker can leave her job at any time and still keep her accrued benefit. This is not the case under the rules of a defined benefit plan. If a worker does not have the requisite tenure and/or age needed to attain the benefit, the worker usually leaves with a much smaller benefit or worse, leaves with no benefit at all if she decides to leave prior to retirement. The most common required retirement age and required tenure is age sixty-five and five years of service.

Because of these differences and other factors, the decision of the firm to have a particular type of deferred compensation is critical. When making the decision, the firm must recognize that there are advantages and disadvantages to offering the different pension plans. Defined benefit plans provide incentives that promote higher productivity and fewer turnovers. However, defined benefit plans have higher administrative costs and are not portable, which could lead to bad job matches between the workers and the firm. On the other hand, defined contribution plans are simpler and cost less, which is also advantageous, but the plan does not offer incentive to keep valued workers and to maintain optimal productivity levels. There are also advantages to offering both plans together. Having a defined benefit plan provides the incentives, while simultaneously offering the de-

fined contribution plan help firms align pay with performance by giving employer matches to the workers' contributions. Typically, only large firms with workers receiving high wages provide these types of benefit packages.

Even when a decision on which type of benefit package is made, a firm is not obligated to keep it. A firm must always re-evaluate its personnel policy to ensure its needs as well as the needs of its workers are met. A firm that currently has a defined benefit plan may have to reconsider whether its incentives for meeting its productivity goals outweigh the costs in providing a defined benefit plans. This is very important as a firm is always faced with changing financial circumstances and changing workforce demographics. Because the costs are sometimes more important, not only do firms regularly change benefit formulas and eligibility rules, it is also not uncommon for firms to grandfather, freeze, or close defined benefit plans and replace it with defined contribution plans. Therefore, it is important that pensions and its role and function in the labor market are understood before any decision is made.

2.2.2 Demand- and Supply-Sides of Pensions

A large body of research has explored both the demand- and supply-oriented theories of pension coverage. Demand-sided theories start from the proposition that employers are indifferent between paying cash wages and making contributions to a pension fund. Thus, pensions are sponsored to satisfy the employee demand for a retirement savings tool. Supply-sided theories are used to explain how pensions are used as incentives and as a way of lowering labor costs. The interaction of the two leads to the type and design of a pension benefit package that maximizes meeting the needs of the workers and the firm.

When studying the demand side of pensions, there are several reasons why workers may want to have one. One reason is workers often view pensions as

retirement insurance. Many workers may want to make sure they do not out-live their assets and that they are financially stable in case of Social Security or Medicare cuts. Thus, having a pension plan enables workers to have more control over their financial security (Dorsey, 1995). Another reason why workers want pension coverage is because of the economies of scale. It is more efficient and less expensive to save through an employer-sponsored pension plan than for workers to try to save individually. Although some scale economies can be captured us-ing pooling mechanism like mutual funds, investing through a company-provided pension plan provides the lowest administrative costs to the worker. Another reason why workers want pensions is for the tax qualifications. When an employee places money into a company-provided group pension plan, the money is sheltered from income and payroll tax. This is particularly useful to high-income workers because pensions reduce the cost of each dollar of savings by a greater amount for high-income workers than for lower-income workers. Lastly, workers may prefer to have pension coverage if they belong to a union. Workers who are employed with unionized firms are more likely provided pension plans through their employer. Presumably, unionized workers are paid more than non-unionized workers because of the existence of rents (Dorsey, 1995). Given these rents, unionized firms will more likely distribute compensation according to the median employee and not the last hired employee. Hence, the rents are distributed toward older union workers and away from younger employees[6].

As for the supply-sided theories, again there are several motivations as to why firms offer pensions. One motivation for a firm to offer a pension plan is to help regulate worker effort and worker quality. A firm may choose a certain accrual

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[6]Collectively bargained defined benefit plans tend to have a different type of formula than non-union plans. Instead of a plan based on final average pay, union plans often have formulas that pay a fixed dollar amount times years of service and some pay a fixed amount to all qualified retirees. These formulas tend to equalize lifetime compensation across workers which is often given as an objective of unions.

pattern and eligibility rules that can motivate an employee to remain at the firm for a certain length of tenure. By defining certain eligibility rules and accrual patterns, a worker leaving the job earlier than the pension requires would mean forfeiture of his pension benefit. Hence, an employee has the incentive to maintain a certain level of productivity to meet the firm's standards and not quit. Another motivation for offering pensions is the firm's use in regulating worker turnover other than retirement. Firms with pensions typically have lower turnover than those without, and this leads to lower training costs. Another motivation for offering pensions is its use in regulating when workers retire. A firm may want to have control over retirement flows because worker productivity may decrease as a worker ages (Gustman, 1994). However, because of age discrimination, a firm is forbidden to lower wages that meet a worker's marginal productivity. Instead, a firm can use defined benefit pensions that are designed to pay a certain benefit when a worker becomes a certain age, encouraging them to retire. Another motivation for providing a certain type of pension is that the firm may want to keep their older workers. The employer may be experiencing a slowly growing labor force. Because of this, the firm may want to shift from a defined benefit plan to a defined contribution plan. Doing so removes the defined retirement age and removes incentives for older workers to leave the firm.

When the interaction of workers' demand and firms' interest in meeting financial and human resource goals is realized, several outcomes are determined. First, pension-related outcomes occur. A firm can now determine what types of pensions, if any, to offer its employees. The pension plans are designed with specific requirements for coverage eligibility and the shape and value of the pension accrual pattern are determined in a way to meet the firm's goals (Gustman and Mitchell, 1992). Second, employment-related outcomes are determined. A firm that offers

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a defined benefit plan specifically, has a clearly defined expectation of tenure and a clearly defined retirement age. Defining a tenure requirement in a defined benefit pension plan is advantageous to the firm because doing so increases tenure at their firm (Ippolito, 1997), and having a clearly defined retirement age allows the firm to encourage older workers to leave. A firm that offers only a defined contribution plan may have a larger share of older workers and may have on average shorter tenure than those that offer defined benefit plans.

Even when a decision on which type of pension to offer has been made by the firm, it is important to know that the demands of the workers and the firms' human resource and financial goals are always changing. As such, so is the resulting deferred compensation plan. Right now the common trends in HR policy are that firms are reducing their pension benefits and are moving away from defined benefit plan offerings. Now, more workers are bearing the responsibility of saving for their retirement because defined contribution plans are becoming more prominent as part of the workers' compensation.

2.2.3 Pension Funding

The way a pension plan is funded or financed can be quite complicated. In a defined contribution plan, the total amount of money in the employees' defined contribution accounts is the total amount the employees are entitled to at that current time. However, when calculating the amount owed to workers in a defined benefit plan, the process is much more complex. The firm has a defined benefit pension asset fund that is used to pay the pension amount based on the benefit formula. The amount of money owed to the workers mainly depends on whether the workers leave now or whether they leave at retirement.

Pension funding is very significant in the financial structure of the firm. For funding and accounting purposes, it is necessary for a firm to assign, in a systematic

and consistent manner, the expected cost of a pension plan to the years of service that give rise to that cost. Two measures that are used to determine the expected cost are current liability and accrued liability. Current liability is the sum of (1) the value of benefits for retirees, (2) the value of benefits for employees who have left the firm with vested pension rights, but have not yet retired, (3) the value of vested benefits accrued to date for active employees and (4) the value of nonvested benefits for active employees. Accrued liability is the sum of the current liability and the effect of future pay increases on past service benefits.

To illustrate[7], suppose that a plan provides benefits of 1% of final salary for each year of service. Consider a 45-year-old employee with ten years of service, currently earning $40,000, but with a projected salary of $75,000 at the normal retirement age of sixty-five. The current liability is equal to the 10% of the $40,000 salary, or $4,000 payable annually beginning at age sixty-five. For an ongoing plan, however, we must recognize that at retirement, the 10% benefit already earned will apply to the projected final salary of $75,000, rather than a current salary of $40,000. The calculation should therefore reflect an annual benefit of $7,500, rather than $4,000. The value of $3,500 goes into the portion that represents the effect of future salary increases on past service benefits. This value is often argued as the equivalent of a bond that a worker accepts from the employer as a condition of employment. Upon reaching retirement, the bond can be fully redeemed. An example of the worker's current and accrued liability is present in Figure 2.1. The pension quit penalties in Figure 2.2 represent the bond that is forgone if a worker leaves after a certain number of years of service.

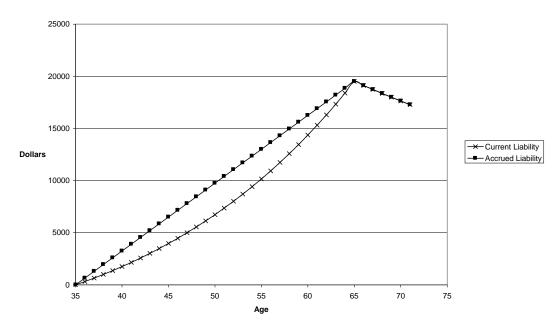
[7]This example is in Bader (1995).

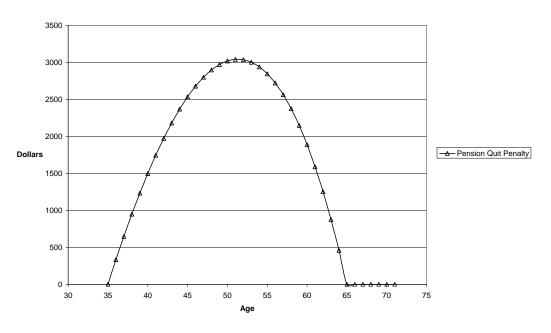**Figure 2.1: Current and Accrued Liabilities for a Worker at a Firm**

Figure 2.2: Pension Quit Penalties for a Worker Hired at Age 35

When the liabilities are compared to the actuarial value of assets, the funding status of a plan is determined. For instance, if the value of plan assets is $300

million and the current and accrued liabilities are $225 million and $350 million respectively, the plan is underfunded on an ongoing basis, but is overfunded on a current liability or termination basis.

Hence, determining how much money is owed to an employee and the status of a defined benefit plan's funding is very important when the firm makes a decision whether to maintain the plan or to convert it. There are different motivations for converting the plan depending on whether the plan is overfunded or underfunded on a termination basis. So not only is the impact on the workers a factor, but the funded status of the defined benefit plan is also important when a firm debates whether to terminate their pensions.

2.3   Reasons for Converting Defined Benefit Plans

The shift from defined benefit plans to defined contribution plans has been prevalent in the past three decades. However, the motivations behind the shift have evolved with changes in legislative and regulatory laws as well as with changes in firms' workforce demographics and firms' structure. This section discusses how the motivations for shifting from defined benefit plans have evolved over the past twenty-five years and what happens to the accrued benefits in the defined benefit plans when the shift occurs.

2.3.1   Conversions in the 1980s

In the 1980s, there were several motivations that led to the shift toward defined contribution plans. One, the offering and utilization of defined contribution plans became much more widespread after the Internal Revenue Code was modified to include section 401(k) provisions that allowed workers to make pretax contributions to thrift and profit sharing plans. The regulatory burden on 401(k) was less onerous than that on defined benefit plans and the administrative costs were much

lower so they became more attractive to many companies. Two, some firms converted from offering a traditional pension to providing a defined contribution plan and used this shift as an opportunity to take the excess assets from their frozen or terminated defined benefit plans.

There were two explanations as to why a firm would convert its defined benefit plans for excess pension assets at that time. One reason why firms converted to defined contribution plans was because some of them were facing internal financial problems. If a firm had insufficient internally generated cash flows and its defined benefit plans had assets that exceeded the liability during that time, then the firm sometimes would freeze or terminate the pension and draw on excess pension assets. This relieved the need for external financing which could negatively impact the firm's financial status. Another motivation for firms converting to defined contribution plans in the 1980s was related to a common merger strategy utilized at that time. Excess pension plan were frequently in firm acquisitions, including a number of hostile takeovers. The acquiring entity would make a bid for a company with excess pension assets, close its pension and use the excess assets to finance the takeover. When General Electric bought RCA in 1986, it terminated RCA's pension plan after acquisition and claimed over 1 billion dollars in assets [GE 10K Statement]. In the case of Schick's acquisition in 1986, up to 20 million dollars of Newreeveco's excess pension assets were used to reduce acquisition debt issues [Schick 10K Statement].

Policymakers came to view this particular use of pension assets to be abusive and by the late 1980's, laws were passed to prevent firms from terminating pension plans as an effort to attain more cash. The Tax Reform of 1986 levied a ten percent excise tax on reverted pension assets, and in 1988, the rate was increased to fifteen percent. In 1990, Congress increased the excise tax to twenty percent

on reverted assets, provided that twenty-five percent of the pension surplus is used as a cushion for a replacement plan, or that benefits are increased by twenty-five percent; otherwise, the excise tax is fifty percent. Most plan sponsors have been reluctant to close plans with excess assets and use the surplus to increase benefits for plan participants so the fifty percent tax is the effective hurdle they face in most terminations. But the fifty percent is an excise tax on top of regular income taxes on any excess assets. The combination of taxes virtually expropriates excess assets in any plan termination. However, although firms now no longer had the incentive to terminate defined benefit plans for the excess assets, in the 1990s, plan closures continued.

2.3.2   Conversions in the 1990s

In the mid and late 1990s many firms saw a large increase in their pension assets because of the economic boom. However, despite these huge increases, firms were still converting their healthy defined benefit plans. There are several reasons behind these conversions. According to Munnell et al (2006) and Schieber (2006), one reason why firms were converting their plans in the 1990s was the desire to cut compensation in order to meet competition. As many firms became more global in the 1990s, it became increasingly difficult to remain competitive with rival foreign firms. American firms typically spend a significant amount of money on benefits for their employees while competing firms in other countries do not have this cost because the governments provide a bulk of these benefits. Also, older companies that were offering defined benefit plans were now competing with newer domestic firms that did not have a defined benefit plan at that time.

Another reason why firms shifted to defined contribution plans in the 1990s was for demographic reasons. By the turn of the century, baby boomers were approaching retirement age. The life expectancies for men and women have increased

drastically since the 1960s and 1970s. According to Munnell, life expectancy tables typically underestimate how long a person is expected to live. If beneficiaries of defined benefit plans end up living longer than is expected, firms would have a serious financial liability that had not been provided for in earlier plan funding.

A third reason why firms were terminating their defined benefit pensions in the late 1990s was because of the emergence of a two-tiered pension system in firms. The gap between the salaries of the executives and the non-executives had grown tremendously. Pension regulations, however, significantly limited the share of executives' earnings that were covered under tax-qualified pensions and they became increasingly dependent on supplemental executive retirement plans for their retirement benefits (SERPs). Some analysts suggest that since highly paid top management no longer has a significant interest in the qualified pension plans because they do not benefit from the plan they have been willing to freeze these plans for their rank-and-file workers..

A fourth reason why firms began converting their defined benefit plans in the 1990s was because of an increase in worker demand for 401(k) plans. There are primarily three reasons why some workers preferred defined contribution plans. The first reason was because there was a decline in job stability. There is evidence to suggest that firms with a higher share of workers who change jobs with no spell of unemployment were more likely to convert their defined benefit pension plans (Anderson and Coronado 2005). The second reason for the increased preference in defined contribution plans in the 1990s was the presence of more women in the workforce. Between 1979 and 1998, the share of workers who were female rose sixteen percent. This rise in the share of women in the labor force implied an increase in the share of workers who are caring for children or elderly parents. These working women with shared responsibilities would not be as attached to

the workforce and particular jobs. Hence, there would be a greater demand for a portable pension benefit. The third reason for an increase in workers' preference for defined contribution plans was there had been changes to production technology over the past few decades. Workers were now gaining skills that can be used in other places of work. Thus, the return of human capital had increased sharply and more people had become mobile in the labor market. Thus, there was an increased demand for a more portable pension benefit to match.

Unfortunately, by the turn of the century the economic boom began to wane and a recession was on the horizon. As the recession set in, the firms were still converting their pension plans, but now by the 2000, they converted them more for financial reasons.

2.3.3 Conversions in the 2000s

In the current decade, the number of defined benefit plans that have been terminated or frozen has skyrocketed. There are several reasons why this surge of conversions has occurred. One reason is because of the drop in the stock market and the rapid decline in interest rates decreased the pension assets and increased the liabilities resulting in significant pension underfunding. This was compounded by the fact that in the 1990s, the combination of growing asset values and regulatory constraints allowed firms to make little or no cash contributions to their pension funds (Schieber 2006). As a result, the median ratio of pension assets to current liability in firms was below one by 2000 (Hill 2006) and firms went from making no contributions to now being required to make seven or eight percent of payroll contributions (Schieber). The firms not wanting to make contributions began converting their plans.

Also, at the beginning of this decade, the healthcare benefit increases reached double-digits and the inflation rate became three times as high as general inflation

(Munnell 2006). These escalating health care costs were the results of providing both health insurance for current employees and post-retirement health care benefits for retirees. Health insurance for current employees began to rise toward the end on the 1990s when firms began to loosen managed care provisions. Post-retirement health care costs began to increase because of the absence of a funding requirement and rapidly rising costs have led to increasing unfunded liabilities. As a result, in order to curtail total benefit costs, firms began converting defined benefit plans as a way of restructuring the total compensation package.

2.3.4   Process in Converting Pension Plans

Although there have been many motivations for converting defined benefit plans, it is important to understand how the transition takes place. When a firm decides to convert all of its defined benefit plans to a defined contribution plan, there are two choices that are offered to its employees in regards to the accrued benefit in the defined benefit plan. One choice is to let the worker keep its vested pension amount in the defined benefit plan which no longer grows. The firm will buy annuities through an insurance company which will take over the terminated accounts. Upon retirement, the worker will receive pension annuity payouts administered through the insurance company and the workers will begin investing in the defined contribution plan beginning at the value of zero. The second choice is taking the accrued benefit, calculating a lump sum value, and then rolling it over into the new defined contribution plan. The worker no longer will get a pension annuity upon retirement, but will have considerable amount of money in their 401(k) plans when she begins investing. Typically, a majority of the employees place their accrued benefit into a 401(k) plan.

Thus, the change in deferred compensation packages can quickly change a firm's finances as well as the workers' compensation package and retirement patterns.

Although the firms are better off financially in the short run, an interesting question is whether in the long term, converting defined benefit plans affects worker productivity.

2.4 Previous Research on the Relationship between Pensions and Productivity

There has been much research on how defined benefit pension incentives result in productivity gains. Regrettably, productivity studies have long been hindered by the lack of direct measures of employee output or firm productivity, and the endogenous nature of pension coverage results in even more stringent data requirements. However, some economists have made attempts to indirectly determine how pensions affect productivity at the firm by finding associations discovered in OLS and logit regression models. Unfortunately, because of limitations in data sets, the results are contradictory. The following cases demonstrate the inconsistencies found in this literature.

Lazear (1979) was the first to address the effects of pensions on productivity by researching why workers with defined benefit plans might be more productive than workers without them. The Lazear theory states that workers agree to an "implicit contract" by accepting a cash compensation in their early career below what they would receive at an alternative job. Because quitting will result in losing her pension benefits, the worker has an incentive to work up to a firm's standards. Thus, she becomes more productive. At the end of a worker's career, the worker receives a pension for her service.

Lazear tests his production enhancement theory empirically by estimating regression models where the dependent variable is whether a worker had a pension plan or not. He finds evidence that providing pensions is a consequence of an optimal wage scheme that reflects differences in productivity and it makes both

the worker and firm better off.

Hutchens (1987) also has evidence that support the production enhancement theory. He argues that implicit contracts introduce fixed costs into the worker-firm relationship. These fixed costs lead firms to hire primarily young people who are willing to work long term with the firm and gain firm-specific skills. He tests his argument by adding an index that measures jobs that employ older workers, but do not hire them into his logit regression models. He finds evidence that firms with pension plans tend to not hire older workers although they do employ older workers.

However, other researchers draw different conclusions about the use of pensions to enhance productivity. Allen and Clark (1987) try to explain with cross-sectional differences the productivity consequences of pension choices. By adding a productivity index to an industry-level wage equation where a pension measure already appeared as a control, they find the productivity factor has no significant impact on the estimated pension-wage trade-off. Thus, they find there is no evidence that firms with pensions would have to pay lower wages in the worker's early career to offset having a pension, refuting the production enhancement theory.

Ippolito (1994,2002) also explored the role of pensions in preserving productive job matches. He argues that based on the production enhancement theory, workers must forgo wages for a pension. However, his evidence shows that workers with pensions actually have higher wages than workers without pensions. But Ippolito feels that rather than argue that the production enhancement theory is incorrect, the theory may instead just be oversimplified. Ippolito argues that workers with pensions are more likely to remain at the firm because pensions generally attract workers who have a propensity to save. These low-discounters would also have higher productivity because firm-specific skills are gained during their tenure.

Thus, workers who are low-discounters are self-selected to work in firms that offer pensions. He argues that once the sorting of low-discounters and high discounters are taken into account, the production enhancement theory has validity.

With almost no direct evidence on pensions' effects on productivity and what little evidence available has contradicting results, there is a call for more work in understanding the relationship between pensions and productivity. The lack of information on the productivity effects of pensions extends to wage premiums, wage structures, bonuses, and other direct incentives. How workers respond to bonus systems, stock incentives, or merit pay is also relevant. If these different forms of compensation do not affect worker performance, then it is also unlikely that workers will respond to the less direct incentives of defined benefit plans (Gustman and Steinmeier, 1993). Unfortunately, because of data limitations, economists cannot answer these questions.

2.5 Theoretical Model

In order to demonstrate that pensions affect productivity and employee behavior, I establish a theory which argues that a firm provides a defined benefit plan to ensure that its workers have an incentive to remain at the firm. The incentive is if the workers leave prior to retirement, then the workers would forfeit their promised pension benefit. Thus, the workers want to stay until retirement, gain firm-specific skills, and maintain a minimum level of productivity to avoid shirking. However, when a firm faces financial problems, often times the firm quickly converts its defined benefit pension to a defined contribution plan. Doing so reduces the firms's pension liabilities which brings down the firm's costs. I follow Lazear's argument about incentives and productivity (2000) in explaining that although a firm now has met its financial goals, productivity may not be as high because the average worker at the firm is more likely to leave and miss receiving firm-specific

training which makes her more productive, and the average worker puts in less effort to keep her job because the pension penalty is gone.

The conditions of the job determine what types of workers accept employment when the firm first offers a defined benefit plan. If the standards are too strict, only the most able will find the job suitable, even at a high wage. I define p to be the productivity level chosen by a worker with a defined benefit plan. The productivity output is a function dependent on A, the ability of the workers and X, the level of effort a worker chooses to avoid shirking. I make the assumption that the firm can observe the productivity level.

I also make the assumption that the firm cannot observe the level of effort a worker has chosen to avoid shirking. Workers who are more willing to remain at the firm for an extended period, and workers who are more likely to leave after a short tenure are not easily identified. Thus, the firm does not know which workers would benefit the most from the firm-specific training and which would not. To screen high types from low types, a firm offers a defined benefit plan. If the worker leaves prior to retirement, the worker loses her promised benefit at retirement. Thus, all low types would face the penalty of leaving by receiving a large reduction in pension benefits or would not bother accepting the job to begin with. The high types are attracted to the firm because they want to stay and gain firm-specific training. This leads to more employees working at optimal productivity level. This is particularly beneficial if the training is very costly.

To ensure the workers are at the optimal productivity level after receiving firm-specific training, the firm specifies some minimally acceptable level of productivity output, say p^*. Thus, the firm fires workers whose productivity level falls consistently below p^*. The firm also offers a wage that is proportional to the level of worker's productivity. Thus, the worker's utility function is given by

$$Utility = U(W, X)$$

where W is income and X is the level of effort chosen to avoid shirking ($U_1 > 0$ and $U_2 < 0$).

The productivity output p depends on the level of effort chosen to avoid shirking and ability which is defined as

$$p = f(X, A)$$

where ($f_1 > 0$ and $f_2 > 0$).

For any given level of productivity p, and ability level A, there is a unique chosen level of effort X that satisfies p in the above equation. Denote by $X^*(A)$ the level of effort chosen to avoid shirking that is necessary to satisfy $p^* = f(X^*(A), A)$ for the required level of productivity p^*. It is clear that

$$\frac{dX}{dA} = \frac{-f_2}{f_1}$$

is negative. Thus higher-ability workers need less effort to achieve a given level of productivity. Thus, it is easier for them to stay and receive training.

For any given pair of required output and wage (p^*, W) there is a group of workers who will accept the job with the firm. The minimum-ability individual who will accept a job in lieu of leisure that requires p^* of output to be produced is A^* such that

$$U(W, X(A^*)) = U(0, 0)$$

where $U(0, 0)$ is defined as the utility associated with leisure.

All workers with ability levels that exceed A^* earn rents from employment because they are required only to produce p^* of productivity, and the pain associated

with producing it is lower than the pain for individuals with ability A^* who are just indifferent between working and not. However, because there is competition from other firms, a worker must compare the rents earned at this firm with those offered elsewhere.

Those willing to work at the firm must not have work alternatives that are preferred to those at the current job. The utility that a worker of ability A can get at another firm that does not necessarily pay workers of all types the same amount is given by $U(W'(A), X'(A))$ where W' and X' refer to the wage and the level of effort chosen to avoid shirking at the best alternative job for the worker of ability A. Higher-ability workers are likely to find that the alternative job with a defined benefit plan is not as attractive if it is more demanding, but pays more. Thus, there may exist an upper cut-off for ability, A_h, such that

$$U(W, X^*(A_h)) = U(W'(A_h), X'(A_h)).$$

Those who work at the current firm have ability A, such that $A^* \leq A \leq A_h$.

Suppose the firm faces a financial situation and responds by converting its defined benefit pension plan. Two things happen. First, some current workers will no longer put forth effort to avoid shirking and will leave because the pension penalty is gone. Second, new workers are hired to replace the workers who left. However, the new defined contribution plan does not easily screen the workers so we have high types and low types being hired. The new utility under the defined contribution plan is

$$Utility = U(W, X_0(A))$$

where W is the wage and X_0 is the level of effort that a worker with ability A now chooses when she has a defined contribution plan. This can be stated more formally with three propositions.

Proposition 1 *The level of effort to avoid shirking does not increase when the firm switches its defined benefit plan to a defined contribution plan. As long as the workers are not at minimum levels of effort, average level of effort to not shirk will decrease.*

Proof. *If the new productivity level under a defined contribution plan is below p^*, then for some level of ability A, where $A_0 \leq A \leq A^*$,*

$$U(W^*, X^*(A^*)) > U(W, X(A))$$

where $X(A)$ is the new level chosen by a worker of type A who is now under a defined contribution plan. As long as a worker has some type A which is below A^*, when the defined benefit pension plan is converted, the average output must decrease. ∎

Another proposition can be stated, given two conditions:

Condition 1 *If a worker with some ability A chooses to work at a certain level of effort to avoid shirking when having a defined contribution plan, then any worker with ability less than A also chooses to work at an effort level appropriate for a defined contribution plan.*

Condition 2 *If a worker with ability A chooses to work at a certain level of effort to avoid shirking when having a defined benefit plan, then any worker with ability greater then A also chooses to work at an effort level appropriate for a defined benefit plan.*

Then,

Proposition 2 *A sufficient condition for the average ability of the workforce to be non-increasing, and more generally, to fall after the defined benefit plan is switched*

to a defined contribution plan is that some workers who normally would not work for the firm because the required level of effort to avoid shirking is too high now accept the job with a defined contribution plan. Some current high-ability workers opt to lower their effort to avoid shirking because the defined contribution plan provides no incentives for the workers to maintain a certain level of productivity or to stay until retirement. As a result, some current high ability workers leave.

Proof. If any worker chooses to work for a job offering a defined benefit plan, then surely the worker with the highest ability would choose to work. But the highest-ability workers cannot, except in the rarest coincidence, be at the maximum which is defined as A_h. If a worker of type A_h works for a firm offering a defined benefit plan, then she would be at worse indifferent in working for a firm offering a defined contribution plan, but more generally, strictly prefers the defined benefit plan. Since A_h would earn rents under the defined contribution plan, the worker with type A_h is no longer the marginal worker. There exists a worker with type $\widehat{A}_h$ with $\widehat{A}_h < A_h$ who would now be the marginal worker for whom

$$U(W, X(\widehat{A}_h)) = U(W', X')$$

where $X(\widehat{A}_h)$ is defined as the new level of effort to avoid shirking for worker of type $\widehat{A}_h$ under the defined contribution plan and where W' and X' are the wage and level of effort at the alternative job.

Also, suppose any worker can accept the defined contribution plan, and the worker with the minimum ability type, A_0, would accept the job. The worker with type A_0 is willing to work for wage W at the level of effort X_0 because she does not plan to stay long enough to gain firm-specific skills. Furthermore, since the defined contribution plan is not any more attractive, no worker with type ability less than A_0 is willing to work for the job now offering the defined

contribution plan.   Since the lower bound remains unchanged and the upper bound does not increase and may in fact fall, the average ability does not increase and generally decreases after the firm switches from a defined benefit plan to a defined contribution plan. ■

Thus, average ability decreases because the ability of the lowest quality worker does not need to change as a result of the switch in pension plans. Low ability workers who are attracted to the firm work at minimum ability. They are actually better off because there are no penalties when they shirk. The high ability workers, just like the low ability workers, can also leave without any pension penalty. Thus, switching pension plan types has the effect of changing the class of workers now attracted to and retained at the firm. This means that overall, the workers at the firm are not producing at optimal productivity as before and they are receiving less firm-specific training.

Finally,

Proposition 3 *A sufficient condition for the range of worker ability and productivity output to decrease after the switch from defined benefit plans to defined contribution plans exists because fewer workers would still want to work in the firm after the switch.*

Proof. *From the proof of Proposition 2, $\widehat{A}_h \leq A_h$. But A_0 cannot change because the job with the defined contribution plan is available only for those willing to produce the productivity output at level p_0. This is sufficient to imply that the range or variance in ability falls. Also before, all workers chose to produce at level p^* when working under the defined benefit plan. Now only some produce in the defined contribution range the positive variance in A. This implies positive variance in p under the defined contribution plan.* ■

Even if underlying ability levels did not change, variance in productivity would

decrease. When it is recognized that the maximum ability levels decrease under the defined contribution plan, the change in output variance decreases also. Thus, not only do workers under the defined contribution plan on average produce at a lower output, but the range in which they produce is smaller because the upper bound of the level of effort to avoid shirking decreases.

In conclusion, when a firm converts its defined benefit plan to a defined contribution plan, there is no longer a promised pension benefit which is used as an incentive to keep workers at the firm. Some of the workers currently at the firm leave because the incentive to stay is gone. Now that the defined benefit plan is no longer used to screen the different types of workers, low-types and high-types are now being hired, so there is a different class of workers. Turnover is now higher and costs are higher. As a result, overall productivity declines at the firm.

2.6 Data

Before discussing the empirical specifications, it is important to discuss the new data set I created. The longitudinal data set I use is created by integrating information from the Form 5500, the U.S. Business Register and LEHD data from twelve states. The states used from LEHD are California, Florida, Idaho, Illinois, Maryland, Minnesota, Missouri, Montana, North Carolina, Oregon, Washington, and Wisconsin. The integration takes place in two stages. The first stage is the integration of the Form 5500 and the U.S. Business Register, which creates a national data set of firms and their information on an Employer Identification Number (EIN) level. The second stage is the integration of this national data set to the LEHD data for twelve states, which takes a subset of firms from the national data and adds information about the workers. Figure 2.3 shows how the two integrations take place. To fully understand the variables in this new data set, one needs to understand the structure of the original data sets, the information they

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entail, and how the information is integrated.

All pension information comes from the Form 5500 and is provided by the Department of Labor (DOL) and the Internal Revenue services (IRS). The Form 5500 details information about all pension, health and fringe benefit plans and stems from the enactment of the Employee Retirement Income Security Act (ERISA) in 1974. The information is on plan level and includes identifying information about the firms including company name and EIN, statistics on participants, a balance sheet, a statement of income and expense, and other information about the operation of the plan. The Form 5500 also has schedule forms, which provide supplemental information about the plan. These schedule forms provide actuarial, insurance, and trustee information as well as other accounting information about the plans.
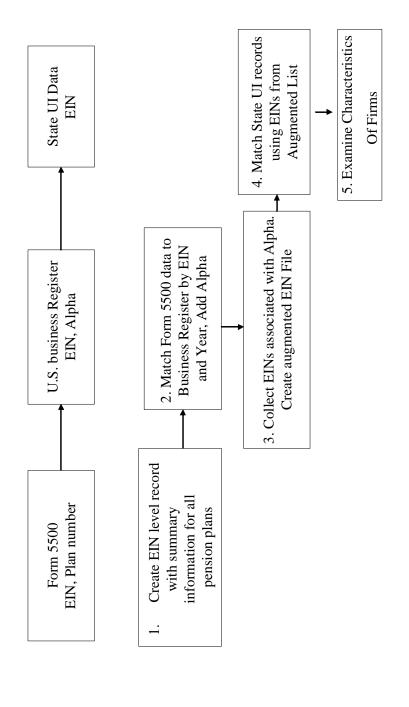
State UI Data
EIN

U.S. business Register
EIN, Alpha

Form 5500
EIN, Plan number

1. Create EIN level record
with summary
information for all
pension plans

2. Match Form 5500 data to
Business Register by EIN
and Year, Add Alpha

3. Collect EINs associated with Alpha.
Create augmented EIN File

4. Match State UI records
using EINs from
Augmented List

5. Examine Characteristics
Of Firms

Figure 2.3: Schemata of Construction of Database

Not all pension plans are included in the Form 5500 data. Some pension plans are not in the Form 5500 file because some firms may not be obligated to file. The following are the plans that are exempt from filing. (1) Pension plans that are unfunded and the benefits go only to a select group of management of highly compensated employees. (2) Pension plans maintained outside the United States if they are qualified foreign plans. (3) Simplified Employee Pensions (SEP) which are pension plans that meet certain minimum qualifications regarding eligibility and employer contributions. (4) Savings Incentive Match Plans for Employees (SIMPLE) of Small Employers that involve SIMPLE Individual Retirement Accounts (IRAs). (5) Pension plans that are church plans. (6) Pension plans that cover residents of Puerto Rico, the U.S. Virgin Islands, Guam, Wake Island, or American Samoa.

The information from the Form 5500 in its original state is not very clean. Some of the information is missing or clearly incorrect, so edits are made by researchers in LEHD. Once the data is edited, the information about the pension plans is collapsed to a firm or EIN level. This is important because many firms offer more than one pension plan and some firms offer more than one type of pension plan. By collapsing to the EIN level, information on how much a firm pays for its entire benefit coverage and the total number of employees covered at a firm are more accurate. Tables 2.1 and 2.2 show the number of pension plans found in the Form 5500 and the number of EINs by pension type used for integration. To fully understand how the Form 5500 data is edited and collapsed to an EIN level, refer to Hill (2006).

**Table 2.1: Listed and Missing Pension Plans from Form 5500 File
To Be Used for Integration**

Plan End Year	Defined Benefit Plans	Defined Contribution Plans	Total
1994	81,042	610,265	691,307
(Row Percentages)	11.72%	88.28%	100.00%
1995	75,218	629,058	704,276
	10.68%	89.32%	100.00%
1996	70,268	648,160	718,428
	9.78%	90.22%	100.00%
1997	65,070	669,101	734,171
	8.86%	91.14%	100.00%
1998	59,486	672,735	732,221
	8.12%	91.88%	100.00%
1999	46,523	611,209	657,732
	7.07%	92.93%	100.00%
2000	48,450	654,420	702,870
	6.89%	93.11%	100.00%
2001	48,300	672,020	720,320
	6.71%	93.29%	100.00%

**Table 2.2: Number of EINs That Offer Defined Benefit Plans Only, Defined Contribution
Plans Only, and Defined Benefit and Defined Contribution Plans Based on Form 5500**

Plan End Year	EINs with Defined Benefit Plans Only	EINs with Defined Contribution Plans Only	EINs with Defined Benefit and Defined Contribution Plans	Total EINs
1994	47,216	495,044	24,446	566,706
(row Percentage)	8.33%	87.35%	4.31%	100.00%
1995	42,943	514,188	23,542	580,673
	7.40%	88.55%	4.05%	100.00%
1996	39,651	532,148	22,438	594,237
	6.67%	89.55%	3.78%	100.00%
1997	35,673	556,269	21,795	613,737
	5.81%	90.64%	3.55%	100.00%
1998	32,467	564,726	20,263	617,456
	5.26%	91.46%	3.28%	100.00%
1999	26,464	521,401	14,916	562,781
	4.70%	92.65%	2.65%	100.00%
2000	26,891	551,737	16,286	594,914
	4.52%	92.74%	2.74%	100.00%
2001	25,980	564,031	16,729	606,740
	4.28%	92.96%	2.76%	100.00%

The Business Register is a file that is maintained by the United States Census Bureau and contains information about all multi-establishment and single-

establishment employer firms in the United States. This file is a list of all establishments that have tax return records at the Internal Revenue Services. In the single-unit file, the establishments are listed on an EIN level. In the multi-unit file, the establishments are listed on an enterprise level, which are identified by an alpha number. The minimum information for each organizational unit of the company includes the company name and EIN, industry code, geographical code, legal form of organization, employment size, imputed total sales[8], and other economic variables. The Business Register includes both part-time and full-time workers. All public administrative establishments are excluded. Thus, government businesses on all levels are not available. Once all establishments from the Business Register are matched using the EIN, the information from the U.S. Business Register multi-unit file is collapsed to an EIN level.

Integrating the Form 5500 into the Business Register in the first stage creates a data set that is more complete than using the Form 5500 alone for two reasons. First, the Form 5500 only lists one EIN per plan record even though workers from other affiliates in an enterprise have the same coverage. By using the Business Register file and getting the list of all affiliates listed under an enterprise, the data set now shows pension coverage for all affiliates. Second, by using the Business Register, one is now able to look at firms that do not offer pension coverage and do comparative analyses. Table 2.3 shows the number of matches found when I integrate the Form 5500 to the Business Register. Approximately 95% of the EINs found in the Form 5500 file match to an EIN found on the U.S. Business Register. However, some of the EINs that match are listed as out-of-business, sold, duplicate, predecessor of another EIN, an administrative EIN, or have zero

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[8]Forty-five percent of sales are missing on the single-unit file. Eighty-nine percent of sales are missing on the multi-unit file. I multiply-imputed the total sales on an establishment level and then sum the results to an EIN level. I make no disctinction between a single unit establishment and a multi-unit establishment when imputing the sales information.

payroll. After using the alpha variable to find the affiliates, I drop all inactive EINs from any future analyses. This sometimes means dropping an enterprise in its entirety. Having an enterprise that is entirely inactive but still has an EIN listed in the Form 5500 is not uncommon because by law, the enterprise is still obligated to file a Form 5500 form if it still has positive assets in a pension plan or if retirees are still receiving pensions. Table 2.4 lists the EIN matches by pension plan type after using the alpha to collect the affiliates and removing the inactive EINs. About ten percent of all employers are found to offer some form of pension plan. Table 2.5 shows the number of employees that work for the firms that offer different types of pension plans. Slightly more than half of the employees are working for a firm that offers some form of pension. More information on this national data set and how it is created is found in Hill (2006).

Table 2.3: EINs from the Form 5500 That Are Found in the U.S. Census Business Register

Plan End Year	Form 5500 EINs	Single Unit Matches Through Valid EINs	Multi-Unit Matches Through Valid EINs	Multi-Unit Matches Through Invalid EINs	Total Matches to Form 5500
1994	566,706	420,454	97,562	30,936	548,952
		74.19%	17.22%	5.46%	96.87%
1995	580,673	432,318	98,498	33,366	564,182
		74.45%	16.96%	5.75%	97.16%
1996	594,237	451,069	91,384	16,196	558,649
		75.91%	15.38%	2.73%	94.01%
1997	613,737	444,381	106,386	32,205	582,972
		72.41%	17.33%	5.25%	94.99%
1998	617,456	454,601	105,210	33,742	593,553
		73.62%	17.04%	5.46%	96.13%
1999	562,781	416,745	93,893	30,671	541,309
		74.05%	16.68%	5.45%	96.18%
2000	594,914	440,039	94,674	33,663	568,376
		73.97%	15.91%	5.66%	95.54%
2001	606,740	450,446	86,626	36,964	574,036
		74.24%	14.28%	6.09%	94.61%

Table 2.4: EINs Offering Pensions by Type from the Form 5500-Business Register File

Plan End Year	Defined Benefit Plans Only	Defined Contribution Plans Only	Defined Benefit Plans and Defined Contribution Plans	Total	Percentage of All Firms In U.S. Business Register
1994 (row percentages)	42,748 7.25%	488,017 82.75%	58,988 10.00%	589,753 100.00%	10.19%
1995	38,594 6.40%	507,951 84.20%	56,697 9.40%	603,242 100.00%	10.26%
1996	34,959 5.69%	526,927 85.78%	52,380 8.53%	614,266 100.00%	10.31%
1997	30,540 4.92%	538,010 86.74%	51,700 8.34%	620,250 100.00%	10.46%
1998	28,331 4.47%	555,922 87.73%	49,422 7.80%	633,675 100.00%	10.51%
1999	22,844 3.89%	521,015 88.74%	43,294 7.37%	587,153 100.00%	9.68%
2000	23,202 3.80%	544,401 89.22%	42,606 6.98%	610,209 100.00%	10.00%
2001	21,459 3.50%	547,789 89.32%	44,064 7.18%	613,312 100.00%	10.11%

Table 2.5: Number of Employees Covered by Pensions by Type from the Form 5500-Business Register File

Plan End Year	Defined Benefit Plans Only	Defined Contribution Plans Only	Defined Benefit Plans and Defined Contribution Plans	Total	Percentage of Employees Covered
1994 (Row Percentages)	3,154,344 5.50%	26,767,088 46.69%	27,407,422 47.81%	57,328,854 100.00%	49.87%
1995	3,613,841 5.68%	30,905,729 48.54%	29,153,608 45.79%	63,673,178 100.00%	51.57%
1996	2,637,699 4.22%	31,280,973 50.06%	28,566,737 45.72%	62,485,409 100.00%	50.92%
1997	2,473,261 3.80%	34,214,349 52.59%	28,365,822 43.60%	65,053,432 100.00%	52.17%
1998	2,387,525 3.43%	38,266,686 55.05%	28,856,832 41.51%	69,511,043 100.00%	52.51%
1999	1,719,400 2.53%	38,875,932 57.22%	27,345,285 40.25%	67,940,617 100.00%	51.48%
2000	1,670,404 2.34%	42,464,331 59.54%	27,189,597 38.12%	71,324,332 100.00%	52.87%
2001	1,536,401 2.05%	42,511,564 56.82%	30,772,399 41.13%	74,820,364 100.00%	54.90%

To determine whether the estimates I created are consistent with other estimates publicly released, I compare my coverage rates with coverage rates and participation rates calculated from the Current Population Survey (CPS) Annual Demographic Files. The CPS coverage and participation rates are based on two questions that ask if the firm the respondent worked for offered a pension plans and

if the respondent participated in the firm's pension plan. I only used respondents in the CPS who work in the private sector. Table 2.6 shows that when I compare my pension coverage rates with the coverage rates from the CPS, they are similar. The participation rates are somewhat smaller, however.

Table 2.6: Comparison of Coverage Rate Estimates from the CPS with Coverage Rates Estimates from the Form 5500-Business Register

	Coverage Rates Found in CPS for All Workers in Private Firrms	Coverage Rates Estimated Using the Form 5500 and Business Register for All Workers
1994	47.61%	49.87%
1995	50.82%	51.57%
1996	49.57%	50.92%
1997	53.91%	52.17%
1998	52.80%	52.51%
1999	50.49%	51.48%
2000	53.96%	52.87%
2001	53.26%	54.90%

I also make more comparisons using additional estimates I calculate using the CPS. Using Social Security Administration (SSA) earnings records available in LEHD, I am able to determine the employers in which the respondents work for. With this added information, I compare what the respondents say about their dominant employer offering pensions to whether this employer filed a Form 5500 form with the IRS and DOL or not. I use only CPS respondents identified as full-time employees working in the private sector. To avoid redundancy, only results from 1997 are shown and are found in Table 2.7. When I compare responses, I find that there are some mismatches. There are several reasons for this. Again, as stated earlier, not all pensions are listed in the Form 5500. Some respondents may work for firms that offer pensions that are exempt from filing. Also, some EINs may have been listed erroneously on the Form 5500 file. The Form 5500 in its original form is not clean and it is impossible to determine whether the EIN listed is correct or not. It is also possible that some employees may not fully

understand their pension benefits. There are some respondents that say their firms do not offer pensions, but their firms are listed in the Form 5500. More detailed information comparing my data set with similar statistics from the CPS is provided in Hill (2006).

Table 2.7: CPS Responses Regarding Whether the Dominant Employer Provided Pensions in 1997

Worker Resonse to CPS	The Firm has a Pension Plan in the Form 5500		
	Yes	No	Total
Yes, my employer provides a pension plan	**30,543**	**7,578**	**38,121**
(Row Percentage)	80.12%	19.88%	100.00%
(Column Percentage)	76.78%	35.64%	62.45%
(Cell Percentages)	50.04%	12.42%	
No, my employer does not provide a pension plan	**9,236**	**13,682**	**22,918**
	40.30%	59.70%	100.00%
	23.22%	64.36%	37.55%
	15.13%	22.42%	
Total	**39,779**	**21,260**	**61,039**
	65.17%	34.83%	100.00%
	100.00%	100.00%	100.00%

Once I have the national data set, I proceed with the second integration by using LEHD data from twelve states. The LEHD data are administrative information about workers constructed primarily from quarterly Unemployment Insurance (UI) system wage reports. Every state in the U.S. through its Employment Security Agency collects quarterly earnings and employment information to manage its unemployment compensation program. The characteristics of the UI wage state vary slightly from state to state, but the UI coverage is broad and comparable from state to state. Using these records, LEHD creates a database that provides longitudinal information on workers and the matches to their employers. The LEHD data includes approximately 96% of private, non-farm and salary workers. The coverage of agricultural and federal government workers is less comprehensive. Self-employed individuals and independent contractors are also not covered.

Although the identifiers in the administrative records are subject to some error, researchers have invested substantial resources in editing the identifiers and making them internally consistent. More information can be found in Abowd and Vilhuber (2002).

Basic demographic information (date of birth, foreign-born status, sex, race, education imputation) is integrated via the person identifier link for almost all workers in the data. The non-match rate is less than 4%. The quarterly earnings listed are a measure of total compensation, including gross wages and salary, bonuses, stock options, tips and gratuities and the value of meals and lodging when these are supplied. Once the employee demographic information is collected, the information is collapsed to an EIN level creating averages and totals.

Once the LEHD data is integrated with the national data set, the final data set is a subset of firms from the LEHD data. I only select firms that offer defined benefit plans in 1995 and keep information from year 1995 and 2000 only. This final data set includes information from 35,109 firms on an EIN level, and they employed a total of 6,311,921 people in 1995. It is important to note that a firm may appear more than once in this data set if it exists in more than one state. By using information from 1995 and 2000 only, I can determine if the pension plans were converted over the five-year period. I can also track the firms' changing demographics including their employees' age profile, sex and race composition, foreign born composition, average education level, average earnings, turnover rates, total sales on the national EIN level, industry classification on a national EIN level, and pension assets and liabilities on a national EIN level.

The number of firms found in the national data set that offer at least one defined benefit plan in 1995 represents 15.8% of all EINs. Table 2.8 shows the number of unique firms on the national level that offer defined benefit plan in 1995 and the

changes in their pension plans in 2000. I also examine the firms found in the twelve states, which offered at least one defined benefit plan in 1995. Again, these firms are not unique since it is possible that a firm exists in more than one state. Since the non-unique firms in the data set have the same pension information, I only examine a list of unique firms to determine which firms converted their pensions. The number of unique firms in my data set is 18,448. When comparing these firms that offered defined benefit plans in 1995 to the firms in the national data set offering defined benefit plans in 1995, the changes in pensions is similar. The percentage of firms in the national data set that converted their defined benefit plans to defined contribution plans is 30.78%. The percentage of firms found in the twelve states that converted their defined benefit plans to defined contribution plans is 31.43%.

Table 2.8: Year 2000 Changes in Pension Plans for EINs Offering Defined Benefit Plans in Year 1995

	Firms from National Set Created in First Integration		Unique EINs from 12 States Created in Second Integration	
	1995	2000	1995	2000
Defined Benefit Plans Only (Column Percentages)	18,464 35.45%	11,873 22.79%	5,590 30.30%	3,534 19.16%
Defined Benefit Plans and Defined Contribution Plans	33,622 64.55%	24,179 46.42%	12,858 69.70%	9,116 49.41%
Defined Contribution Plans Only	0 0.00%	16,034 30.78%	0 0.00%	5,798 31.43%
Total	52,086 100.00%	52,085 100.00%	18,448 100.00%	18,448 100.00%

Table 2.9 and 2.10 lists of summary statistics for firms that switched their pensions during the five-year time period and pensions who kept their pension plan[9]. Several things are striking when I make the comparison. Approximately,

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[9]In Table 2.10, the Churning Rate=2(|A+S|-|E-B|)/(B+E) where A=Accessions, S=Separations, B=Employment at Beginning of Qtr, and E=Employment at End of Qtr. Quit Rate=2S/(B+E). Net Growth=2(E-B)/(E+B)

22% of the firms terminated all of their defined benefit plans within the five-year period. Firms that converted their pensions offered lower salaries than those that kept their pensions. Also, although the firms that converted and the firms that kept their pensions had similar churning rates in 1995, by the year 2000 firms that converted their pensions had significantly higher churning rates. When comparing the percentage of females employed, the firms that converted their defined benefit plans have on average a much higher percentage of females. Approximately, 43% of the workforce is female compared to 35% of the workforce who are women in the firms that kept their defined benefit plans. It also appears that firms with lower revenue are the ones that are more likely to convert their pension plans. Surprisingly, the firms that switched their pensions on average have a higher productivity. Labor productivity is defined as the logarithm of total national sales divided by the total of national employees.

Table 2.9: Means and Standard Deviations for Firms That Offered a Defined Benefit Plan in 1995-State-EIN Level

	1995		2000	
	Offer DB Plans in 2000	No DB plans in 2000	Offer DB plans in 2000	No DB plans in 2000
N	27,329	7,780	27,329	7,780
Percentage of Workers age 45 or older	0.3552	0.3308	0.4237	0.3974
(Standard Deviation)	(0.2693)	(0.2593)	(0.2800)	(0.2694)
Percentage of Workers with at least a College Degree	0.4046	0.3794	0.3675	0.3440
	(0.2622)	(0.2501)	(0.2566)	(0.2437)
Percentage of Foreign Born Workers	0.0976	0.1034	0.1101	0.1152
	(0.1784)	(0.1822)	(0.1867)	(0.1882)
Percentage of Female Workers	0.3523	0.4323	0.3573	0.4355
	(0.2994)	(0.3145)	(0.3036)	(0.3164)
Percentage of Black Workers	0.05467	0.0596	0.0592	0.0667
	(0.1144)	(0.1288)	(0.1199)	(0.1412)
Percentage of Hispanic Workers	0.0405	0.0480	0.0525	0.0616
	(0.1033)	(0.1156)	(0.1206)	0.1313
Percentage of "Other Race" Workers	0.04100	0.0424	0.0464	0.0482
	(0.1088)	(0.1080)	(0.1151)	(0.1148)
Average Earnings	51651.11	45739.77	56254.65	50445.01
	(49372.10)	(50206.25)	(70819.32)	(95269.39)

Table 2.10: More Means and Standard Deviations for Firms That Offered a Defined Benefit Plan in 1995-State-EIN Level

	1995		2000	
	Offer DB Plans in 2000	No DB plans in 2000	Offer DB plans in 2000	No DB plans in 2000
N	27,329	7,780	27,329	7,780
Multi-Unit Firm	0.1618	0.1167	0.1680	0.1292
	(0.3682)	(0.3211)	(0.3739)	(0.3354)
Firm has 0-4 Employees Nationally	0.3051	0.2758	0.3030	0.2847
	(0.4605)	(0.4470)	(0.4596)	(0.4513)
Firm has 5-99 Employees Nationally	0.4625	0.5508	0.4499	0.5203
	(0.4986)	(0.4974)	(0.4975)	(0.4996)
Firm has 100-999 Employees Nationally	0.1916	0.1523	0.1960	0.1659
	(0.3936)	(0.4974)	(0.3970)	(0.3720)
Firm has 1000 or More Employees Nationally	0.0407	0.0211	0.0426	0.0213
	(0.1977)	)0.1437)	(0.2019)	(0.1445)
Firm Age	16.2286	15.8563	21.1286	20.7754
	(5.0959)	(5.7845)	(5.3992)	(6.1278)
Churning Rate for First Quarter[1]	0.2137	0.2285	0.3121	0.4131
	(1.9442)	(0.7009)	(16.7198)	(11.8434)
Quit Rates in First Quarter[2]	0.1586	0.1723	0.1586	0.1723
	(0.9994)	(0.4173)	(0.9994)	(0.4173)
Net Growth in Employees in First Quarter[3] (On State-EIN Level)	197.1914	121.2236	197.1915	121.2236
	(1113.27)	(682.1247)	(1113.27)	(682.1247)
Current Liabilites (OBRA 1987)	45265108	143321466	818586858	0
	(2206084318)	(1006504614)	(4402662766)	0
Current Assets	543333768	160469102	1577576569	0
	(2724957273)	(1205432361)	(9425411393)	0
lg(Sales)	35.4019	15.91223	45.4437	15.9726
	(138.8677)	(101.1643)	(1419.08)	(1228.97)
Productivity	0.7101	1.1893	0.7014	1.2232
	(1.6205)	(1.7834)	(1.6935)	(2.0190)

2.7   Empirical Results

This section discusses the empirical results from analyses on the data set described above. I break down the analyses into four different areas. I first discuss the different associations between the characteristics of the firms and their workforce with the conversion of defined benefit plans, reduction in benefits per worker and the reduction in pension funding per worker. I then discuss how a change in the number of employees, which is measured in different ways, is affected when defined

benefit pension plans are converted. I follow with a discussion on the relationship between the conversion of defined benefit pensions and productivity in the year 2000 only. I finally discuss how converting defined benefit plans possibly leads to a reduction in productivity over the five-year period.

Before discussing the regression results, it is important to acknowledge again that there is possibly endogeneity between converting pensions plans and productivity. Thus, I use a two step estimation. In addition to using an indicator in the regressions for converting pensions, I calculate estimations using the difference in current liabilities per employee from 1995 to 2000 and the difference in pension assets per employee from 1995 to 2000 as instruments for pension conversions. The difference in liabilities per worker and the difference in pension assets per worker are ways of measuring the reduction in benefits for each worker and the reduction in pension funding for each worker, respectively.

I argue that these instruments are positively correlated to converting pensions, but are exogenous to productivity. As stated earlier, current liabilities are the total pension amount the employees are obligated to get if the plan is converted or the employees leave prior to retirement. Liabilities may drop over a five-year period not only when firms reduce their workers' pensions or convert the defined benefit plans, but also when firms change discount rates, use a different pension benefit accrual cost method, or use a different expected mortality rate. Assets in the defined benefit pension fund not only drop when firms convert their pension plan and seize the assets to pay other debts, but also as a result of market fluctuations. Table 2.11 shows the correlations between converting pensions, the difference in current liabilities per worker from 1995 to 2000 and the difference in pension assets per worker from 1995 to 2000. The correlations are positive and significant at the 1% level among all three variables.

Table 2.11: Correlations Between Coverting Pension Plan, Differences in Liability and Differences in Assets

	Conversion of Pension Plan	Difference in Liability per Worker	Difference in Assets per Worker
Conversion of Pension Plans	1	0.22090	0.22056
(p-value)	-	<0.0001	<0.0001
N	35109	35078	35081
Difference in Liability per Worker		1	0.98074
		-	<0.0001
		34936	35078
Difference in Assets per Worker			1
			-
			34939

In order to estimate the two step estimation system using the difference in current liabilities per worker or the difference in pension assets per worker as an instrument, I need to define the first equation. Suppose there are k regressors on the right hand side and i represents the ith firm in the data set. Then the first equation used for the two step estimation model is defined as

$$CP_i = \gamma_0 + \gamma_1 X_{1i} + \ldots + \gamma_k X_{ki} + \psi D_i + u_i$$

where CP_i is the change in pension indicator for the ith firm, and D_i is either the difference in current liabilities per worker or the difference in pension assets per worker for the ith firm in the data set. The results of the first equation where the instrument is the change in current liability is listed in Table 2.12. The results of the first equation where the instruments is the change in pension assets is listed in Table 2.13. The second regression equation is defined as

$$Y_i = \beta_0 + \beta_{1i} X_{1i} + \ldots + \beta_{ki} X_{ki} + \theta CP_i + \epsilon_i$$

In performing the two step estimation both equations are estimated simultaneously and are discussed in the analyses below.

Table 2.12: Regression Results for the First Equation in the Two Step Estimation where Instrument is Change in Liability

	Dependent Variable is Indicator Variable for Converting Defined Benefit Plans, 1=Conversion Occurred,0=No Conversion		
	(1)	(2)	(3)
Intercept	-0.7351***	0.8965***	-0.0015
(Chi Square Values)	(26.90)	(67.06)	(0.00)
Difference in Liability from 1995 to 2000	-0.2832***	-0.2765***	-0.2716***
	(1517.38)	(1348.70)	(1270.87)
DC Plan in 1995	-0.0308	-0.0970***	-0.1338***
	(2.19)	(20.43)	(37.31)
Percentage of Workers age 45 or older	0.0541*		0.0340
	(3.06)		(1.15)
Percentage of Workers with at least a College Degree	0.0886***		0.1404***
	(6.96)		(15.75)
Percentage of Foreign Born Workers	0.0138		-0.0094
	(0.05)		(0.02)
Percentage of Female Workers	-0.2749***		-0.1873***
	(99.74)		(36.36)
Percentage of Black Workers	0.2091***		-0.1653**
	(8.45)		(0.0263)
Percentage of Hispanic Workers	-0.0520		-0.0818
	(0.30)		(0.71)
Percentage of "Other Race" Workers	0.1657*		0.1772**
	(3.13)		(3.51)
Log(Average 1995 Earnings)	0.1508***		0.0934***
	(128.20)		(41.48)
Multi-Unit Firm		0.1363***	0.1453***
		(26.64)	(29.86)
Firm has 5-99 Employees		-0.2172***	-0.1652***
		(124.25)	(66.04)
Firm has 100-999 Employees		-0.0554**	0.0115
		(3.97)	(0.15)
Firm has 1000 or More Employees		0.2028***	0.2649***
		(14.86)	(24.26)
Firm Age		0.0489***	0.0455***
		(14.86)	(50.75)
Firm Age Squared		-0.0021***	-0.0020***
		(77.94)	(67.55)
One Digit Industry Indicators	No	Yes	Yes
State Indicators	Yes	Yes	Yes
N	34,754	34,938	34753
log likelihood	-17056.6176	-16938.30064	-16776.35462

***-Denotes significance at 1%, **-Denotes significance at 5%, *-Denotes significance at 10%

Table 2.13: Regression Results for the First Equation in the Two Step Estimation where Instrument is Change in Pension Assets

	Dependent Variable is Indicator Variable for Converting Defined Benefit Plans, 1=Conversion Occurred,0=No Conversion		
	(1)	**(2)**	**(3)**
Intercept	-0.7462***	0.8870***	-0.0199
(Chi Square Values)	(27.69)	(65.60)	(0.01)
Difference in Pension Assets from 1995 to 2000	-0.2808***	-0.2740***	-0.2692***
	(1530.78)	(1362.33)	(1285.15)
DC Plan in 1995	-0.0280	-0.0946***	-0.1314***
	(1.81)	(19.41)	(35.94)
Percentage of Workers age 45 or older	0.0581*		0.0374
	(3.52)		(1.39)
Percentage of Workers with at least a College Degree	0.0901***		0.1424***
	(7.18)		(16.18)
Percentage of Foreign Born Workers	0.0117		-0.0115
	(0.03)		(0.03)
Percentage of Female Workers	-0.2742***		-0.1863***
	(99.04)		(35.93)
Percentage of Black Workers	0.2079***		0.1636**
	(8.34)		(4.83)
Percentage of Hispanic Workers	-0.0425		-0.0735
	(0.20)		90.57)
Percentage of "Other Race" Workers	0.1657*		0.1776*
	(3.12)		(3.52)
Log(Average 1995 Earnings)	0.1514***		0.0941***
	(128.97)		(41.97)
Multi-Unit Firm		0.1358***	0.1448***
		(26.44)	(269.68)
Firm has 5-99 Employees		-0.2168***	-0.1644***
		(123.66)	(65.39)
Firm has 100-999 Employees		-0.0551*	0.0134
		(3.78)	(0.20)
Firm has 1000 or More Employees		0.2040***	0.2666***
		(15.04)	(24.57)
Firm Age		0.00500***	0.0466***
		(15.04)	(53.19)
Firm Age Squared		-0.0022***	-0.0020***
		(80.08)	969.58)
One Digit Industry Indicators	No	Yes	Yes
State Indicators	Yes	Yes	Yes
N	34,751	34,935	34750
log likelihood	-17046.69132	-16928.04288	-16765.41674

***-Denotes significance at 1%, **-Denotes significance at 5%, *-Denotes significance at 10%

2.7.1 Workforce and Firm Characteristics and Pension Conversion

To determine the relationship between the characteristics of the firm and its workforce with the conversion of defined benefit pensions, I first estimate probit regressions and use an indicator for the conversion of defined benefit plans as the dependent variable. The dependent variable is one if all of the firm's defined benefit plans was converted during the five-year time period, zero otherwise. The

estimates found are for modeling the probabilities of keeping the defined benefit plans. In Table 2.14, the first and third regression results show that firms with a larger percentage of women in the workforce have a negative and significant association with converting pension plans. Also, the percentage of college-educated workers is positive and significant in the first and third regressions. This implies that firms with more college-educated workers and fewer women are less likely to convert their defined benefit plans. This seem understandable because workers without college degrees and women may not value their defined benefit plan as much because they are more mobile in the labor market. Also, the logarithm of earnings from 1995 is positive and significant in the first and third regressions. Thus, firms that paid higher salaries in 1995 are more likely to not convert their pension plans over the five-year period. Older firms are also more likely to keep their defined benefit plans. Firm age has a positive and significant association.

In the second regression, it is interesting to note that different firm sizes have different associations. For small firms, there is a negative association with the indicator variable. However, for middle-size and large firms, there is a positive association. This remains true when the workforce characteristics are included in the model as demonstrated in the third regression.

I next use the difference in pension liabilities per employee from 1995 to 2000 as my dependent variable and estimate OLS regression models. Again, the dependent variable implies that the larger the difference, the larger the reduction in benefits per employee. The results of the first and third regressions found in Table 2.15 show that firms with a larger percentage of women have a positive association with the difference in liability per person and is significant. Also, in the first and third regressions, the percentage of workers over the age of forty-five both has a negative association and is significant. However, the percentage of college-educated workers

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is insignificant. The logarithm of average total earnings of workers in 1995 is negatively associated with the difference in liabilities per worker. It seems that firms with higher paid employers in 1995 were less likely to reduce benefits of workers over the five-year period.

In the second regression in Table 2.15, different firm sizes all have the same associations unlike in Table 2.14. There is a negative and significant association for all three firm sizes. However, the largest firm size has the most negative association. The results are similar when the dependent variable is the difference in pension assets per employee found in Table 2.16.

Table 2.14: Probit Model Regression Results

	Dependent Variable is Indicator Variable for Converting Defined Benefit Plans, 1=Conversion Occurred,0=No Conversion		
	(1)	(2)	(3)
Intercept	-1.1645***	0.5462***	-0.5015***
(Chi square values)	(73.62)	(30.57)	(8.35)
DC Plan in 1995	-0.0249	-0.0804***	-0.1268***
	(1.55)	(14.65)	(35.93)
Percentage of Workers age 45 or older	0.0554*		0.0308
	(3.37)		(1.00)
Percentage of Workers with at least a College Degree	0.0777**		0.1224***
	(5.63)		(12.78)
Percentage of Foreign Born Workers	-0.0143		-0.0297
	(0.05)		(0.23)
Percentage of Female Workers	-0.3601***		-0.2676***
	(183.44)		(79.35)
Percentage of Black Workers	0.1891***		0.0747
	(7.55)		(1.09)
Percentage of Hispanic Workers	0.1890**		-0.0203
	(4.49)		(0.05)
Percentage of "Other Race" Workers	0.0745		0.1758*
	(0.67)		(3.84)
Log(Average 1995 Earnings)	0.1890***		0.1142***
	(222.49)		(65.16)
Multi-Unit Firm		0.1574***	0.1718***
		(33.83)	(41.79)
Firm has 5-99 Employees		-0.1015***	-0.0375*
		(29.08)	(3.81)
Firm has 100-999 Employees		0.0906***	0.1745***
		(10.32)	(36.39)
Firm has 1000 or More Employees		0.3229***	0.4258***
		(26.39)	(44.76)
Firm Age		0.0577***	0.0533***
		(86.82)	(75.47)
Firm Age Squared		-0.0023***	-0.0022***
		(95.31)	(84.61)
Net Growth Rate in 2000 Quarter 1		0.0000	0.0000
		(1.51)	(0.79)
One Digit Industry Indicators	No	Yes	Yes
State Indicators	Yes	Yes	Yes
N	34,920	33,532	34779
Log-Likelihood	-17130.90257	-17130.90257	-17584.96227

***-Denotes significance at 1%, **-Denotes significance at 5%, *-Denotes significance at 10%
Estimates are for modeling the probabilities of keeping the defined benefit plan

Table 2.15: OLS Model Regression Results

	Dependent Variable is Difference in Liabilities Per Worker from 1995 to 2000		
	(1)	(2)	(3)
Intercept	1.74776***	0.20127*	1.17458***
(Chi Square values)	(12.20)	(1.94)	(6.52)
DC Plan in 1995	0.22372***	0.19842***	0.23396***
	(10.57)	(9.22)	(10.69)
Percentage of Workers age 45 or older	-0.08329***		-0.06700**
	(-2.75)		(-2.21)
Percentage of Workers with at least a College Degree	-0.02138		0.01401
	(-0.65)		(0.42)
Percentage of Foreign Born Workers	0.06856		0.06794
	(1.09)		(1.10)
Percentage of Female Workers	0.21673***		0.22632***
	(7.77)		(7.38)
Percentage of Black Workers	0.08883		0.28222***
	(1.24)		(3.88)
Percentage of Hispanic Workers	-0.38584***		-0.26246***
	(-4.02)		(-2.76)
Percentage of "Other Race" Workers	-0.17656*		-0.09110
	(-1.95)		(-1.02)
Log(Average 1995 Earnings)	-0.18100***		-0.10050***
	(-13.50)		(-6.94)
Multi-Unit Firm		-0.09991***	-0.10585***
		(-3.86)	(-4.09)
Firm has 5-99 Employees		-0.19755***	-0.25456***
		(-10.58)	(-13.15)
Firm has 100-999 Employees		-0.26520***	-0.35630***
		(-9.60)	(-12.37)
Firm has 1000 or More Employees		-0.29434***	-0.39357***
		(-5.34)	(-7.06)
Firm Age		-0.03469***	-0.03156***
		(5.15)	(-4.92)
Firm Age Squared		0.00126***	0.00117***
		(5.15)	(4.78)
Net Growth Rate in 2000 Quarter 1		-0.00000829	-0.00000718
		(-0.93)	(-0.80)
One Digit Industry Indicators	No	Yes	Yes
State Indicators	Yes	Yes	Yes
N	34,754	34,654	34653
Adjusted R-Square	0.0168	0.0447	0.0493

***-Denotes significance at 1%, **-Denotes significance at 5%, *-Denotes significance at 10%

	Dependent Variable is Difference in Pension Assets Per Worker from 1995 to 2000		
	(1)	(2)	(3)
Intercept	1.76629***	0.14799	1.14872***
(Chi Square values)	(12.14)	(1.40)	(6.27)
DC Plan in 1995	0.24101***	0.21324***	0.24943***
	(11.21)	(9.75)	(11.21)
Percentage of Workers age 45 or older	-0.07434**		-0.05869
	(-2.41)		(-1.90)
Percentage of Workers with at least a College Degree	-0.01610		0.02084
	(-0.48)		(0.61)
Percentage of Foreign Born Workers	0.05208		0.05406
	(0.82)		(0.86)
Percentage of Female Workers	0.21016***		0.22006***
	(7.42)		(7.06)
Percentage of Black Workers	0.09236		0.28343***
	(1.27)		(3.83)
Percentage of Hispanic Workers	-0.34012***		-0.22153***
	(-3.49)		(-2.29)
Percentage of "Other Race" Workers	-0.15292*		-0.06518
	(-1.66)		(-0.71)
Log(Average 1995 Earnings)	-0.18486***		-0.10358***
	(-13.58)		(-7.04)
Multi-Unit Firm		-0.10518***	-0.11124***
		(-4.00)	(-4.23)
Firm has 5-99 Employees		-0.19223***	-0.24909***
		(-10.13)	(-12.66)
Firm has 100-999 Employees		-0.25416***	-0.34547***
		(-9.06)	(-11.80)
Firm has 1000 or More Employees		-0.28683***	-0.38592***
		(-5.12)	(-6.81)
Firm Age		-0.03004***	-0.02689***
		(-4.60)	(-4.12)
Firm Age Squared		0.00114***	0.00105***
		(4.60)	(4.22)
Net Growth Rate in 2000 Quarter 1		-0.00000788	-0.00000677
		(-0.87)	(-0.75)
One Digit Industry Indicators	No	Yes	Yes
State Indicators	Yes	Yes	Yes
N	34,751	34,651	34,650
Adjusted R-Square	0.0171	0.0439	0.0483

***-Denotes significance at 1%, **-Denotes significance at 5%, *-Denotes significance at 10%

2.7.2 Changes in Employment and Pension Conversion

Before determining how converting pensions affect employee change, I first define two different ways of measuring employee growth. A firm that grows by one employee may do so by simply hiring one new employee, or by hiring ten workers and letting go of nine. Having to replace workers who left in the second case is more costly to the firm because the firm now must invest in training ten workers instead of one like in the previous case. Thus, it is important to look at the net growth

(adding one new worker) and churning (total of 10+9-1= 18 extra employees who came and left above those needed to increase the number by 1) separately. The net growth rate is defined as the difference between the number of workers at the end of the quarter minus the number of employees at the beginning of the quarter divided by the average number of employees between the beginning and end of the first quarter in the year 2000. The churning rate is defined as churning described above divided by the average number of employees between the beginning and end of the first quarter in the year 2000. I also calculate quit rates for the firms. A quit rate is defined as the number of separations divided by the average number of employees between the beginning and end of the first quarter in the year 2000.

Table 2.17 shows the OLS regression results where the churning rates and quit rates are the dependent variables. Unfortunately, variance in the data is not explained by these regressions. There are no or little significant results. However, when I estimate OLS regressions where net growth rate is the dependent variable, I have some estimates that are significant. Table 2.18 has the results of the regressions. The conversion of the defined benefit pension plans is negatively associated with net growth in the first regression once I only control for worker characteristics. This implies that converting defined benefit plans some time over the five-year period negatively affects employee growth by the year 2000. However, the estimate is insignificant in the second and third regressions.

When I use the difference in liabilities per worker as an instrumental variable for the change in pension plans, the results are similar. In Table 2.19, I use the churning rate and quit rate as dependent variables. Again, the results are mostly insignificant. However, I have some significant results when I use the net growth rate as the dependent variable and the difference in liabilities per worker as an instrument. In Table 2.20, the estimate for the predicted probability of

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converting the defined benefit plan is negatively associated with the net growth rate and it is significant in all three regressions. This again implies that converting defined benefit plans negatively affects employee growth by the year 2000. These similar conclusions are also found when I use the difference in pension assets per worker as an instrumental variable for the change in pensions. These results are found in Table 2.21 and Table 2.22.

Table 2.17: OLS Regression Results Using an Indicator for the Conversion of Defined Benefit Plans

	Dependent Variable is Churning Rate for Year 2000 Quarter 1			Dependent Variable is Quit Rate in Year 2000 Quarter 1		
	(1)	(2)	(3)	(4)	(5)	(6)
Intercept	2.11427	0.12707	1.16210	1.29208	0.15339	0.83214
(t values)	(1.32)	(0.12)	(0.58)	(1.60)	(0.28)	(0.83)
Changed to a DC plan by 2000 Indicator	0.09365	0.13452	0.14748	0.04582	0.06230	0.06775
	(0.45)	(0.64)	(0.69)	(0.44)	(0.59)	(0.63)
DC Plan in 1995	0.04105	-0.011134	-0.05446	0.04504	0.02254	0.00316
	(0.18)	(-0.05)	(-0.22)	(0.39)	(0.19)	(0.03)
Percentage of Workers age 45 or older	-0.01121		0.04539	-0.00223		0.02714
	(-0.03)		(0.13)	(-0.01)		(0.16)
Percentage of Workers with at least a College Degree	-0.02409		-0.02687	-0.01361		-0.01754
	(-0.07)		(-0.07)	(-0.07)		(-0.09)
Percentage of Foreign Born Workers	-0.33822		-0.35899	-0.15732		-0.16816
	(-0.49)		(-0.52)	(-0.45)		(-0.48)
Percentage of Female Workers	-0.36083		-0.49551	-0.19563		-0.25744
	(-1.16)		(-1.43)	(-1.25)		(-1.48)
Percentage of Black Workers	-0.13878		-0.76138	-0.06497		-0.35269
	(-0.17)		(-0.92)	(-0.16)		(-0.85)
Percentage of Hispanic Workers	-0.18133		-0.18344	-0.14877		-0.13473
	(-0.17)		(-0.17)	(-0.28)		(-0.25)
Percentage of "Other Race" Workers	0.18364		-0.03418	0.06553		-0.03766
	(0.18)		(-0.03)	(0.13)		(-0.08)
Log(Average 1995 Earnings)	-0.18072		-0.08280	-0.10815		-0.05700
	(-1.20)		(-0.51)	(-1.44)		(-0.70)
Multi-Unit Firm		0.05687	0.03696		0.02579	0.01414
		(0.19)	(-.13)		(0.18)	(0.10)
Firm has 5-99 Employees		0.07145	0.13146		0.01170	0.03917
		(0.34)	(0.60)		(0.11)	(0.36)
Firm has 100-999 Employees		0.29022	0.40659		0.11492	0.16866
		(0.94)	(1.25)		(0.74)	(1.04)
Firm has 1000 or More Employees		2.21307***	2.37569***		1.06488***	1.14331***
		(4.04)	(4.25)		(3.88)	(4.08)
Firm Age		0.01504	0.01628		0.00766	0.00879
		(0.21)	(0.23)		(0.21)	(0.24)
Firm Age Squared		-0.00133	-0.00147		-0.00072312	-0.00081574
		(-0.49)	(-0.53)		(-0.53)	(-0.59)
One Digit Industry Indicators	No	Yes	Yes	No	Yes	Yes
State Indicators	Yes	Yes	Yes	Yes	Yes	Yes
N	33,408	33,532	33370	33,408	33,663	33370
Adjusted R-Square	0.0001	0.0010	0.0009	0.0002	0.0009	0.0010

***-Denotes significance at 1%, **-Denotes significance at 5%, *-Denotes significance at 10%

Table 2.18: OLS Regression Results Using an Indicator for the Conversion of Defined Benefit Plans

	Dependent Variable is Net Growth Rate for Year 2000 Quarter 1		
	(1)	(2)	(3)
Intercept	608.210011***	-101.81739	-400.24477***
(t values)	(5.60)	(-1.60)	(-3.48)
Changed to a DC plan by 2000 Indicator	-100.51569***	12.21628	-16.06874
	(-7.07)	(-1.51)	(-1.31)
DC Plan in 1995	189.80134***	35.47809**	30.38105**
	(12.01)	(2.57)	(2.13)
Percentage of Workers age 45 or older	-18.80134		-12.03311
	(-0.81)		(-0.61)
Percentage of Workers with at least a College Degree	-27.43409		17.70307
	(-1.10)		(0.81)
Percentage of Foreign Born Workers	-46.65976		-29.65421
	(-0.99)		(-0.74)
Percentage of Female Workers	146.22065***		8.79649
	(6.94)		(0.44)
Percentage of Black Workers	633.90570***		8.99597
	(11.63)		(0.19)
Percentage of Hispanic Workers	164.97794**		56.48136
	(2.31)		(0.92)
Percentage of "Other Race" Workers	222.64324***		35.84133
	(3.29)		(0.62)
Log(Average 1995 Earnings)	54.13590*		29.29539***
	(1.98)		(3.11)
Multi-Unit Firm		122.40654***	124.51767***
		(7.24)	(3.11)
Firm has 5-99 Employees		12.98873	18.14364
		(1.07)	(1.44)
Firm has 100-999 Employees		252.93663***	260.94510***
		(14.16)	(13.91)
Firm has 1000 or More Employees		2997.46626***	3006.93798***
		(94.73)	(92.99)
Firm Age		4.66626	3.95218
		(1.13)	(0.95)
Firm Age Squared		-0.14723	-0.11490
		(-0.93)	(-0.72)
One Digit Industry Indicators	No	Yes	Yes
State Indicators	Yes	Yes	Yes
N	33,408	33,532	33370
Adjusted R-Square	0.0154	0.2842	0.2839

***-Denotes significance at 1%, **-Denotes significance at 5%, *-Denotes significance at 10%

Table 2.19: Two Step Regression Results Using the Difference in Pension Liabilities Per Worker as the Instrumental Variable

	Dependent Variable is Churning Rate for Year 2000 Quarter 1			Dependent Variable is Quit Rate in Year 2000 Quarter 1		
	(1)	(2)	(3)	(4)	(5)	(6)
Intercept	2.02922	0.05903	0.86625	1.22225	0.13637	0.71317
(t values)	(1.14)	(0.05)	(0.41)	(1.37)	(0.23)	0.67
Predicted Probability that DB Plan Changed by 2000	0.20561	0.55889	0.73637	0.13162	0.24330	0.32976
	(0.22)	(0.57)	(0.74)	(0.29)	(0.50)	(0.66)
DC Plan in 1995	0.03898	-0.02428	-0.08126	0.04442	0.01704	-0.00896
	(0.`7)	(-0.10)	(-0.32)	(0.38)	(0.14)	(-0.07)
Percentage of Workers age 45 or older	-0.00901		0.05113	0.00001283		0.03043
	(-0.03)		(0.15)	(0.00)		(0.018)
Percentage of Workers with at least a College Degree	-0.02178		-0.00728	-0.01166		-0.00910
	(-0.06)		(-0.02)	(-0.06)		(-0.05)
Percentage of Foreign Born Workers	-0.34249		-0.36639	-0.15959		-0.17191
	(-0.49)		(0.52)	(-0.46)		(-0.49)
Percentage of Female Workers	-0.37438		-0.53832	-0.20574		-0.27949
	(-1.15)		(-1.53)	(-1.26)		(-1.56)
Percentage of Black Workers	-0.13226		-0.75317	-0.05799		-0.34884
	(-0.16)		(-0.91)	(-0.14)		(-0.84)
Percentage of Hispanic Workers	-0.17954		-0.18249	-0.14866		-0.13400
	(0.19)		(-0.17)	(-0.28)		(-0.25)
Percentage of "Other Race" Workers	0.19214		-0.00466	0.07199		-0.02459
	(0.19)		(-0.00)	(-0.14)		(-0.05)
Log(Average 1995 Earnings)	-0.17460		-0.06283	-0.10315		-0.04816
	(-1.09)		(-0.38)	(-1.29)		(-0.58)
Multi-Unit Firm		0.07398	0.06287		0.03293	0.02557
		(0.25)	(0.21)		(0.22)	(-0.17)
Firm has 5-99 Employees		0.05959	0.12658		0.00657	0.03676
		(0.28)	(0.58)		(0.06)	(0.33)
Firm has 100-999 Employees		0.30244	0.43940		0.12033	0.18332
		(0.97)	(1.33)		(0.77)	(1.11)
Firm has 1000 or More Employees		2.26232***	2.45631***		1.08668***	1.17970***
		(4.07)	(4.29)		(3.90)	(4.11)
Firm Age		0.02092	0.02442		0.00977	0.01201
		(0.28)	(0.33)		(0.26)	(0.32)
Firm Age Squared		-0.00158	-0.00181		-0.00081637	-0.00095630
		(-0.56)	(-0.64)		(-0.57)	(-0.67)
One Digit Industry Indicators	No	Yes	Yes	No	Yes	Yes
State Indicators	Yes	Yes	Yes	Yes	Yes	Yes
N	33,264	33,421	33263	33,264	33421	33263
Adjusted R-Square	0.0001	0.0010	0.0009	0.0002	0.0011	0.0010

***-Denotes significance at 1%, **-Denotes significance at 5%, *-Denotes significance at 10%

Table 2.20: Two Step Regression Results Using the Difference in Pension Liabilities Per Worker as the Instrumental Variable

	Dependent Variable is Net Growth Rate for Year 2000 Quarter 1		
	(1)	(2)	(3)
Intercept	885.49182***	-84.01064	-335.20933***
(t values)	(7.40)	(-1.22)	(-2.75)
Predicted Probability that DB Plan Changed by 2000	-403.69628***	-140.37917**	-119.57901**
	(-6.54)	(-2.50)	(-2.09)
DC Plan in 1995	193.31908***	37.88220***	33.57901**
	(12.19)	(2.72)	(2.33)
Percentage of Workers age 45 or older	-23.46137		-14.41501
	(-1.03)		(-0.73)
Percentage of Workers with at least a College Degree	-34.71344		14.00888
	(-1.41)		(0.64)
Percentage of Foreign Born Workers	-50.51613		-36.68708
	(-1.07)		(-0.91)
Percentage of Female Workers	174.73430***		17.48794
	(7.94)		(0.85)
Percentage of Black Workers	614.92474***		4.86424
	(11.26)		(0.10)
Percentage of Hispanic Workers	153.08494**		45.19058
	(2.13)		(0.73)
Percentage of "Other Race" Workers	210.75931***		37.24532
	(3.11)		(0.64)
Log(Average 1995 Earnings)	-79.49440***		23.96930**
	(-7.37)		(2.50)
Multi-Unit Firm		116.74076***	119.15772***
		(6.85)	(6.94)
Firm has 5-99 Employees		15.46119	17.71490
		(1.27)	(1.41)
Firm has 100-999 Employees		248.98088***	254.35261***
		(13.93)	(13.42)
Firm has 1000 or More Employees		2988.45650***	2996.75631***
		(93.45)	(90.99)
Firm Age		4.47046	4.32053
		(1.05)	(1.01)
Firm Age Squared		-0.12532	-0.11437
		(-0.77)	(-0.70)
One Digit Industry Indicators	No	Yes	Yes
State Indicators	Yes	Yes	Yes
N	33,264	33,421	33263
Adjusted R-Square	0.0154	0.2865	0.2862

***-Denotes significance at 1%, **-Denotes significance at 5%, *-Denotes significance at 10%

Table 2.21: Two Step Regression Results Using Difference in Pension Assets Per Worker as the Instrumental Variable

	Dependent Variable is Churning Rate for Year 2000 Quarter 1			Dependent Variable is Quit Rate in Year 2000 Quarter 1		
	(1)	(2)	(3)	(4)	(5)	(6)
Intercept	2.02772	0.0612	0.87073	1.22120	0.13662	0.71435
(t values)	(1.14)	(0.05)	(0.41)	(1.37)	(0.23)	(0.67)
Predicted Probability that DB Plan Changed by 2000	0.20847	0.55580	0.73073	0.13322	0.24260	0.32841
	(0.23)	(0.57)	(0.74)	(0.29)	(0.50)	(0.66)
DC Plan in 1995	0.03859	-0.02440	-0.08134	0.04425	0.01697	-0.00905
	(0.16)	(-0.10)	(-0.32)	(0.38)	(0.14)	(-0.07)
Percentage of Workers age 45 or older	-0.00920		0.05068	-0.00006112		0.03024
	(-0.03)		(0.15)	(0.00)		(0.18)
Percentage of Workers with at least a College Degree	-0.02177		-0.00769	-0.01165		-0.00924
	(-0.06)		(-0.02)	(-0.06)		(-0.05)
Percentage of Foreign Born Workers	-0.34256		-0.36642	-0.15957		-0.17190
	(-0.49)		(-0.52)	(-0.46)		(-0.49)
Percentage of Female Workers	-0.37487		-0.54423	-0.20596		-0.27951
	(-1.15)		(-1.53)	(-1.26)		(-1.56)
Percentage of Black Workers	-0.13241		-0.75368	-0.05803		-0.34905
	(-0.16)		(-0.91)	(-0.14)		(-0.84)
Percentage of Hispanic Workers	-0.18008		-0.18338	-0.14895		-0.13444
	(-0.17)		(-0.17)	(-0.28)		(-0.25)
Percentage of "Other Race" Workers	0.19212		-0.00571	0.07200		-0.02499
	(0.19)		(-0.01)	(0.14)		(-0.05)
Log(Average 1995 Earnings)	-0.17446		-0.06306	-0.10306		-0.04821
	(-1.09)		(-0.38)	(-1.29)		(-0.58)
Multi-Unit Firm		0.07385	0.06260		0.03290	0.02550
		(0.25)	(0.21)		(0.22)	(0.17)
Firm has 5-99 Employees		0.05971	0.12668		0.00662	0.03681
		(0.28)	(-.58)		(0.06)	(0.33)
Firm has 100-999 Employees		0.30233	0.43910		0.12031	0.18326
		(0.97)	(.33)		(0.77)	(1.11)
Firm has 1000 or More Employees		2.26201***	2.45568***		1.08662***	1.17957***
		(4.07)	(4.29)		(3.90)	(4.11)
Firm Age		-0.00158	0.02433		0.00976	0.01200
		(-0.56)	(0.33)		(0.26)	(0.32)
Firm Age Squared		-0.00158	-0.00181		-0.00081639	-0.00095596
		(-0.56)	(-0.64)		(-0.57)	(-0.67)
One Digit Industry Indicators	No	Yes	Yes	No	Yes	Yes
State Indicators	Yes	Yes	Yes	Yes	Yes	Yes
N	33,261	33,418	33260	33,264	33421	33263
Adjusted R-Square	0.0001	0.0010	0.0009	0.0002	0.0011	0.0010

***-Denotes significance at 1%, **-Denotes significance at 5%, *-Denotes significance at 10%

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Table 2.22: Two Step Regression Results Using the Difference in Pension Assets Per Worker as the Instrumental Variable

	Dependent Variable is Net Growth Rate in Year 2000 Quarter 1		
	(1)	(2)	(3)
Intercept	877.34524***	-84.65233	-336.37652***
(t values)	(7.33)	(-1.23)	(-2.76)
Predicted Probability that DB Plan Changed by 2000	-393.76912***	-138.05738**	-117.61663**
	(-6.40)	(2.47)	(-2.06)
DC Plan in 1995	193.18093***	37.80731***	33.51250**
	(12.18)	(2.71)	(2.33)
Percentage of Workers age 45 or older	-23.25052		-14.37770
	(-1.02)		(-0.73)
Percentage of Workers with at least a College Degree	-34.47714		14.08739
	(-1.40)		(0.64)
Percentage of Foreign Born Workers	-50.65954		-36.71742
	(1.08)		(-0.91)
Percentage of Female Workers	173.68467***		17.33507
	(7.89)		(0.85)
Percentage of Black Workers	615.44386***		4.89460
	(11.27)		(0.10)
Percentage of Hispanic Workers	153.63207**		45.26128
	(2.14)		(0.73)
Percentage of "Other Race" Workers	211.58356***		37.41676
	(3.12)		(0.65)
Log(Average 1995 Earnings)	-78.91098***		24.03350**
	(-7.32)		(2.50)
Multi-Unit Firm		116.84992***	119.25428***
		(6.85)	(6.94)
Firm has 5-99 Employees		15.38677	17.68759
		(1.26)	(1.40)
Firm has 100-999 Employees		249.03981***	254.45192***
		(13.93)	(13.43)
Firm has 1000 or More Employees		2988.67022***	2996.98366***
		(93.46)	(91.01)
Firm Age		4.51764	4.35799
		(1.06)	(1.02)
Firm Age Squared		-0.12713	-0.115581
		(-0.78)	(-0.71)
One Digit Industry Indicators	No	Yes	Yes
State Indicators	Yes	Yes	Yes
N	33,261	33,418	33260
Adjusted R-Square	0.0153	0.2869	0.2862

***-Denotes significance at 1%, **-Denotes significance at 5%, *-Denotes significance at 10%

2.7.3 Productivity in the Year 2000 and Pension Conversion

To determine the relationship between productivity and converting pensions, the dependent variable is productivity in year 2000 in the regressions. Again, productivity is defined as the logarithm of total sales divided by the total of national workers. In Table 2.23, I use the indicator for converting pension plans where the indicator equals one if there was a conversion by the year 2000, zero if there was not. When looking at the association between converting defined benefit plans

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and productivity in 2000, interestingly, there is a positive association, and it is significant at the 1% level in all three regressions. However, what is surprising is that when I use the two step estimation, I get different results. In Table 2.24, I use the difference in liabilities per worker as an instrument. It is very striking that the probability of converting has a negative association and is significant at the 1% level in all three regressions. Thus, the more likely a firm converts its defined benefit plans, the lower the productivity is in the year 2000. In Table 2.25, I use the difference in assets per worker as an instrument. Again, the association between the probability of converting a defined benefit plan and productivity in 2000 is negative and significant at the 1% level in all three regressions. Using the difference in liabilities per worker and the difference in pension assets per worker as instruments in the two step estimation shows that converting defined benefit plans is negatively associated with productivity in the year 2000. Thus, firms that convert their defined benefit plans have lower productivity than firms that do not convert their defined benefit plans by the year 2000.

Table 2.23: OLS Regression Results Using an Indicator for the Conversion of Defined Benefit Plans

	Dependent Variable is Productivity in Year 2000		
	(1)	(2)	(3)
Intercept	1.30553***	3.34176***	2.82640***
(t values)	(7.31)	(28.65)	(13.61)
Changed to a DC plan by 2000 Indicator	0.42021***	0.31310***	0.28045***
	(18.52)	(14.64)	(13.22)
DC Plan in 1995	-1.20118***	-1.10791***	-1.01226***
	(-48.13)	(-46.03)	(-41.68)
Percentage of Workers age 45 or older	0.50191***		0.39845***
	(12.58)		(10.63)
Percentage of Workers with at least a College Degree	0.07973*		-0.13478***
	(1.83)		(-3.20)
Percentage of Foreign Born Workers	-0.12632		-0.20234***
	(-1.57)		(-2.72)
Percentage of Female Workers	0.92760***		0.88198***
	(26.77)		(24.31)
Percentage of Black Workers	-0.72167***		-0.20763**
	(-8.36)		(-2.55)
Percentage of Hispanic Workers	-0.82975***		-0.35870***
	(-7.14)		(-3.33)
Percentage of "Other Race" Workers	0.23318**		0.28930***
	(2.10)		(2.82)
Log(Average 1995 Earnings)	-0.02633		0.01691
	(-1.56)		(0.99)
Multi-Unit Firm		0.10953***	0.10849***
		(3.90)	(3.90)
Firm has 5-99 Employees		-1.11804***	-1.13316***
		(-49.73)	(-49.53)
Firm has 100-999 Employees		-1.49103***	-1.52195***
		(-47.44)	(47.13)
Firm has 1000 or More Employees		-1.62014***	-1.68545***
		(-27.03)	(-28.10)
Firm Age		-0.03128***	-0.03066***
		(-4.19)	(-4.15)
Firm Age Squared		-0.00022235	-0.00024412
		(-0.79)	(-0.87)
Net Growth Rate in 2000 Quarter 1		-0.00001750*	-0.00001831*
		(-1.83)	(0.0526)
One Digit Industry Indicators	No	Yes	Yes
State Indicators	Yes	Yes	Yes
N	29,812	29739	29738
Adjusted R-Square	0.1699	0.2767	0.2941

***-Denotes significance at 1%, **-Denotes significance at 5%, *-Denotes significance at 10%

Table 2.24: Two Step Regression Results Using Difference in Liabilities Per Worker as the Instrumental Variable

	Dependent Variable is Productivity in Year 2000		
	(1)	(2)	(3)
Intercept	-1.62184***	2.72980***	1.72213***
(t values)	(-8.50)	(22.49)	(7.91)
Predicted Probability that DB Plan Changed by 2000	-3.83480***	-2.31975***	-2.13390***
	(41.59)	(24.40)	(22.29)
DC Plan in 1995	-1.24782***	-1.14602***	-1.07642***
	(-51.06)	(-47.12)	(-43.41)
Percentage of Workers age 45 or older	0.55584***		0.41752***
	(-14.23)		(11.03)
Percentage of Workers with at least a College Degree	0.15259***		-0.06489
	(3.57)		(-1.52)
Percentage of Foreign Born Workers	-0.13428*		-0.21045***
	(-1.71)		(-2.81)
Percentage of Female Workers	0.56325***		0.71506***
	(15.98)		(19.09)
Percentage of Black Workers	-0.52001***		-0.10234
	(-6.14)		(-1.24)
Percentage of Hispanic Workers	-0.72683***		-0.34857***
	(-6.39)		(-3.22)
Percentage of "Other Race" Workers	0.41989***		0.39590***
	(3.86)		(3.85)
Log(Average 1995 Earnings)	0.18773***		0.07444***
	(10.79)		(4.24)
Multi-Unit Firm		0.19769***	0.19299***
		(6.87)	(6.75)
Firm has 5-99 Employees		-1.15667***	-1.13888***
		(-50.97)	(-49.34)
Firm has 100-999 Employees		-1.42043***	-1.41500***
		(-44.53)	(-42.61)
Firm has 1000 or More Employees		-1.40864***	-1.45116***
		(-23.09)	(-23.55)
Firm Age		0.00454	0.00017040
		(0.59)	(0.02)
Firm Age Squared		-0.00165***	-0.00149***
		(-5.62)	(-5.11)
Net Growth Rate in 2000 Quarter 1		-0.00002210**	-0.00002283**
		(-2.43)	(-2.54)
One Digit Industry Indicators	No	Yes	Yes
State Indicators	Yes	Yes	Yes
N	29,788	28653	28528
Adjusted R-Square	0.2065	0.2873	0.3032

***-Denotes significance at 1%, **-Denotes significance at 5%, *-Denotes significance at 10%

Table 2.25: Two Step Regression Results Using Difference in Pension Assets Per Worker as the Instrumental Variable

	Dependent Variable is Productivity in Year 2000		
	(1)	(2)	(3)
Intercept	-1.63772***	2.71728***	1.69078***
(t values)	(-8.59)	(22.40)	(7.77)
Predicted Probability that DB Plan Changed by 2000	-3.85014***	-2.36155***	-2.17771***
	(41.94)	(24.98)	(22.90)
DC Plan in 1995	-1.24722***	-1.14665***	-1.07768***
	(-51.05)	(-47.17)	(-43.48)
Percentage of Workers age 45 or older	0.55412***		0.41698***
	(14.19)		(11.02)
Percentage of Workers with at least a College Degree	0.15251***		-0.06352
	(3.57)		(-1.49)
Percentage of Foreign Born Workers	-0.13272*		-0.20934***
	(-1.69)		(-2.80)
Percentage of Female Workers	0.56331***		0.71298***
	(16.00)		(19.05)
Percentage of Black Workers	-0.51755***		-0.10009
	(-6.12)		(-1.21)
Percentage of Hispanic Workers	-0.72778***		-0.34953***
	(-6.40)		(-3.23)
Percentage of "Other Race" Workers	0.41613***		0.39536***
	(3.82)		(3.85)
Log(Average 1995 Earnings)	0.18888***		0.07631***
	(10.86)		(4.35)
Multi-Unit Firm		0.19945***	0.19497***
		(6.94)	(6.83)
Firm has 5-99 Employees		-1.15676***	-1.13827***
		(-51.00)	(-49.34)
Firm has 100-999 Employees		-1.41838***	-1.41186***
		(-44.49)	(-42.55)
Firm has 1000 or More Employees		-1.40416***	-1.44555***
		(-23.03)	(23.47)
Firm Age		0.00532	0.00094108
		(0.69)	(0.12)
Firm Age Squared		-0.00168***	-0.00152***
		(-5.73)	(-5.22)
Net Growth Rate in 2000 Quarter 1		-0.00002198**	-0.00002273***
		(-2.42)	(-2.53)
One Digit Industry Indicators	No	Yes	Yes
State Indicators	Yes	Yes	Yes
N	29,785	28650	28525
Adjusted R-Square	0.2072	0.2877	0.3037

***-Denotes significance at 1%, **-Denotes significance at 5%, *-Denotes significance at 10%

2.7.4 Change in Productivity Over Five-Year Period and Pension Conversion

Finally, I determine if there is any evidence that suggests that converting pensions reduces productivity over the five-year period. In Table 2.26, I use the difference in productivity from 1995 to 2000 as my dependent variable. This variable implies that the larger the difference in productivity from 1995 to 2000, the larger the reduction in productivity. When using the indicator variable for converting

pension plans in an OLS regression, there is no significant association with the difference in productivity once I control for the workforce and firm characteristics in the three equations.

However, in Table 2.27 I use the difference of liabilities per worker as an instrument and estimate the two step estimation system. Interestingly, when I control for the workforce and firm characteristics, the probability of converting defined benefit plans has a positive association with the difference in productivity, and it is significant at the 1% level in all three regressions. This implies that when the probability for firms to convert their defined benefit plans increase, productivity fell from 1995 to 2000 after I control for the firm and workforce characteristics. In Table 2.28, I use the difference of assets per worker as an instrument when estimating the two step estimation system. The results are again similar to the results found when using the liabilities per worker as an instrument. There is a positive association between the probability of converting defined benefit plans and the reduction in productivity once I control for the firm and workforce characteristics.

Table 2.26: OLS Regression Results Using an Indicator for Plan Change

	Dependent Variable is Difference in Productivity from 1995 to 2000		
	(1)	(2)	(3)
Intercept	-0.81139***	0.06277	-0.28384*
(t values)	(-6.05)	(0.69)	(-1.72)
Changed to a DC plan by 2000 Indicator	-0.01670	-0.00517	0.00306
	(-1.00)	(-0.31)	(0.18)
DC Plan in 1995	0.00256	0.02184	0.00067960
	(0.14)	(1.18)	(0.04)
Percentage of Workers age 45 or older	-0.03879		-0.05972**
	(-1.34)		(-2.03)
Percentage of Workers with at least a College Degree	0.07506**		0.06810**
	(2.38)		(2.08)
Percentage of Foreign Born Workers	0.13452**		0.14124**
	(2.32)		(2.44)
Percentage of Female Workers	-0.09300***		-0.10225***
	(-3.65)		(-3.54)
Percentage of Black Workers	0.08998		0.10718*
	(1.41)		(1.65)
Percentage of Hispanic Workers	-0.00239		-0.02794
	(-0.03)		(-0.33)
Percentage of "Other Race" Workers	-0.20219**		-0.17267**
	(-2.53)		(-2.17)
Log(Average 1995 Earnings)	0.08286***		0.03752***
	(5.76)		(2.74)
Multi-Unit Firm		0.03710	0.04183*
		(1.58)	(1.78)
Firm has 5-99 Employees		-0.04187**	-0.03076*
		(-2.40)	(-1.72)
Firm has 100-999 Employees		-0.01796	-0.00237
		(-0.72)	(-0.09)
Firm has 1000 or More Employees		-0.00480	0.01334
		(-0.09)	(0.25)
Firm Age		-0.03216***	-0.03347***
		(-5.51)	(-5.73)
Firm Age Squared		0.00120***	0.00126***
		(5.42)	(5.66)
Net Growth Rate in 2000 Quarter 1		-0.00000014826	0.000000719866
		(-0.01)	(-0.07)
One Digit Industry Indicators	No	Yes	Yes
State Indicators	Yes	Yes	Yes
N	27,493	26633	27471
Adjusted R-Square	0.0036	0.0054	0.0076

***-Denotes significance at 1%, **-Denotes significance at 5%, *-Denotes significance at 10%

Table 2.27: Two Step Regression Results Using Difference in Liabilities Per Worker as the Instrumental Variable

	Dependent Variable is Difference in Productivity from 1995 to 2000		
	(1)	(2)	(3)
Intercept	-3.17524***	-0.81497***	-2.55358***
(t values)	(-22.36)	(-8.94)	(-15.26)
Predicted Probability that DB Plan Changed by 2000	2.62697***	3.26466***	3.39663***
	(39.93)	(45.29)	(46.49)
DC Plan in 1995	-0.04115**	-0.09981***	-0.17484***
	(-2.33)	(-5.46)	(-9.30)
Percentage of Workers age 45 or older	0.00809		-0.02268
	(0.29)		(-0.79)
Percentage of Workers with at least a College Degree	0.13326***		0.17074***
	(4.34)		(5.30)
Percentage of Foreign Born Workers	0.12594**		0.09852*
	(2.23)		(1.74)
Percentage of Female Workers	-0.38714***		-0.37576***
	(-15.03)		(-13.01)
Percentage of Black Workers	0.23712***		0.14369**
	(3.81)		(2.25)
Percentage of Hispanic Workers	0.09230		0.02115
	(1.13)		(0.26)
Percentage of "Other Race" Workers	-0.05260		0.02796
	(-0.68)		(0.36)
Log(Average 1995 Earnings)	0.24805***		0.17987***
	(19.11)		(13.23)
Multi-Unit Firm		0.16484***	0.18382***
		(7.03)	(7.84)
Firm has 5-99 Employees		-0.10414***	-0.02237
		(-6.08)	(-1.27)
Firm has 100-999 Employees		0.09987***	0.22192***
		(4.03)	(8.56)
Firm has 1000 or More Employees		0.26340***	0.39517***
		(5.05)	(7.48)
Firm Age		0.03071***	0.02453***
		(5.24)	(4.20)
Firm Age Squared		-0.00131***	-0.00109***
		(-5.90)	(-4.92)
Net Growth Rate in 2000 Quarter 1		0.00001394	0.00001207
		(1.52)	(1.32)
One Digit Industry Indicators	No	Yes	Yes
State Indicators	Yes	Yes	Yes
N	27,493	26519	26402
Adjusted R-Square	0.0582	0.0775	0.0827

***-Denotes significance at 1%, **-Denotes significance at 5%, *-Denotes significance at 10%

Table 2.28: Two Step Regression Results Using Difference in Assets Per Worker as the Instrumental Variable

	Dependent Variable is Difference in Productivity from 1995 to 2000		
	(1)	(2)	(3)
Intercept	-3.08267***	-0.78353***	-2.47292***
(t values)	(-21.68)	(-8.58)	(-14.75)
Predicted Probability that DB Plan Changed by 2000	2.52733***	3.15815***	3.27597***
	(38.49)	(43.95)	(45.01)
DC Plan in 1995	-0.03980**	-0.09634***	-0.16919***
	(-2.25)	(-5.26)	(-8.98)
Percentage of Workers age 45 or older	0.00423		-0.02625
	(0.15)		(-0.91)
Percentage of Workers with at least a College Degree	0.13075***		0.16552***
	(4.25)		(5.13)
Percentage of Foreign Born Workers	0.12622***		0.09982
	(-14.59)		(1.76)
Percentage of Female Workers	-0.37620***		-0.36593***
	(-14.59)		(-12.64)
Percentage of Black Workers	0.23189***		0.14112**
	(3.72)		(2.21)
Percentage of Hispanic Workers	0.08723		0.01698
	(1.07)		(0.21)
Percentage of "Other Race" Workers	-0.06196		0.01613
	(-0.80)		(0.21)
Log(Average 1995 Earnings)	0.24121***		0.17525***
	(18.56)		(12.86)
Multi-Unit Firm		0.16061***	0.17872***
		(6.84)	(7.61)
Firm has 5-99 Employees		-0.10227***	-0.02277
		(-5.95)	(-1.29)
Firm has 100-999 Employees		0.09554***	0.21359***
		(3.85)	(8.22)
Firm has 1000 or More Employees		0.25350***	0.38049***
		(4.85)	(7.19)
Firm Age		0.02864***	0.02241***
		(4.88)	(3.82)
Firm Age Squared		-0.00124***	-0.00101***
		(-5.53)	(-4.54)
Net Growth Rate in 2000 Quarter 1		0.00001376	0.00001189
		(1.50)	(1.30)
One Digit Industry Indicators	No	Yes	Yes
State Indicators	Yes	Yes	Yes
N	27,490	26516	26399
Adjusted R-Square	0.0546	0.0739	0.0784

***-Denotes significance at 1%, **-Denotes significance at 5%, *-Denotes significance at 10%

2.8   Conclusions

Using the Form 5500 data combined with the Business Register and LEHD state data reveals much insight on how converting defined benefit plans affect productivity.   It also helps identify the characteristics of the firms that are converting and what types of workers are at risk of losing their defined benefit pensions.   The reason why new information about the relationship between productivity and pensions is discovered is because this unique data set has variables that can be used as

instruments. Because of endogeneity, using an indicator variable is inappropriate in determining how converting defined benefit plans affects productivity. However, when instrumental variables like the difference in current liabilities per worker and the difference in pension assets per worker are used, the results I find are strongly significant and show a distinct relationship between converting pensions and productivity. There are several conclusions that can be made from analyzing this new data set.

First, firms that convert their defined benefit plans appear to have lower productivity than firms that do not in the year 2000. This may be because firms that primarily have kept their defined benefit plans over the five-year period are large firms in the manufacturing sector. Training requirements in these firms are higher than the smaller, non-manufacturing firms. Also, in large firms, productivity is not easily monitored. Using defined benefit plans is a way of encouraging long tenure and early retirement, so that the employees have a career over their peak productivity performance. Union presence may also be a factor of which firms convert their defined benefit plans. Most firms that have a strong union presence are more likely to maintain their defined benefit plans.

Second, firms that convert their defined benefit plans experience a reduction in productivity. This may occur because the workers who lost their defined benefit plans no longer have the incentive to remain at the firm by the year 2000. The firms lose valuable, trained employees as a result. Also, new employees who could not easily be screened are now working and may not put forth as much effort to avoid shirking. Thus, average productivity is decreasing. Unfortunately, in order to test this directly, the employees' human capital measures must be incorporated in the empirical analyses.

Third, firms that keep their defined benefit plans and firms that convert their

plans are different and each have a very distinct class of workers. Firms that have less than 100 employees, have more female workers, and provide low paying jobs are more likely to convert their defined benefit plans. Also, firms that tend to have a smaller percentage of college-educated workers and a smaller percentage of older employees are more likely to convert their defined benefit plans. Firms that are single establishments are also more likely to convert their pensions.

Finally, there are no significant results that reveal how converting defined benefit pensions affect the attraction or retention at the firm. Using net growth rates as a dependent variable in OLS and two step regressions provide some results that show that workers are leaving more because there is no pension penalty. The summary statistics show that firms that convert their pensions do have higher churning, higher quit rates and lower net growth than firms that keep their defined benefit pensions. However, using quit rates and churning rates as dependent variables in the regression models yield insignificant results.

2.9 Recommendations for Future Work

Currently, many firms are making less dramatic changes to their pension benefits by converting their traditional defined benefit plans to hybrid plans instead of traditional defined contribution plans. Hybrid plans are pension plans that are based on a formula like traditional defined benefit plan, but are portable like defined contribution plans. It would be of interest to determine how converting traditional defined benefit plans to hybrid plans affect productivity. Another avenue to investigate is whether the effects of changing benefits on employee training can be determined. Third, it is not uncommon for some firms to give their employees a choice whether to have a defined benefit plan or a defined contribution plan as their retirement benefit when they are first hired. It would be interesting to know if giving workers a choice that better fits their own needs for saving for retirement

affect the productivity in the firm. Lastly, in this paper I focus solely on defined benefit pension terminations. It may be interesting to look at pension freezes and the conversion to defined contribution plans.

2.10   Appendix A: Certainty Model

To illustrate how a firm makes a decision when it knows it cannot maintain its defined benefit pension plan because of costs, a certainty model is theorized. To simplify, suppose the firm only employs one worker and she starts working at the firm at time zero. I make a restriction that once the worker starts working she remains at the firm until retirement at time T. There is a probability $p(t)$ where $t \in (0,T)$ that the firm will switch plan types from a defined benefit plan to a defined contribution plan. If a firm does switch pension types, the firm reneges on the implicit contract and the worker loses the pension plan she is promised at retirement. However, although the worker's wage profile remains unchanged throughout her career, the worker now has a tax-deferred account in which she and/or the firm contribute. Since, the account is portable, and there is no vesting rule, the combined wage and annual defined contribution plan (DC) contribution equals the value of marginal product (VMP) at the time of conversion and stays equal for the worker's remaining years at the firm.

Figure 4 illustrates the worker's wage and benefit profiles at a firm that initially offers a defined benefit plan. Line V(t) represents the VMP expected for the worker at the firm throughout her career. Line W(t) is a wage profile for a worker who has a defined benefit plan. As mentioned earlier, a worker receives a wage below her VMP early in her career and receives a wage above her VMP later in her career. When the worker retires at time T, she immediately receives an annual pension until her death at time D. The annual pension benefit is represented by line B(t). Line C(t) is the wage path for the worker who initially had a defined benefit plan, but the plan was replaced with a defined contribution plan at time S. The combined wage and defined contribution account equals VMP at time of conversion and remains equal until she retires.

Since the firm can legally terminate the defined benefit plan, I define the present value of total wages and benefits over the worker's career as

$$Z(W(t), B(t), C(t), S) = \int_0^T e^{-rt}W(t)dt + \int_T^D e^{-rt}B(t)dt - p(t)*$$

$$\int_0^T e^{rt} \left[\int_S^T e^{-r\xi}W(\xi)d\xi + \int_T^D e^{-r\xi}B(\xi)d\xi - \int_S^T e^{-r\xi}C(\xi)d\xi \right] dt.$$

where

W(t)	=	Wage at time t
B(t)	=	Pension benefit at time t
C(t)	=	Wage plus DC contribution at time t
p(t)	=	Probability of firm switching to DC plan
T	=	Retirement age
D	=	Time of death
S	=	Time of plan conversion
r	=	Discount rate

The first two terms are the total wage and pension benefit for a person who remained at the firm until she retired and has a defined benefit plan throughout her career. The remaining terms are the probability of the firm switching plan types times the new accumulated wages that now includes the DC contributions.

To ensure that a worker will accept an offer from the firm and remain there until retirement, the worker must have a wage profile and benefits at least as large as those at an alternative job. Otherwise, the firm could lower the wage and pension benefits to increase its profit and the worker will still remain at the firm. Thus, the constraint that must be satisfied for a worker to accept an offer from the firm is

$$\int_0^T e^{-rt}W(t)dt + \int_T^D e^{-rt}B(t)dt - p(t) \int_0^T e^{rt}$$

$$\left[\int_S^T e^{-r\xi}W(\xi)d\xi + \int_T^D e^{-r\xi}B(\xi)d\xi - \int_S^T e^{-r\xi}C(\xi)d\xi \right] dt \geq \overline{W}.$$

where $\overline{W}$ is the total present value of wages and pension benefits at an alternative job.

Suppose a firm hires a worker and provides a defined benefit pension plan. The firm later converts a defined benefit plan to a defined contribution plan in order to cut costs. Once the plan is replaced, a worker is no longer bound to work a certain number of years to get a benefit and can now leave at any time. As a result, the worker may no longer be inclined to be as productive as before. Therefore, once the contract is gone, the firm now pays a reputation cost, which reduces overall profit.

Suppose the worker's revenue is defined as

$$R(W(t), B(t), C(t), S) = V + Ig(W(t), B(t), C(t), S)$$

where V is the total VMP over a worker's career and $g(W(t), B(t), C(t), S)$ is the reputation cost. I equals one if there is a plan switch within a worker's career and zero otherwise.. The firm will only hire a worker if profit is not negative, so the constraint that must be satisfied in order for the firm to hire the worker is

$$R(W(t), B(t), C(t), S) - Z(W(t), B(t), C(t), S) \geq 0$$

For a firm to decide what is the appropriate compensation package, the firm must choose the correct wage path, defined benefit accrual and if necessary, the time to switch plan types so that the firm's profit is maximized. Hence, the firm's problem is to maximize the following profit function:

$$\max_{W(t), B(t), C(t), S} \{R(W(t), B(t), C(t), S) - Z(W(t), B(t), C(t), S)\}$$

s.t.

$$R(W(t), B(t), C(t), S) - Z(W(t), B(t), C(t), S) \geq 0$$

$$\int_0^T e^{-rt} W(t) dt + \int_T^D e^{-rt} B(t) dt - p(t) \int_0^T e^{rt} *$$

$$\left[\int_S^T e^{-r\xi} W(\xi) d\xi + \int_T^D e^{-r\xi} B(\xi) d\xi - \int_S^T e^{-r\xi} C(\xi) d\xi \right] dt \geq \overline{W}.$$

To illustrate with an example, suppose the worker starts employment at age twenty-five and retires at age sixty-five resulting in forty years of service for the firm, and suppose the worker is expected to have a VMP equal to W every year. If a worker has a defined benefit plan, I define the worker wage path as $W(t) = 0.5W$ for the first thirty years and $W(t) = 1.5W$ for the remaining ten years. Once the worker retires at age sixty-five, she receives an annual pension benefit accrual $B(t) = 0.5W$. If the worker lives until eighty years old, then the firm will pay the pension benefit for fifteen years. Suppose the firm cannot switch plan types after the worker reaches age fifty-five. If the firm decides to switch pension plan types prior to age fifty-five, the new wage path plus the annual DC contributions is equal to the VMP until the worker retires. Suppose the discount rate is zero and the probability of a firm switching pension plan types is constant at 0.1. Then the cost of a worker to the firm is $Z(W, S) = 37.75W - 0.05SW$. If there is no switch, S equals the years of service at retirement age.

Suppose, the worker's total VMP over her career is $V = 40W$ and the reputation cost has the formula $g(W(t), S) = I[5S - 39W - 0.05SW]$ where I is one if there was a switch at any time during the worker's career and zero otherwise. To determine the optimal compensation package and time of switching plan types, the firm must find the solution to the following maximization problem:

$$\max_{W,S} \{40W + I[1000S - 39W - 0.05SW] - 37.75W - 0.05SW\}$$

s.t.

$$37.75W - 0.05SW \geq \overline{W}$$

$$40W + I[1000S - 39W - 0.05SW] - 37.75W - 0.05SW \geq 0.$$

Solving this maximization problem, the optimal wage is $W^* = \$20,000$ and $S^* = 20$. The optimal solution gives the firm a profit of $\$20,000 - \overline{W}$. Hence after twenty years of service, the firm finds it optimal to switch their plan to a defined contribution plans and pay the worker $\$20,000$ for the remainder of her career.

In conclusion, although this example is a simplified scenario in which a firm knows in the future it has to change its pension plan, it easily shows that a worker is always at risk of losing her benefit because the firm wants to have the best human resource policy which will optimize its profit. Having a pension plan conversion helps the firm meet its goals while still providing the worker with an optimal salary.

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