Impact of Government Policies on Pension Decisions

by

Angela E. Chang

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Author .....
Department of Economics
May 1993

Certified by .....
James M. Poterba
Professor of Economics
Thesis Supervisor

Accepted by .....
Richard Eckaus
Chairman, Departmental Committee on Graduate Students

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Abstract

This thesis consists of three essays that examine the impact of government policies on pension decisions of workers and firms. The first and second essays analyze the effect of pension-related tax policies imposed on workers and firms, respectively. These tax policies did not change the behavior of workers and firms to the extent policymakers anticipated. The third essay examines moral hazard problems associated with the federal insurance of defined benefit (DB) pension benefits, as administered by the Pension Benefit Guaranty Corporation (PBGC). Moral hazard problems may have contributed to the PBGC's current deficit of $2.7 billion.

The first essay examines the 10% tax penalty on uses of pre-retirement lump-sum pension distributions (LSDs) other than rollovers. Congress imposed this penalty on workers who did not invest all of the LSDs in tax-deferred instruments. Results from the May 1988 Current Population Survey show that rollovers did not increase in response to this penalty so much as Congress had anticipated.

The second essay examines the change in full-funding limits that occurred as of 1988. Employer contributions to pension plans that were overfunded by 150% or more became nondeductible. This raised the real cost of providing pension benefits for sponsors of the affected overfunded plans. Results from the Internal Revenue Service Form 5500 indicate that this change has not reduced employer contributions to the affected overfunded plans.

The third essay outlines a framework for analyzing moral hazard problems associated with the PBGC insurance. It emphasizes the distinction between old moral hazard (MH) problems which had existed before the establishment of the PBGC in 1974 from new MH problems which arose from the PBGC insurance. The PBGC Termination Case File provides weak evidence that the PBGC insurance may have led to new MH problems that had not existed before 1974. Results also suggest that the severity of totality of old and new MH problems may have increased after 1974.

Thesis Supervisor: James M. Poterba
Title: Professor of Economics

Acknowledgments

When I was an undergraduate, one of my professors advised me to go to graduate school. He told me I would learn a great deal. He also told me that I would develop an ability to drink lots of caffeine and to curse with gusto. As he noted, graduate school is not an easy process. Ironically, it cannot be made easy, because it is a process by which one learns to teach oneself — to think critically about the existing literature, to discern an area wanting more research, and to do the research. The end result is the defining of one's intellectual self.

Numerous people have helped me throughout this process. First and foremost, many thanks go to my thesis advisors, Prof. Poterba and Prof. Gruber. Their comments never failed to clear away the mental blocks I encountered. They have taught me valuable skills for doing solid, empirical research: translating interesting policy issues into testable hypotheses, gathering evidence from less than ideal data, and presenting it in the most informative manner.

Many thanks also go to my friends, Josephine M. Iacuzzo and Sook Hee Lee, for their support and understanding. I would also like to thank Beng-Hong Lim for his expert computer help, economic insights, sense of humor, and neverending moral support.

Finally, I am grateful to my family. Their love and support gave me the courage and the strength to seek out my potential. My achievements are a testament to their faith in me.

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Chapter 0

Introduction

Private employer-sponsored pensions play two major roles in the U.S. economy. First, they play a significant role in the accumulation of personal saving. The flow and stock of pension assets is enormous. Each year, workers and firms contribute over $90 billion to pension funds. This amounts to approximately 20% of total personal saving in the U.S.[1] The total stock of pension assets exceeds $2 trillion. Second, private pensions are a major source of retirement income for many workers. In 1989, approximately 75% or retired individuals had received or expected to receive benefits from pension plans of former employers.[2] The importance of these two roles has motivated federal government intervention since 1917.[3] With the enactment of the Employee Retirement Income Security Act of 1974 (ERISA), the federal government became inseparably involved in every major aspect of pension decision making. This thesis examines the sensitivity of workers' and firms' pension decisions to the federal regulations. It also explores the unforeseen consequences of government policies.

[1]This is based on Flow of Funds (FOF) figures tabulated by the Federal Reserve System. Unlike the national income product accounts figures, FOF figures include pensions.

[2]For more details, see: Daniel J. Beller and David D. McCarthy. "Private Pension Benefits." Chapter 10 in *Trends in Pensions 1991.* Eds. John A. Turner and Daniel J. Beller. Washington: GPO, 1992.

[3]The Department of Treasury issued administrative guidance in 1917, which gradually led to favorable tax treatment of pensions.

0.1 Tax Penalty on Lump-Sum Distribution

The first essay examines individuals' use of preretirement lump-sum pension distributions (LSDs). As of May 1988 approximately 8.5 million workers, or about 8% of the labor force, reported having received LSDs from prior jobs. Approximately 87% of these recipients did not save any of their LSDs for retirement. They shifted approximately 78% of the total $42 billion in LSDs out of retirement savings to invest in more liquid assets and to finance consumption.

To encourage the saving of LSDs for retirement, Congress changed the tax treatment of LSDs in the Tax Reform Act of 1986 (TRA). Prior to TRA, individuals paid income taxes on the amount of LSDs that they did not invest in tax-deferred instruments such as Individual Retirement Accounts (IRAs). After TRA, individuals have had to pay a 10% tax penalty, in addition to income taxes, on the amount of LSDs not rolled over to tax-deferred instruments.

Aggregate evidence suggests that the tax penalty has had little impact on rollovers. The actual tax revenue raised from the tax penalty has far exceeded anticipated tax revenue. During 1987–89, the tax penalty raised over $1.9 billion in tax revenue; Congress had anticipated $547 million. Microdata evidence from the May 1988 Current Population Survey also suggests that the tax penalty has had small impact, an increase of at most 11 percentage points in the probability of rollover.

The paper explores two explanations for the small impact of the tax penalty. One explanation is that many recipients of LSDs may face liqudity constraints, such that they choose to spend their LSDs in spite of the tax penalty. The second explanation is that individuals may make saving decisions based on rules of thumb and mental accounts rather than based solely on rational utility maximization.

The trend toward defined contribution (DC) pension plans, most of which offer workers the option to receive their pension benefits as LSDs, will lead to an increase in the number and amount of LSDs. This trend, in conjunction with the estimated unresponsiveness of rollovers to the tax penalty, suggests that the leakage out of retirement savings via LSDs will increase in the future.

0.2 Deduction of Employer Pension Contributions

Private pension plans receive two forms of favorable tax treatment. First, employer contributions to pension plans are deductible from corporate taxable income. Second, earnings within pension funds are exempt from corporate taxes; pension assets enjoy tax-free buildup. Recently, proposals to reduce the favorable tax treatment granted to pensions have emerged. In particular, there are proposals not to allow firms to deduct pension contributions from taxable income. If contributions are not sensitive to the deduction, then taking away the deduction would raise badly needed tax revenue without decreasing personal saving or endangering the security of workers' pension benefits. The sensitivity of contributions to the deduction is not known.

The second essay examines the tax sensitivity of employer contributions to defined benefit (DB) pension plans. In particular, it examines the effects of a change in the tax price of contributions that occurred in 1988. Before 1988, employer contributions were deductible from corporate taxes. Since 1988, employer contributions were tax-exempt so long as the value of the assets in the pension fund did not exceed 150% of the present value of pension liabilities. If a pension fund was overfunded by more than 150%, then nondeductible, after-tax employer contributions were permitted. About 28% of DB pension plans were overfunded by 150% or more in 1987 and were subject to this loss of deduction for contributions.

The paper uses data from the Internal Revenue Service Form 5500 to estimate the change in contributions before and after the law change. The results suggest that sponsors of plans overfunded by 150% or more did not reduce their pension contributions in response to the loss of deduction for the contributions. One explanation is that firms may derive most of the tax benefit from the tax-free buildup within the pension funds. Firms would then continue to make nondeductible contributions to overfunded pension plans after 1988 to enjoy the tax-free buildup within the pension funds.

0.3 Moral Hazard Problems of PBGC Insurance

In 1974, Congress enacted ERISA which established the Pension Benefit Guaranty Corporation (PBGC). Since that time, the PBGC has insured workers against complete loss of pension benefits in the event that their firms fail with underfunded pension plans (i.e., with pension assets less than pension benefits). At the end of 1992, the PBGC had an accumulated deficit of $2.7 billion. This deficit may be due in part to moral hazard problems.

The third essay examines moral hazard problems associated with the PBGC insurance. It reviews the literature on moral hazard problems that may arise from firms' and workers' actions. It also presents evidence from the PBGC Termination Case File. The dataset contains information on single-employer plans that have terminated with underfunding.

The discussion highlights the distinction between "old" and "new" moral hazard problems. Old moral hazard problems are those that existed prior to the establishment of the PBGC. New moral hazard problems are those directly induced by the provisions of the PBGC insurance. Examples of old moral hazard problems include underfunding and risky investment of risky assets by failing firms. An example of a new moral hazard problem involves firms filing for bankruptcy or liquidation before terminating underfunded pension plans. Firms' incentive to take such actions arises from a provision of ERISA that gave the PBGC claims up to 30% of firms' net worth for the amount of underfunding. Entering insolvency proceedings prior to terminating underfunded pension plans push down the priority of the PBGC's claim on firms' net worth. Another possible new moral hazard problem is that workers with underfunded pension plans in financially weak firms have an incentive to raise pension benefits in lieu of wages, because they know the PBGC insures the higher pension benefits. The magnitude of moral hazard problems seems to have increased over time.

The analyses in the three essays point out the difficulty of predicting the effects of policies beforehand. Workers' decision about uses of LSDs and firms' decision about pension contributions appear to be less sensitive to taxes than policymakers have anticipated. Consequently, tax policies designed to change their decisions did not have much of an impact. The difficulty in formulating policies is also apparent in the case of the PBGC. What started out as a good-intentioned, seemingly inexpensive social insurance program has created distortions resulting in moral hazard problems that policymakers did not foresee. The discussion in the three essays also point out the long-lived nature of policies. Policymakers do not appear ready to rescind or reform the three policies examined in this thesis, though we now have fair knowledge about the flaws of these policies.

Chapter 1

Tax Policy, Lump-Sum Pension Distributions, and Household Saving*

1.1 Introduction

The personal saving rate in the United States remained steady during the post-World War II until the mid-1980s. It declined sharply between 1986 and 1990. The National Income Accounts (NIA) indicate that personal saving as a percentage of net national product ranged between 4.4–7.2% prior to 1986. Since the mid-80s, the personal saving rate has ranged between 3.5–4.9%.[1] The reasons for the decline in personal

*I would like to thank Daniel Beller, Peter Diamond, Jonathan Gruber, Richard Hinz, Sook Hee Lee, James Poterba, Andrew Samwick, Rob Shumsky, and participants at the Harvard-MIT Public Economics Seminar for helpful comments. All remaining errors are my own. I would also like to thank Daniel Feenberg for figures from IRS tax data. I gratefully acknowledge financial support from the National Science Foundation, Lynde and Harry Bradley Foundation, and World Economy Laboratory. The data used in this paper were made available by the Inter-University Consortium for Political and Social Research. The data for Current Population Survey, May 1988 were originally collected and prepared by the U.S. Dept. of Commerce, Bureau of the Census. I bear all responsibility for the analyses and interpretations of the data presented herewithin.

[1] *Economic Report of the President 1992*, p. 326. The magnitude of the decline has been open to debate. Bosworth et al. (1991) made several adjustments to the NIA figures. In particular, they counted state and local pension assets as personal saving. Their computations indicate that personal saving as a percentage of net national product declined from 8–10% prior to 1986 to less than 6% in 1990.

saving are unclear. Several explanations have been put forth, such as changes in the demographic characteristics of the U.S. population and an increase in payout of corporate earnings to bond- and stockholders.[2]

The decline in the personal saving rate and the lack of a good explanation may explain Congress's concern about the trend away from defined benefit (DB) pension plans and toward defined contribution (DC) pension plans.[3] Most DB pension plans pay pension benefits to workers at retirement, such that the pension money remains locked up as retirement savings. In contrast, most DC pension plans allow workers to receive their pension benefits as lump-sum distributions (LSDs) when they are separated from their employers. When workers in DC plans move across jobs and receive LSDs, they have the opportunity to shift money out of retirement savings and into other uses such as buying a house and investing in a money market account.

As more workers become covered by DC plans, LSDs will become more prevalent, and the dissipation of retirement savings for consumption may increase. Congress's desire to stem such a dissipation of retirement savings is understandable. It has the potential to undo Congress's efforts to raise personal saving via private pensions. Congress's efforts have included granting of favorable tax treatment to contributions to DC pension plans. If workers in DC plans spend their LSDs, then the foregone tax revenue from the favorable tax treatment will have been for nought.

Consequently, in 1986 Congress imposed a 10% tax penalty on uses of LSDs other than rollovers. In other words, unless an individual reinvested the entire LSD in tax-deferred instruments such as IRAs and insurance annuities, the individual was subject to the 10% tax penalty. Congress wanted to keep the money locked up as retirement savings by requiring the saving of LSDs in instruments that penalize withdrawal before retirement.[4] Such a penalty on consumption is not new. Congress

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[2]See: Bosworth et al. (1991), Hatsopoulos et al. (1989), and Poterba (1991).

[3]There are two measures of the prevalence of DB plans: (1) the percentage of firms that sponsor DB plans and (2) the percentage of workers covered by DB plans. Both measures indicate a trend away from DB plans. Between 1975 and 1988, the fraction of firms with pension plans that sponsored DB plans fell from 33% to 20%. During the same period, of all workers covered by pension plans, the fraction with DB plans fell from 84% to 71%. See: *Trends in Pensions 1992*, p. 590–93.

[4]Another motivation may have been a desire to recapture some of the foregone tax revenue from the favorable tax treatment of contributions to the pension plans.

had imposed a 10% tax penalty on early withdrawals from Individual Retirement Accounts (IRAs) in 1982.

Whether the tax penalty on not rolling over LSDs has actually succeeded in increasing the saving of LSDs is not known.[5] Past studies of individuals' use of LSDs have not addressed the effect of the tax penalty.[6] Thus, the purpose of this paper is to present some empirical evidence on the impact of the tax penalty on individuals' decision to save or spend their LSDs.

The paper proceeds as follows. Section 1.2 contains a brief description of two types of institutional details about LSDs: when individuals can receive LSDs and how the tax treatment differs by the particular use of LSDs. It describes the changes in the tax treatment that occurred in 1986. Section 1.3 describes the May 1988 Current Population Survey (CPS) that served as the primary dataset for analyzing the effect of taxes on individuals' decision to roll over LSDs. Section 1.4 presents a model to illustrate the effect of taxes on the "rational" choice of saving instruments for recipients of LSDs. It also includes a discussion of recent works by Shefrin and Thaler (1988) and Thaler (1991), who argue that individuals' actual saving behavior does not match predictions of models of rational saving decision based on a well-defined utility maximization problem.do not predict The predicted effect of taxes from the behavioral model differs from that from the model of rational choice. Section 1.5 presents aggregate evidence from the U.S. Treasury Individual Tax Model File on the effect of the 10% tax penalty on rollovers of LSDs. It also presents individual-level evidence from the May 1988 CPS on the effect of the tax penalty. Section 1.6 concludes the paper with a discussion of policy implications.

[5]Engen and Gale (1992) examined the effect of the penalty on early withdrawals from IRAs on savings. They find that an increase in the penalty would decrease savings, because individuals would be more reluctant to contribute to IRAs.

[6]See: Andrews (1991) and Piacentini (1990).

1.2 Background

This section briefly describes two sets of federal regulations concerning lump-sum distributions (LSDs): the set of regulations concerning when workers can receive LSDs and those regarding the tax treatment of LSDs.

1.2.1 Recipiency

Workers may receive LSDs under three types of circumstances. First, the provisions of some pension plans offer participants the option of receiving their accrued pension benefits as LSDs upon separation from the employers (whether the separations are voluntary or involuntary).[7] Workers whose pensions give them the LSD option are referred to as being **eligible for LSDs**. Second, the Employee Retirement Income Security Act of 1974 (ERISA) allowed employers to cash out employees with small accrued benefits unilaterally. In other words, employers can give LSDs to workers upon separation whether the workers want to receive them or not, given that the amount of accrued benefits is less than the legal maximum unilateral cashout limit. The current maximum unilteral cashout limit is $3,500. Workers may also receive LSDs without experiencing separation from employers. If an employer terminates a pension plan, then he/she may offer workers the option of LSDs.[8] Exact figures on the fraction of workers who receive LSDs under each of these three circumstances are not available.

Individuals who receive LSDs have three options: (1) they can leave the money with the firms they are leaving, if the firms have not failed, (2) they can receive checks for the amount of the LSDs and save or spend as they please, and (3) they can arrange to have the money rolled over into their new employers' DC pension plans.[9]

[7]About 10% of defined benefit plans and between 80–90% of defined contribution plans allow LSDs. If a pension plan does not offer workers the LSD option, then the workers receive their pension benefits as an annuity that starts payment at retirement. See: Fernandez in *Trends in Pension.*

[8]This commonly occurs when an employer terminates a pension plan as a result of going out of business. LSDs are less common during asset reversions or other types of plan termination by ongoing firms.

[9]Most pension plans do not offer employees the option of transferring money from former em-

Taxes may affect individuals' choice among these options.

1.2.2 Tax Treatment

The tax treatment of LSDs has changed over the years. Prior to 1987, individuals paid income taxes on the amount of LSDs that they did not invest in tax-deferred instruments such as Individual Retirement Accounts (IRAs) or insurance annuities. Since the passage of the Tax Reform Act of 1986 (TRA), individuals have had to pay a 10% penalty, in addition to income taxes, on the amount of LSDs not rolled over within 60 days of receiving an LSD.[10] This tax penalty became effective as of January 1, 1987 (U.S. Joint Tax Comm. 719). Some recipients were exempt from this tax penalty. Notably, those who received LSDs as a result of job separation during or after the year they turned 55 years of age were not subject to this penalty.

TRA introduced two sets of changes in the tax treatment of LSDs. First, it changed the structure of federal personal income tax, generally lowering the marginal tax rates and reducing the number of tax brackets. Second, it imposed a 10% penalty on uses of LSDs other than rollovers.

Figures 1 and 2 illustrate the federal personal income marginal tax rates (MTRs) for married individuals filing joint returns and for single individuals, respectively. The MTRs for 1986 and 1987 are illustrated. For older recipients (55 or older), the MTRs on consumption out of LSDs before and after TRA are as illustrated in Figures 1 and 2. By "consumption out of LSDs," I am referring to uses to LSDs other than rollovers and not strictly consumption uses. The older recipients were not subject to the 10% penalty, such that the change in the structure of federal income tax rates is the sole source of variation in the MTRs before and after TRA. For these recipients, the MTRs on consumption out of LSDs are generallylower after TRA than before TRA, as shown in Figures 1 and 2.

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ployers' pension plans.

[10]To illustrate the impact of income taxes and the tax penalty, consider how much a person must pay to the IRS for not rolling over any of a $10,000 LSD. The tax penalty amounts to $1,000. If the individual is in the 28% tax bracket, then he/she owes $2,800 in income taxes. The net result is a payment of $3,800 or 38% of the LSD to the IRS.

In contrast, younger recipients were subject to a 10% tax penalty on consumption out of LSDs. After TRA, their MTRs on consumption out of LSDs equal the federal income tax rates plus 10 percentage points for every level of taxable income. Figures 3 and 4 illustrate the MTRs on consumption out of LSDs for younger recipients before and after TRA. They show the MTRs for married individuals filing joint returns and for single individuals, respectively. The figures show that the penalty has overwhelmed the effect of fewer and lower tax brackets. The MTRs increased for most recipients after 1986. In fact, the MTRs rose more for recipients with lower taxable income than for those at the high end of taxable income.[11]

Figures 3 and 4 show that the receipt of an LSD was less likely to push a recipient into a higher tax bracket after TRA. The figures also show that if an individual experienced a bracket jump as a result of receiving an LSD, then the size of the bracket jump was larger in 1987 than in 1986. Appendix A presents tabulations from the May 1988 CPS that support these observations. We would expect the likelihood and the size of bracket jumps to affect rollovers.

In July 1992, Congress changed the administration of taxing LSDs. They enacted a 20% withholding tax on LSDs that are paid out to workers. This withholding tax became effective as of January 1, 1993. Under the new law, if an individual leaves the money in the former employer's pension plan or has the former employer roll over the money into a tax-deferred instrument, then he/she is exempt from the 20% withholding tax, the 10% tax penalty, and from income taxes on the LSD (i.e., no taxes are owed when the LSD is received). If the individual chooses to receive a check for the amount of the LSD, then the former employer withholds 20% of the LSD and sends the worker a check for only 80% of the LSD. The 20% withholding tax is a prepayment of taxes on the amount of the LSD not rolled over. If the individual does not roll over the entire pre-tax LSD, then he/she is subject to the 10% tax penalty and income taxes on the amount of the LSD.[12] Thus, this new withholding tax is

[11]This would suggest that the tax penalty is a regressive tax. Since this paper is a positive analysis and not a normative analysis of the tax treatment of LSDs, I leave equity considerations to future research.

[12]In other words, the recipients must make up for the 20% withheld and roll it over, along with

designed to discourage individuals from ever having possession of the LSDs.[13]

As results in Section 1.5 will show, the tax penalty has not succeeded in increasing rollovers. On the other hand, it has raised considerably more tax revenue than Congress had anticipated. During 1987–89, the tax penalty raised over $1.9 billion in tax revenue; Congress anticipated $547 million (Table 5). The revenue potential of the tax penalty may have motivated the recent change in the administration of the tax penalty. This withholding tax was included in the bill that extended unemployment benefits passed in July 1992; it was expected to raise tax revenue to pay for part of the cost of the extended unemployment benefits.

1.3 Data

The analysis in this paper is based on data from the May 1988 Current Population Survey (CPS), which includes a supplement on employee benefits. The supplement questions were asked of adults in one-half of the basic CPS sample who were employed for pay at the time of the interview. For the sake of convenience, we shall refer to these adults who were employed at the time of the interview as simply workers. Out of 109,192 adults in the basic CPS sample 27,701 workers answered the supplement questions. Like the basic CPS data, the supplement data provide weights that allow adjusting the supplement sample to be representative of the U.S. population.

The supplement includes a set of questions about the receipt of lump-sum distributions (LSDs) from pensions on prior jobs.[14] Recipients of LSDs answered questions only about their most recent LSDs. They were asked to report the year they received their most recent LSD and the amount.

Both recipient-weighted and dollar-weighted tabulations from the May 1988 CPS supplement are presented in the following discussion, because a small fraction of

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the check they received for 80% of the LSDs. In this case, they are eligible to request refunds from the IRS on line 54 of Form 1040. They are also exempt from the 10% tax penalty and income taxes.

[13]For more information, contact the Taxpayer Service Division of the IRS. Also, refer to: Ellen E. Schultz's article in the *Wall Street Journal* and Dick Janssen's article in *Business Week*.

[14]The exact question from the May 1988 CPS supplement was "Have you received a lump-sum payment from a pension or retirement plan on a previous job?" (U.S. CPS, attachment 15).

individuals receive a large fraction of the total amount of LSDs. Tabulations on the recipiency, size, and uses of LSDs follow.

1.3.1 Recipiency of LSDs

In May 1988, approximately 53% of workers participated in pension plans (item A of Table 1). Of these workers, about 36% were eligible to receive their accrued pension benefits as LSDs. In other words, their pension plans contained provisions that allowed them to receive their accrued pension benefits as LSDs. About 8% of the supplement sample or 2,162 adults reported having received at least one LSD from a prior job. Using weights to make the sample representative of the U.S. labor force shows that a total 8.5 million workers had received at least one LSD from a prior job by May 1988 (item D of Table 1). They had received a total of approximately $42 billion in LSDs.[15] This total is in 1988 dollars, as are all dollar figures in subsequent tables.

The dataset probably provides an underestimate of the number of people who received LSDs, since those who had received LSDs but were unemployed at the time of the interview were not included in the supplement interview. Figures from this dataset probably also underestimate the incidence of LSDs, since the number of LSDs the workers received were not included in the supplement. Another caveat about the data is the ambiguity about the possible receipt of multiple LSDs from one separation. A worker may have received more than one LSD as a result of separation from an employer if he/she had participated in more than one pension plan that allowed LSDs. It is not clear which LSD such individuals would have reported on the CPS. Presumably, they reported the largest LSD.

Table 2 presents tabulations on the distribution of LSD recipiency. The second and third columns show the distribution weighted by the number of recipients, while the last two columns show the distribution weighted by the amount of the LSDs. The distribution of LSD recipiency by two characteristics is noteworthy. First, the

[15]Workers received the bulk of this total amount after 1974, when the trend toward defined contribution pension plans began.

distribution is not uniform across age. Over half of the recipients were under the age of 35 when they received their most recent LSDs. Second, the distribution is not uniform across family income. Unfortunately, May 1988 CPS and its supplement do not provide any information on family income at the time of receipt of LSDs. Instead, they contain data on family income for 1987 that was recorded in brackets.[16] About 42% of individuals who received LSDs had a family income less than $30,000 in 1987. Recipiency of LSDs did not differ much by other characteristics such as gender or education.

The last two columns of Table 2 show that the LSDs of younger recipients were small. Recipients under 35 comprised 61% of the recipients yet received only 37% of the total amount of LSDs, a disproportionately low percentage of the total amount. Similarly, individuals with lower family income received a disportionately low fraction of the total amount of LSDs.

1.3.2 Size of LSDs

Recipients of LSDs reported the amount of their most recent LSDs, with the responses being topcoded at $99,999.[17] Table 3 shows the distribution of the size of LSDs by age at the time of receipt and 1987 family income. It shows that the average amount of LSDs tends to rise with age at the time of receipt. The average amount also rises with the recipients' 1987 family income.[18]

The last two rows of Table 3 show the recipient-weighted and dollar-weighted distribution of the size of LSDs. Weighted by recipients, the average LSD was $5,989. Most of the LSDs were small, with approximately 41% of the recipients reporting

[16]The brackets are as follows: (1) Less than $5,000, (2) $5,000–$7,499, (3) $7,500–$9,999, (4) $10,000–$12,499, (5) $12,500–$14,999, (6) $15,000–$17,499, (7) $17,500–$19,999, (8) $20,000–$24,999, (9) $25,000–$29,999, (10) $30,000–$34,999, (11) $35,000–$39,999, (12) $40,000–$49,999, (13) $50,000–$74,999, and (14) $75,000 and over.

[17]Only 10 individuals reported LSDs of $99,999; thus, topcoding may not be of much importance for estimation. If the dependent variable in the estimation were the amount of LSD allocated to a particular use, then the truncation would be of some concern. Because estimation is based on a binary dependent variable representing whether an LSD was invested to tax-deferred instrument, the truncation is of lesser concern. Section 1.5.3 describes the estimation procedure in more detail.

[18]The average amount of LSDs did not differ much by education, year when received LSDs, or occupation. It did differ by gender. The average LSD for men was $7,375; and for women, $4,389.

LSDs smaller than $1,000. Consequently, the median was much lower than the mean; the median LSD was $2,451. Weighted by dollars, LSDs that were at least $20,000 composed 41% of the total amount of LSDs.

1.3.3 Uses of LSDs

The recipients of LSDs were asked if they had allocated any of their LSDs to the uses listed in Table 4. The responses were coded as yes/no. Table 4 shows that an overwhelming majority of recipients (86.5%) did not roll over any of their LSDs to tax-deferred instruments. In fact, approximately 41% did not save any of their LSDs for future consumption.[19] About 16% of the recipients allocated at least some of their LSDs toward investment such as starting or buying a business, buying a house or paying educational expenses.[20] Approximately 7% of the recipients reported using at least part of their LSDs to pay expenses incurred during unemployment. Lastly, slightly over a quarter of the recipients used at least some of their LSDs for uses not specified in the questionnaire.

The last two columns of Table 4 present dollar-weighted figures. The May 1988 CPS supplement does not provide information on the amount of LSDs allcoated to various uses. Thus, we can only infer a range of possible amounts (i.e., minimum and maximum amounts) from the number of uses reported. The median value of these ranges are presented in the last two columns of Table 4.

Table 4 shows that the percentage of recipients who allocated at least some of their LSDs to non tax-deferred instrument (e.g., savings accounts, other financial instruments) is higher than the percentage who rolled over any of their LSDs. The percentage of the total amount allocated to non tax-deferred instruments is also higher

[19]Saving is defined as allocating at least part of an LSD to increase resources available for future consumption. Thus, it includes paying off existing debt as well as allocating any of an LSD to tax-deferred instruments, savings accounts, and other financial instruments such as stocks or money market accounts.

[20]Buying a house can be considered a form of saving for retirement, since the individual can use the value of the house to obtain financial resources via instruments such as home equity loans and reverse mortgages; however, work by Venti and Wise (1989) shows that the elderly are reluctant to reduce housing equity.

than the percentage allocated to tax-deferred instruments. The next section examines why many recipients allocate much of their LSDs to non tax-deferred instruments rather than tax-deferred instruments.

1.4 Choice of Uses

The tax treatment of LSDs can influence individuals' choice of uses along two dimensions: (1) the choice between consumption and saving and (2) the choice among different saving instruments.[21] A useful starting point for a discussion of the choice between consumption and saving is the Life-Cycle Hypothesis (LCH), as formulated by Modigliani and Brumberg (1954a, 1954b).

LCH assumes perfect capital markets and consumption smoothing. These assumptions imply that pension benefits accrued in employers' pension plans are not "forced" savings, since individuals can borrow in the capital markets to finance the desired level of consumption. Consequently, when an individual receives pension benefits as an LSD, the model predicts that he/she would reinvest the entire LSD in tax-deferred instruments that are close substitutes of employers' pension plans.[22] If this model is valid, then we would expect almost all recipients of LSDs to roll over their LSDs and the federal government to raise little revenue from the 10% penalty.

The data show that most do not roll over any of their LSDs. Two factors may account for the wide discrepancy between the predictions of LCH and the actual behavior of recipients. The first factor is liquidity constraints. A liquidity-constrained recipient would spend as much of the LSD as necessary to relax the liquidity con-

[21] It has little, if any, effect on the choice among different consumption uses. Any differences in the tax burden across different consumption uses arise from tax provisions other than those regarding LSDs.

[22] This prediction is valid so long as the receipt of an LSD marks a change only in the timing of income receipt and not an increase in total lifetime resources. If total lifetime resources increase as a result of receiving an LSD, then the desired level of consumption will rise such that the recipient may spend out of LSDs. Lifetime resources are not likely to increase, because workers may be more risk-averse in their investing of LSDs than firms and because workers may not have large enough sums of money to diversify away investment risk as well as firms can with larger pension funds. If lifetime resources decline as a result of receiving an LSD, then the desired consumption level will fall such that the recipient will save all of the LSD.

straint and would save the remainder.[23] If the tax burden on consumption out of LSDs increases substantially, then the total lifetime resources of liquidity-constrained recipients may decrease to the point where they would lower their desired consumption path and roll over the LSDs. Thus, the tax penalty would increase rollovers among some liquidity-constrained recipients. A second explanation may be that individuals do not always make "rational" saving decisions. They may use rules of thumb and mental accounts to make saving decisions.[24]

The rationality of saving decision is questionable for individuals' choice among different saving instruments. As mentioned in Section 1.3.3, many recipient save in non tax-deferred instruments and incur a heavy tax burden rather than saving in tax-deferred instruments. To examine the effect of the tax treatment of LSDs on individuals' choice among different saving instruments, I describe below a model that assumes individuals make "rational" choices of saving instruments based on considerations of liquidity and after-tax returns. The last part of this section considers the behavioral model of saving. The behavioral model posits that individuals do not make "rational" saving decisions.

1.4.1 Model of "Rational" Saving Decision

Recipients of LSDs who decide to save their LSDs can choose between saving instruments in two broad categories: tax-deferred and non tax-deferred instruments. If they save in tax-deferred instruments such as Individual Retirement Accounts (IRAs) and insurance annuities, then they do not pay any income taxes nor the 10% tax penalty (after 1986) on the LSDs. In contrast, if they save in non tax-deferred instruments such as savings accounts, stocks, bonds, and municipal bonds, then they must pay income taxes and the 10% penalty on the LSDs.[25] The discussion concentrates on

[23]The following studies discuss other predictions of models of liquidity constraints: Hayashi (1985), Jappelli (1990), and Zeldes (1989).

[24]A third explanation is the purchase of big-ticket items such as cars or houses. Recipients who want to make such purchases may be unable to know precisely how much to allocate toward the purchases and how much to save before they actually make the purchases. There are too few observations on car and house purchases to explore this interesting explanation in detail.

[25]Variations in the tax treatment across non tax-deferred instruments arise from tax provisions other than those concerning LSDs. For example, municipal bonds offer buildup that is exempt from

the choice between two particular instruments: IRAs and savings accounts. Among recipients who save any of their LSDs, these are the most popular tax-deferred and non tax-deferred instruments, respectively. They are useful examples also because they are commonly known. The conclusions do not differ much for other particular instruments that earn positive interest on accruing income.

The value of investing an LSD in a savings account versus an IRA depends on four factors: (1) length of investment, (2) age at the time of withdrawal, (3) year of receipt of the LSD, and (4) age at the time of receipt of the LSD. The length of investment is important, because the advantage of tax-free buildup in an IRA increases with the length of investment. The age at which an individual expects to withdraw money from a saving instrument affects the choice between a savings account and an IRA. Individuals who make withdrawals from IRAs before the age of $59\frac{1}{2}$ are subject to a 10% penalty.[26] The year of receipt of the LSD affects individuals' choice, since the 10% tax penalty on uses of LSDs other than rollovers became effective in 1987. Individuals who were 55 or older at the time of receipt of the LSD were exempt from this penalty. Thus, the age at the time of receipt is also a contributing factor.

A simple model with which to examine the effect of these factors follows. Suppose an individual receives an LSD worth $\$L$ at age A. Let r be the annual nominal interest rate or annual yield; and t, the income tax rate. For the present discussion, assume that the yield is the same across instruments and that the tax rate does not change over time. Relaxing these assumptions does not significantly change the predictions of the model. A discussion of the implications of relaxing these assumptions is at the end of this section.

As the discussion will show, the choice of a saving instrument depends crucially on whether an individual wants short-term or long-term investment of an LSD. By short-term investment, I am referring to investment of an LSD with the anticipation of withdrawing the money before retirement; whereas, an individual who seeks long-

federal taxation.

[26]Insurance annuities, the other major type of tax-deferred instruments, also penalize early withdrawals. They typically pay less than the present value of the worth at maturity as a penalty on early withdrawals.

term investment does not anticipate withdrawing the money until after retirement.

The following table shows the value of investing \$1 of an LSD in a savings account and in an IRA when an individual seeks short-term investment of the LSD.[27] The individual anticipates withdrawing the money when he/she reaches age $j < R$, where R is the age at which the individual is exempt from the penalty on early withdrawals from an IRA.[28] As a reminder, "savings account" and "IRA" listed in the table below should be interpreted as referring to non tax-deferred and tax-deferred instruments in general.

Value of Investing: Short-Term

Group	Savings Account	IRA	Rational Choice
Younger:			
Pre-TRA	(1) $(1-t)[1+r(1-t)]^{j-A}$	(2) $(1+r)^{j-A}(1-t-0.1)$	Uncertain
Post-TRA	(1') $(1-t-0.1)[1+r(1-t)]^{j-A}$	(2') $(1+r)^{j-A}(1-t-0.1)$	IRA
Older:			
55–59½	(3) $(1-t)[1+r(1-t)]^{j-A}$	(4) $(1+r)^{j-A}(1-t-0.1)$	Uncertain
59½	(5) $(1-t)[1+r(1-t)]^{j-A}$	(6) $(1+r)^{j-A}(1-t)$	IRA

If an individual invests in a savings account, then he/she is subject to a tax burden at the time of receipt. Consider a younger individual (i.e., less than 55 years of age) who received an LSD prior to the Tax Reform Act of 1986 (TRA) and decided to save the entire LSD in a savings account. He/She could invest in the savings account only the after-tax amount of LSD, as denoted by $(1-t)$ in (1). A younger recipient was also subject to a 10% penalty after 1986 if he/she invested in a savings account; thus, he/she was able to invest only $(1-t-0.1)$ as shown in (1'). All older individuals (i.e., 55 or older) were exempt from the penalty such that they were able to invest the $L(1-t)$ in a savings accounts before and after TRA. Note that the interest is taxed as it accrues in a savings account, as denoted by $r(1-t)$ in (1), (1'), (3), and

[27]The normalization by the amount of the LSD is solely for the sake of convenience; to compute the value of investing an LSD worth \$$L$ simply requires multiplying the equations in the table by L.

[28]If we are interested in other tax-deferred instruments such as insurance annuities, then we can assume R is the age at which the individual receives at least the present value of the worth of the annuity at maturity and is not penalized for withdrawing early.

(5).

If an individual invests in an IRA, then he/she does not pay taxes on LSDs at the time of receipt. Furthermore, he/she earns the before-tax interest rate r. At the time of withdrawal, the individual must pay income taxes. He/She may also be subject to a 10% penalty on early withdrawals from an IRA, as denoted by $(1 - t - 0.1)$ in (2), (2'), and (4). The difference in the after-tax returns for those 55–$59\frac{1}{2}$ and those over $59\frac{1}{2}$ in equations (4) and (6) is noteworthy. Individuals who are between 55 and $59\frac{1}{2}$ years of age at the time of receipt and withdraw money from an IRA before $59\frac{1}{2}$ are subject to the 10% penalty (equation 4), while those over $59\frac{1}{2}$ were exempt from this penalty (equation 6). The duration of investment in an IRA necessary to avoid the 10% penalty declines with the age at the time of receipt of an LSD, such that individuals who are close to the age of $59\frac{1}{2}$ are likely to delay withdrawals from their IRAs until they are at least $59\frac{1}{2}$.

The rational choice for a recipient is the instrument that maximizes the after-tax return at the time of withdrawal. For younger individuals who received their LSDs prior to TRA, the rational choice is uncertain, because (2) does not strictly dominate (1) for all values of $(j - A)$. The rational choice for younger recipients after 1986 was certain. They should have invested their entire LSDs in IRAs, because IRAs offered higher after-tax returns than savings accounts for any length of investment. The 10% tax penalty on LSDs that was imposed only on younger recipients changed their rational choice which was uncertain before TRA to IRAs.

The rational choice is uncertain also for recipients between 55 and $59\frac{1}{2}$, because (4) does not exceed (3) for all lengths of investment. However, many of these recipients may expect to avoid the 10% penalty on early IRA withdrawals by withdrawing after the age of $59\frac{1}{2}$. In this case, they face the same situation as individuals who are $59\frac{1}{2}$ at the time of receipt; the rational choice is an IRA since (6) exceeds (5) for all values of $(j - A)$.

The rational choice for younger recipients prior to TRA and for older recipients (55–$59\frac{1}{2}$) who expect to withdraw before the age of $59\frac{1}{2}$ is uncertain, because the value of investing in an IRA is actually less than that in a savings account for low values of

$(j - A)$. The 10% penalty on early withdrawals from IRAs overwhelms the advantage of the tax-free buildup for short duration of investment. As the length of investment increases, the advantage of the tax-free buildup dominates the disadvantage of the 10% penalty.[29]

For given values of r and t in the equations above, we can compute the length of investment after which an IRA earns a higher after-tax return than a savings account at the time of withdrawal. For the sake of convenience, call this the **threshold length of investment**. The following table shows the threshold length of investment for two values of r and t. The income tax rate (t) considered in the table below does not include the 10% penalty on not rolling over an LSD nor the 10% penalty on early withdrawals from IRAs.

Threshold Length of Investment in Years

Interest Rate	Tax Rate	
	0.28	0.38
0.05	11	9
0.10	5	5

Several observations about the table above deserve mention. We can observe the effect of a 10 percentage point increase in the tax rate on the threshold length of investment. When the interest rate is 0.05, a 10 percentage point increase in the tax rate decreases the threshold length of investment from 11 to 9 years. Thus, for a given interest rate, an increase in the tax rate can make the IRA more attractive. When the interest rate is 0.10, the increase in the tax rate does not affect the threshold length of investment. In summary, as the interest rate increases, the distortion in individuals' choice between an IRA and a savings account due to an increase in the tax rate diminishes.

The following table shows the value of investing in a savings account and in an IRA when an individual anticipates withdrawing the money at age $j \geq R$ when he/she is exempt from the penalty on early withdrawals from an IRA. What is clear

[29]Hubbard (1984) discusses how the advantage of an IRA increases with the length of investment.

from this table is that the rational choice for long-term investment was an IRA for younger and older (at least 55 years of age) recipients before and after TRA. The reason is simple; an individual who saves for retirement does not expect to pay the 10% penalty on early withdrawals from IRAs and does not place a high value on liquidity such that he/she should take advantage of the tax-free buildup in an IRA. Note that the imposition of the 10% tax penalty on LSDs did not change the rational choice of younger or older recipients.

Value of Investing: Long-Term

Group	Savings Account	IRA	Rational Choice
Younger:			
Pre-TRA	(1) $(1-t)[1+r(1-t)]^{j-A}$	(2) $(1+r)^{j-A}(1-t)$	IRA
Post-TRA	(1′) $(1-t-0.1)[1+r(1-t)]^{j-A}$	(2′) $(1+r)^{j-A}(1-t)$	IRA
Older	(3) $(1-t)[1+r(1-t)]^{j-A}$	(4) $(1+r)^{j-A}(1-t)$	IRA

The model presented above is based on two major assumptions.[30] The first assumption is that the before-tax return r is same for tax-deferred and non tax-deferred instruments. Relaxing this assumption reduces the magnitude of the effect of the 10% tax penalty on the "marginal" savers, recipients who are debating whether to save in a tax-deferred instrument or in a non tax-deferred instrument. A difference in the return between the tax-deferred and the non tax-deferred instrument would reduce the impact of the tax penalty on their decisions.

The second assumption is that the income tax rate t does not change over time. Consider how the income tax rate might change over time for a younger and an older recipient. A younger recipient may expect his/her income and t to rise in the future. The tax rate imposed on money withdrawn from an IRA in the future would be higher than the current tax rate. The advantage of an IRA diminishes such that younger

[30]Besides the assumptions mentioned, the model also assumes that the cost of learning about the taxation of LSDs is negligible. This assumption is realistic. Pension sponsors and administrators send workers information about the taxation of LSDs at the time of separation. The workers have this information before they have to make the rollover decision.

recipients who are marginal savers would be more likely to invest in a savings account. An older recipient may expect his/her income and t to fall in the future. The current tax rate imposed on interest earned in a savings account is higher than the future tax rate imposed on money withdrawn from an IRA. This enhances the advantage of an IRA such that older recipients who are marginal savers would be more likely to invest in an IRA.

In summary, the 10% tax penalty on LSDs affected primarily younger recipients who sought short-term investments in non tax-deferred instruments. If we allow returns from a savings account and an IRA to differ, then the impact of the tax penalty diminishes among these younger recipients. If they expect their income tax rates to rise in the future, then the impact of the tax penalty diminishes even further; the expected rise in the tax rates will induce more younger recipients to invest in savings accounts.

1.4.2 Behavioral Model of Saving Decision

The discussion above has assumed that individuals act rationally, weighing their need for liquidity (i.e., withdrawal in the near future) against their desire for high after-tax returns. They would base their decision on a comparison of the after-tax returns at the time of expected withdrawal. The actual choices of individuals may not match the prediction from such a model that is based on rationality.

Shefrin and Thaler (1988) and Thaler (1991) propose that individuals use "mental accounts" to make saving decisions. By mental accounts, they are referring to individuals' classifying different types of bundles of money into three mental accounts: current income, assets, and future income. The classification is important, because individuals have the highest marginal propensity to consume (MPC) out of current income and the lowest out of future income. A discussion of the predictions for the saving of LSDs follows.

The first prediction is that individuals are more likely to spend money that they receive as LSDs than money that is locked up in employers' pension plans, because they are more likely to classify "checks that arrive in the mailbox" for the amount of

LSDs as current income but money in pension plans as future income, all else equal.[31]

The second prediction is that individuals are more likely to save larger bundles of money, because they would classify larger bundles as assets or future income and smaller bundles as current income. Thus, individuals are more likely to save larger checks that arrive in the mailbox for the LSD and to spend smaller checks.

The third prediction concerns individuals' choice of saving instruments. Those who classify LSDs as current income are likely to invest them in liquid instruments while those who classify them as assets or future income are likely to invest them in instruments that offer less liquidity. In fact, they may want as little "flexibility" as possible for investment of assets and future income.[32] "Perceived" liquidity may be more relevant to individuals' actual choice of instruments than liquidity as examined in Section 1.4.1. Individuals may perceive tax-deferred instruments that explicitly penalize early withdrawals such as IRAs as being more illiquid than they really are.[33] This would suggest that an increase in the tax penalty on uses of LSDs other than rollovers would not raise the probability of rollover very much; individuals who value liquidity would continue to save their LSDs in non tax-deferred instruments such as savings accounts, since they perceive tax-deferred instruments as illiquid.

1.5 Results

This section presents the effect of the tax changes described in Section 1.2. It starts with aggregate evidence, comparing the actual tax revenue raised from the tax penalty on LSDs with the anticipated tax revenue figures. It then proceeds to more disaggre-

[31] Hatsopoulos et al. (1989) and Poterba (1991) present evidence of such a "mailbox effect." They find that individuals are less likely to spend out of money that is in the form of an investment in firms and more likely to spend the cash that results from corporate payouts and realized capital gains.

[32] This may explain an anomaly observed with participation in 401(k) plans. Participation rates are higher in plans that do not allow loans or hardship withdrawals nor offer investment choices. See: Poterba, Venti, and Wise (1993).

[33] This may explain why many individuals do not contribute to IRA accounts. The number of contributors peaked in 1985 at 16.2 million or 16% of taxpayers (*Individual Income Tax Returns 1986*). Hausman and Poterba (1987) point out that most taxpayers can benefit from saving in IRAs even without the deductibility of contributions, since they offer tax-free buildup.

gated evidence. First, tabulations of rollovers by year using data from the May 1988 CPS are presented. Of course, these tabulations do not control for demographic characteristics and family income of recipients, which may influence their decision to roll over their LSDs. Thus, the most disaggregated evidence comes from probit equations where the dependent variable is whether a recipient rolled over his/her LSD.

1.5.1 Evidence from Aggregate Data

Aggregate data suggest that the 10% tax penalty on uses of LSDs other than rollovers did not increase rollovers so much as had been anticipated. Congress estimated that this 10% penalty would increase revenues by $97 million in 1987, $209 million in 1988, and $241 in 1989 (U.S. Joint Tax Comm. 719). A comparison of these figures with the actual tax revenue figures provides some insights into the effect of the tax penalty. Unfortunately, exact figures on the actual tax revenue raised from the tax penalty are not available. I have used data from the May 1988 CPS and the U.S. Treasury Individual Tax Model File (henceforth, IRS data) to estimate the actual tax revenue (Table 5).

Using the May 1988 CPS, we can only get figures for 1987. These figures indicate that approximately 926,000 individuals or 75% of recipients of LSDs paid the 10% tax penalty. They paid a total of about $360 million. This far exceeds the $97 million that Congress anticipated in tax revenue.

Figures from the IRS data yield a similar conclusion. IRS makes available for public use a sample of individual tax returns every year. Figures mentioned below are weighted tabulations from this sample. The IRS dataset basically contains items from Form 1040. No item on Form 1040 specifically asks about the tax penalty on LSDs. Instead, one item asks individuals to list the amount of the tax penalty on early withdrawals from IRAs and/or the tax penalty on the amount of LSDs not rolled over to tax-deferred instruments. From this item, we can estimate the number of individuals who paid the penalty on LSDs and the total amount.[34] The estimates

[34]To estimate the number of individuals who paid the tax penalty on early withdrawals from IRAs, I assumed that the number remained constant at the 1986 level during the 1987–1989 period.

from the IRS data show that the actual tax revenues raised from the tax penalty on LSDs exceeded those anticipated by Congress at least threefold throughout 1987–1989.

1.5.2 Microdata Evidence

The aggregate evidence does not control for factors other than taxes, such that changes in these factors may have dampened the effect of the tax penalty on rollovers. To consider the effect of these factors, we now turn to microdata evidence. We start with tabulations of rollovers.

Tabulations of the percentage of recipients who rolled over any of their LSDs and the percentage of the amount of LSDs rolled over can provide insights into time trends not indicated by the aggregate tax figures. The following table shows that rollovers have increased over time, such that the increase after 1986 may be due to a time trend or changes in the aggregate conditions of the U.S. economy and not due to the tax penalty.

Rollover by Year of Receipt

Year	Percentage of Recipients	Percentage of Amount
Before 1980	4.0%	7.6%
1980–84	14.9	29.0
1985–86	17.5	23.8
1987–88	20.6	30.7

To examine whether the tax penalty had any effect, we can examine cross tabulations by year of receipt and age group. We know that only younger recipients (under 55) were subject to the tax penalty after 1986. Thus, the penalty should have increased rollovers only among younger recipients. If the increase in rollovers after 1986 is due to changes in the aggregate conditions of the U.S. economy that affected all

Whether this assumption yields an underestimate or an overestimate of the actual number is unclear. On the one hand, IRA participation declined sharply after 1986. This may indicate a concurrent drop in IRA withdrawals. On the other hand, withdrawals may have increased over 1986 since marginal tax rates declined which reduced the tax burden on early withdrawals.

recipients, then one would expect to see an increase in rollover among all recipients.

Rollover by Year of Receipt and Age Group

Year	Under 55	55 or Older
Before 1980	3.6%	27.0%
1980–84	13.3	44.7
1985–86	15.9	28.0
1987–88	20.3	27.4

The figures above show that rollovers increased among younger recipients after 1986 but remained fairly steady among older recipients. The figures therefore suggest that the tax penalty imposed on the younger recipients may have had some impact on rollovers. Since there has been an upward trend in rollovers among younger recipients throughout the 1980s, we cannot definitively attribute the increase in rollovers after 1986 solely to the law change.

1.5.3 Estimation Procedure

The aggregate tax figures and tabulations of rollovers do not control for demographic characteristics and family income of recipients that may affect rollovers. Thus, we must estimate equations representing individuals' decision process about the rollover of LSDs.

Ideally, we would use the amount of LSD allocated to tax-deferred instruments as the dependent variable and estimate the effect of taxes on the amount rolled over. The May 1988 CPS does not have information on the amount rolled over but yes/no responses to whether any of the LSD was allocated to particular uses. We can discern whether a recipient rolled over none, some, or all of his/her LSD. The data indicate that if a recipient rolled over any of his/her LSD, then he/she was likely to roll over all of it. About 79% of recipients who made any rollovers rolled over all of their LSDs. I chose to estimate two sets of probit equations: one set where the dependent variable denotes whether a recipient rolled over any of the LSD and a second set where the dependent variable denotes whether a recipient rolled over all of the LSD. Results for

both sets of probit equations are in Section 1.5.6.

We assume that a recipient saves his/her LSD in tax-deferred instruments if the utility attained from rolling over the LSD exceeds the utility attained from not rolling over any of it. The observed discrete choice is therefore the outcome of an unobservable process, possibly based on a comparison of after-tax returns from different saving instruments as described in Section 1.4.1. This process for recipient i can be described as:

$$U_i^* = U_i(s_i^* > 0) - U_i(s_i^* = 0) = \beta' x_i + \varepsilon_i \tag{1.1}$$

$$S_i = \begin{cases} 1 & \text{if } U_i^* > 0 \\ 0 & \text{if } U_i^* \leq 0 \end{cases}$$

$$Pr(S_i = 1) = Prob(\varepsilon_i > -\beta' x_i) \tag{1.2}$$

where U_i^* denotes the difference between utility attained from rolling over some of the LSD and utility attained from not rolling over any of the LSD; s_i^*, the unobservable desired level of LSD rollover; and x, observable characteristics of the recipient and of the LSD. With the data from the May 1988 CPS, we can define a binary (0,1) variable S_i that equals one if a recipient rolls over at least some of his/her LSD. As mentioned before, we can also define the binary variable to be equal to one if a recipient rolls over all of the LSD. The appropriate tax measure will differ for each of these definitions of the dependent binary variable.

The following factors may influence the saving decision and have been included in the vector x_i : (1) age, (2) gender, (3) years of schooling completed, (4) marital status, (5) family income, (6) amount of the LSD in 1988 dollars, (7) federal personal income marginal tax rates (MTRs), and (8) 10% tax penalty if applicable. I allowed the MTRs and the tax penalty to have separate effects on the probability of any rollover, since their effect differs in timing. A tax penalty is imposed at the time of receipt of LSDs. In contrast, recipients may consider the current MTRs imposed at the time of receipt and the future MTRs imposed at the time of withdrawal. The MTRs can change over time, such that their effect on rollovers may differ from that of the tax penalty. The tax penalty equals 0 if a recipient was 55 or older or received the LSD

before 1987. It equals 0.1 if the recipient was subject to the 10% penalty on LSDs (i.e., less than 55 years of age and received the LSD since 1987). The computation of the tax rates is described in Section 1.5.4.

Probit equations have been used to estimate equation 1.2. The probit model is based on the assumption that ϵ is distributed $IN(0,1)$. With this assumption,

$$Pr(S_i = 1) = \Phi(\beta' x_i) \tag{1.3}$$

where $\Phi(.)$ is the cumulative distribution function for a standard normal distribution. We can then estimate the following log likelihood function:

$$L = \sum_i S_i \log \Phi(\beta' x_i) + \sum_i (1 - S_i) \log[1 - \Phi(\beta' x_i)]. \tag{1.4}$$

Results for two sets of probit equations are presented. For one set of equations, the dependent variable S_i equals 1 if a recipient rolls over any of his/her LSD and 0 otherwise. For the second set of equations, S_i equals 1 if a recipient rolls over all of his/her LSD and 0 otherwise.

Since we are interested in individuals' allocation of LSDs before and after the Tax Reform Act of 1986 (TRA), the sample has been limited to workers who received LSDs between 1984–1988. Not including years earlier than 1984 is an attempt to control for aggregate conditions by selecting two years before and two years after 1986, the year TRA was passed.

1.5.4 Computation of Marginal Tax Rates

Because of data limitations, the computed marginal income tax rates (MTRs) for individual recipients are imprecise. The first data limitation is the availability of family income only for 1987. The best we can do to estimate recipients' family income and MTRs at the time of receipt of the LSDs is to make the assumption that real family income at the time of receipt of the LSDs was highly correlated to the family income in 1987. Whether this is a reasonble assumption depends on the time

variation in individuals' income and on the event that triggered the LSD receipt.

Marginal tax rates apply to bracket of income and analysis is limited to, at most, a three-year period between the time of receipt of the LSDs and 1987. This suggests that the assumption may not be too strong; however, estimates from Samwick (1993) suggest considerable variation in income over time. He estimates the income variation for men. From the PSID, Samwick finds that the standard deviation is about 15%. Thus, if the mean annual income is about $23,000 then the standard deviation is $2,250. This variation in income over time is large enough for imputation of wrong income tax brackets, especially before 1987. Prior to TRA, tax brackets changed every $2,000–$3,000 up to about $45,000. Samwick focuses primarily on men in his study. In my CPS dataset, about half (46%) of LSD recipients are women who probably experience greater income variation than men.

The event that triggered the LSD receipt is important in determining the validity of the assumption. If a large fraction of workers received their LSDs as a result of layoffs, then their family income in the year they received the LSDs was probably substantially lower than what they later earned in 1987 due to an unemployment spell. In this case, the assumption would be invalid. Tabulations from the CPS data show that only about 10% of workers received their LSDs as a result of layoffs.[35]

In summary, family income in 1987 serves as a crude approximation of family income in the year of LSD receipt. While most recipients may not experience layoffs in the year of LSD receipt, the time variation in income is large enough for imputation of wrong tax brackets prior to 1987.

The second data limitation is the availability of the 1987 family income in brackets, as noted in Section 1.3. To compute MTRs, the recipients were assumed to have had 1987 family income equal to the median value of the income brackets. In other words, if a recipient reported having a family income in 1987 between $30,000–$34,999, he/she was assumed to have had family income equal to $32,500 in 1987.

Other assumptions were required to compute MTRs. First, the marital status of

[35]This figure in based on only workers who received their LSDs in 1987. For this group of workers, the May 1988 CPS provides enough information to discern whether they received their LSDs as a result of quits or layoffs.

the recipients as reported in 1987 was assumed to be the same as that in the year they received the LSDs. Since analysis is limited to a four-year period 1984–88 this may not be a strong assumption. Second, married recipients were assumed to file joint returns. Lastly, recipients were assumed to take the standard deductions and not to itemize deductions.

1.5.5 Econometric Issues

Three econometric issues arise when estimating the effect of taxes on the saving of LSDs. The first is self-selection bias, which is due to limited data. The second is identification; the issue of whether we can identify the effect of taxes that is separate from the effect of other variables, notably income. The last issue is the possible endogeneity of the tax rate that is imposed on an LSD. An individual can partly influence the tax rate via his/her decision to roll over an LSD.

Self-Selection Bias

As mentioned at the end of Section 1.5.3, the sample consists of observations only for individuals who received LSDs and not for all individuals who were eligible to receive LSDs. Due to this limited sample, a self-selection bias may be present. The total effect of taxes on the saving of LSDs consists of two components: the effect on the decision to exercise the LSD option and the effect on the decision to roll over an LSD that has been received. The self-selection issue arises, because we can estimate with the sample only the second effect without taking into account the first effect. It is plausible that the tax penalty induced some individuals not to exercise the LSD option and to leave the money with the employers they were leaving. If this is true, then the estimates of the effect of taxes on rollovers (in Section 1.5.6) underestimate the total effect of taxes on the saving of LSDs.

Data from IRS Form 5500 allow rough estimates of the effect of taxes on the decision to exercise the LSD option. Employers must file Form 5500 annually for every pension and welfare benefit plan (e.g., health insurance plan) with 100 or more

participants that they sponsor.[36] Employers must report on Form 5500 the number of active, separated, and retired participants of each plan. The plans of interest are the defined contribution (DC) pension plans, most of which offer workers the LSD option.[37] By examining changes in the number of active, separated, and retired participants in DC plans before and after the tax penalty went into effect (i.e., for 1986–1988), we can determine whether the fraction of separated participants who did not take the LSD option increased noticeably after the tax penalty was imposed in 1987.

Results from the Form 5500 suggest that the effect of the tax penalty on the decision to exercise the LSD option is likely to be small. Between 1986–1987, 19.8% of workers who were eligible for LSDs chose not to exercise the LSD option.[38] Between 1987–1988, 18.6% of workers eligible for LSDs chose not to exercise the LSD option. The fraction of workers who have the LSD option but chose not to exercise the option did not increase after the tax penalty went into effect in 1987. These figures indicate that the tax penalty did not increase the saving of LSDs by inducing more workers not to exercise the LSD option and to leave their pension money in the employers' pension plans. This suggests that the self-selection bias is not severe.[39]

Although I cannot correct for the self-selection bias in estimating probit equations of the probability of rollovers, the direction of the self-selection bias makes the estimated effect of taxes in Section 1.5.6 more plausible. Consider the most extreme form of self-selection such that the sample includes only individuals who chose to exercise the LSD option and who are "spenders."[40] The saving decision of these spenders is probably not sensitive to the tax penalty on LSDs; they have a low propensity to save

[36]Employers must file a similar form every three years for plans with fewer than 100 participants. Analysis has been limited to larger plans that file Form 5500.

[37]Between 80–90% of DC plans offer the LSD option.

[38]These are workers who participated in DC plans, experienced separation from their employers during 1986–1987, and chose not to take the LSD.

[39]A Gallup survey indicates that only 24% of individuals who have the LSD option choose not to exercise the option. This also suggests the self-selection bias may not be severe. The survey was conducted during February–June 1991. The sample consisted of 327 individuals. David Wray at the Profit Sharing Council kindly provided the survey results.

[40]This is an extreme form of self-selection, because some workers receive their LSDs as a result of unilateral cashouts by their former employers.

such that they are not likely to be the "marginal savers" whose saving decisions hinge primarily on the tax penalty or other tax considerations. Therefore, the estimated effect of the tax penalty (Section 1.5.6) serves as a lower bound on the effect of the tax penalty on all workers eligible for LSDs.

Identification

An identification issue arises in the estimation of the effect of taxes on rollovers, because the effect of taxes may be indistinguishable from that of family income. Marginal income tax rates (MTRs) are a nonlinear function of income, among other factors, such that if the results show a positive relationship between MTRs and rollover of LSDs, we cannot rule out the explanation that the results are merely reflecting a positive nonlinear relationship between income and rollover of LSDs. Feenberg (1987) gives a clear discussion of this identification issue.

To test whether identification is an issue, I estimated separate probit equations for recipients with lower family income and for those with higher family income. Since the MTRs increased more for lower-income recipients than for higher-income recipients, we would expect a bigger impact of taxes on lower-income recipients. Also, family income for each of the subsamples is more homogeneous than for the full sample; therefore, a nonlinear effect of income would be lower for the subsamples than for the full sample. If the MTRs reflect just a nonlinear effect of income, then one would expect that the coefficients for the MTRs would be lower for each of the subsamples than for the full sample.

Estimation for lower- and higher-income recipients is a weak test of identification. If MTRs are not identified, then one cannot estimate the effect of MTRs on rollovers with cross-sectional data, in which variations in MTRs arise primarily from differences in family income among recipients. The law change may offer a solution to this identification issue. The Tax Reform Act (TRA) changed the tax price on not rolling over LSDs, such that recipients with similar characteristics faced different MTRs depending on whether they received their LSDs before or after the TRA.[41]

[41] Another solution is to do instrumental variable estimation. Feenberg (1987) uses state tax rates

Thus, there is variation in MTRs over time for recipients with same family income depending on whether they received their LSDs before or after TRA. In other words, the law change is like a "natural experiment," whereby different groups of recipients experience different changes in their MTRs.

I have used the variation in MTRs over time to address this identification issue. I estimated difference-in-difference probit equations to take advantage of the natural experiment. These equations test whether the law change had any effect on the "treatment" group relative to the "control" group. In particular, we know that younger recipients were subject to the 10% tax penalty while older recipients were exempt from this penalty. Thus, one would expect younger recipients to have increased rollovers more than older recipients after this penalty was imposed. The difference-in-difference probit equations are a better test of identification than separate probit equations for lower and higher income groups. The difference-in-difference probits allow testing whether the tax penalty affected rollovers along a dimension along which income tax rates are not based.

Endogeneity

Another econometric issue is the possible endogeneity of bracket jumps and the appropriate measure of MTRs.[42] Two measures of the MTR naturally come to mind. One measure is the MTR on the first dollar of an LSD. The second measure is the MTR on the last dollar of an LSD.

The first-dollar MTR is based on family income and marital status but not the size of an LSD.[43] The advantage of using the first-dollar MTR is that it is not based on how the recipient used the LSD; therefore, it is an "exogeneous" measure of taxes.

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as an instrument in his study of the effect of taxes on charitable giving. State tax rates are not a good instrument for this paper, because the CPS does not provide any information on individuals' state when they received the LSDs. If most receive their LSDs when they are separated from their employers, then many may have moved to another state for their next job.

[42] Andrews (1991) discusses other sources of endogeneity such as the possibility that individuals with a higher propensity to save are more likely to participate in pension plans and to accrue more pension benefits.

[43] The true first-dollar MTR is based on factors other than family income and marital status such as the number of children. The first-dollar MTR as computed from the May 1988 CPS are based only on family income and marital status.

If an individual receives $1 as an LSD, then the MTR on that $1 is based on family income and marital status regardless of whether he/she rolled it over or spent it. The disadvantage is that it ignores any bracket jumps the recipiency of LSDs may cause and thereby underestimates the true MTR the recipients face; thus, it is subject to measurement error.

The first-dollar MTR is the appropriate measure for equations where the dependent variable is whether a recipient rolled over all of the LSD. I will refer to these probit equations as **probits for entire rollover**. To understand why, consider how the rollover decision affects current taxable income. The decision about whether to roll over all of the LSD is about whether to take any of the LSD into current taxable income. It is a decision about whether to take even one dollar of the LSD into current taxable income, where the first dollar is taxed at a MTR that does not include bracket jumps.

The first-dollar MTR is less appropriate for equations where the dependent variable is whether a recipient rolled over any of the LSD. For convenience, I will refer to these equations as **probits for any rollover**. The decision to roll over at least some of the LSD is about whether to take the entire LSD into current taxable income or less than the entire LSD. In other words, it is a decision about whether to take the last dollar of the LSD into current taxable income, where the last dollar is taxed at a MTR that would include any applicable bracket jumps.

I computed MTRs with bracket jumps based on the sum of family income and the amount of LSDs as well as on the recipients' marital status. The advantage of MTRs with bracket jumps is that they are probably less noisy measures of the actual MTRs the recipients faced. The disadvantage is that the bracket jumps may be endogeneous such that including MTRs with bracket jumps may introduce an endogeneity bias.[44] Bracket jumps may be endogeneous, since a recipient's decision to rol over an LSD is

[44]Note that the MTRs with bracket jumps as I have computed them are less likely to introduce an endogeneity bias than MTRs that include actual bracket jumps. The MTRs with bracket jumps that I include in the probits are based on the assumption that the recipients roll over none of their LSDs. In contrast, MTRs with actual bracket jumps would be based on whether the recipients actually rolled over their LSDs and would definitely introduce an endogeneity bias.

inseparable from his/her experiencing bracket jumps. A recipient who rolls over the entire LSD experiences no bracket jumps, since he/she owes no income taxes or tax penalty on the amount of the LSD that is rolled over. One who rolls over none or only part of the LSD may experience bracket jumps. The possible endogeneity of bracket jumps argues for the inclusion of MTRs without bracket jumps even in probits for any rollover.

Feldstein et al. (1980) address this tradeoff between correcting for endogeneity bias and alleviating measurement error in their study of the capital gains tax. Their study favors correcting for endogeneity bias over alleviating measurement error. Within the context of LSDs, the measurement error is more severe and deserves more attention. The reason is that realized capital gains are typically a small fraction of total income. In the case of LSDs, the amount of an LSD can be a large fraction of an individual's income such that the difference between the MTR with and without the bracket jumps can be large.

In summary, a tradeoff between endogeneity bias and measurement error arises primarily in probit equations where the dependent variable is whether a recipient rolled over any of the LSD. I have attempted to deal with the endogeneity bias in probits for any rollover in two ways. First, I used MTRs without bracket jumps as the measure of taxes, as well as MTRs with bracket jumps.[45] Second, I have used MTRs with imputed bracket jumps. MTRs with imputed bracket jumps are based on the sum of family income and predicted amount of LSD as well as the marital status. Estimates from the OLS equation used to predict the amount of LSD are in Table 6.[46]

The motivation for using imputed bracket jumps is to take account of both the endogeneity bias and measurement error. The idea is to estimate the amount of LSD received by groups of workers with similar characteristics (e.g., age, gender) and to compute the bracket jumps for these groups. MTRs that include these group-specific

[45]Both measures of MTRs are computed using the assumptions described in Section 1.5.4.

[46]I have estimated equations with specifications different from those in Table 6. The predicted amount of LSD from the various equations does not differ much from that from the equation in Table 6.

bracket jumps are related to the characteristics of the individual workers in each group such that they are subject to less measurement error than MTRs that do not account for bracket jumps at all (i.e., MTRs on the first dollar of LSDs). Also, these imputed bracket jumps may not introduce endogeneity bias like MTRs based on individual-specific bracket jump, since they are not related to the individuals' decision to roll over the LSDs.

In summary, I include the first-dollar MTRs in probits for entire rollover. I include the first-dollar MTRs, MTRs with bracket jumps, and MTRs with imputed bracket jumps in probits for any rollover. I included the tax penalty as a variable distinct from the MTRs in all the probit equations.

1.5.6 Basic Results

Table 7 presents results from a probit equation, where the dependent variable represents whether a recipient rolled over all of his/her LSD to tax-deferred instruments. The equation includes the MTRs without bracket jumps, the tax penalty, the real amount of the LSDs, and demographic variables.[47] Table 7 shows that the coefficient for the MTRs without bracket jumps is not statistically significant at the conventional levels. In contrast, the tax penalty has a significantly positive effect on rollovers as expected.

While the coefficient is large, the magnitude of the effect of the tax penalty is small. Table 8 shows that the estimated change in the probability of rollover due to a 1 percentage point increase in the tax penalty is about 0.5%. From this result, we can make a rough approximation of the effect of the imposition of the tax penalty on younger recipients. The Tax Reform Act of 1986 increased the tax penalty from 0 to 10%. A 10 percentage point increase in the tax penalty would have raised the

[47]Specifications other than those presented have been estimated to check for robustness (Section 1.5.7). I have included variables such as (female*married) and a dummy variable for college graduates; neither had statistically significant effect on rollover. The interaction term (female*married) was included to test whether married women are less likely to roll over their LSDs since they have another source of income, namely their husbands' income. The college graduate dummy was included to test whether college graduates are more likely to roll over their LSDs possibly because they have lower discount rates.

probability of rollover by 5 percentage points. This is an approximation, since the effect of the tax penalty may well be nonlinear.

Table 9 presents results from probits for any rollover, where the dependent variable represents whether a recipient rolled over any of his/her LSD to a tax-deferred instrument. It shows that the coefficients for all three measures of the MTRs are positive; individuals in higher tax brackets are more likely to roll over their LSDs. More importantly, the tax penalty has a significantly positive effect on rollovers. Younger recipients who were subject to the tax penalty were more likely to roll over their LSDs. The coefficient for the tax penalty is statistically significant at the 10% level in the equation with the first-dollar MTRs. The coefficients are statistically significant at the 5% level in qequations with MTRs that take account of bracket jumps. This difference in the significance of the tax penalty coefficient may be due to the measurement error inherent in MTRs without bracket jumps.

Table 10 shows that the magnitude of the effect of the tax penalty is small. The estimated change in the probability due to a 1 percentage point change in the tax penalty (i.e., a rise from 10% to 11%) ranges from 0.6% to 1.1%. As a rough approximation, the imposition of the 10% tax penalty on younger recipients increased their probability of rollover by 6–11 percentage points. Again, this is a rough approximation, since the effect of the tax penalty may well be nonlinear.

Tables 7 and 9 show that the probability of rollover increases with the size of an LSD. The coefficient for the real amount of LSDs is positive in all equations. The probability of rollover also increases with the age at the time of receipt of an LSD.

These results do not accord with the predictions of the Life-Cycle Hypothesis (LCH). LCH predicts that taxes, the size of LSDs, and the age at the time of receipt should bear no influence on the probability of rollover, so long as the receipt of an LSD is basically a change in the timing of income receipt. On the other hand, the results cannot rule out the relevance of the model of saving under liquidity constraints and the behavioral model.

An increase in taxes would induce some liquidity-constrained individuals to save rather than spend on current consumption. An increase in the size of an LSD is more

likely to relax a binding liquidity constraint and increase the number of rollovers. Models of liquidity constraints also provide an explanation for the positive relationship between age and the probability of rollover. Older recipients are less likely to be liquidity constrained and therefore more likely to save.

The behavioral model of saving predicts that the probability of rollovers increases with the size of the LSDs, because individuals are more likely to classify larger LSDs as assets or future income rather than current income. It also accounts for the positive relationship between age and rollovers. Older recipients receive larger LSDs, which they would classify as assets or future income and roll over.

The results do not support the prediction of the model outlined in Section 1.4.1. The model of rational choice of saving instrument predicts that the tax penalty affected primarily younger recipients who sought short-term investment. For these recipients, the tax penalty should have distorted their choice more toward tax-deferred instruments (e.g., IRAs) and away from non tax-deferred instruments (e.g., savings accounts). The data do not validate these predictions. The following table shows that a lower fraction of younger recipients chose to invest in tax-deferred instruments than in non tax-deferred instruments in each year during 1984-1988.[48]

Choice of Saving Instruments: Percent of Younger Recipients

Year	Tax-Deferred	Non Tax-Deferred
1984	14.9	28.9
1985	13.7	27.3
1986	15.5	22.4
1987	17.5	26.1

More younger recipients may have continued to prefer investing in non tax-deferred instruments even after the imposition of the tax penalty, because they perceived tax-deferred instruments as being more illiquid than they really are and therefore opted

[48]The table shows the percentage of recipients who invested exclusively in tax-deferred and in non tax-deferred instruments. For example, 14.9% of younger recipients in 1984 invested at least some of their LSDs in tax-deferred instruments but none in non tax-deferred instruments, and 28.9% invested in non tax-deferred instruments but not in tax-deferred instruments.

to save in non tax-deferred instruments which they perceived as being more liquid. This would suggest that individuals do not always make rational choice of saving instruments.

The model of rational choice of saving instrument (Section 1.4.1) also predicts that the tax penalty should have had little impact on older recipients. The figures in the following table cannot reject this prediction. No upward or downward trend in the percentage of older recipients who choose tax-deferred verus non tax-deferred instruments is apparent. The percentage of older recipients who choose tax-deferred instruments was higher than the percentage who choose non tax-deferred instruments in 1984; lower, in 1985; higher, in 1986; and lower, in 1987.

Choice of Saving Instruments: Percent of Older Recipients

Year	Tax-Deferred	Non Tax-Deferred
1984	23.2	16.7
1985	43.8	48.7
1986	34.6	10.7
1987	20.2	28.5

In summary, the results rule out the Life-Cycle Hypothesis but not the model of saving under liquidity constraints nor the behavioral model of saving. I leave for future research the interesting question of which is a better explanation for the low percentage of recipients who roll over their LSDs. To determine the impact of liquidity constraints on individuals' rollover decision requires data on assets or wealth of recipients, which is not available on the CPS.

1.5.7 Specification Checks

As mentioned before, one criticism of the results in Tables 7 and 9 is that the effect of taxes cannot be identified separately from the effect of family income on the probability of rollover. To address this criticism, I have estimated separate probit equations (1) for lower- and higher-income recipients and (2) for younger and older recipients.

Income Groups

The motivation for estimating separate probit equations for lower- and higher-income recipients is twofold. First, the tax penalty raised the tax price of not rolling over LSDs for younger recipients with lower income. It had less impact on younger recipients with higher income. If the effect of taxes is distinct from that of income, one would expect the coefficient for the tax penalty to be higher for the lower-income group than the higher-income group. Second, the splitting of the sample is a crude test of whether the marginal income tax rates (MTRs) merely reflect a nonlinear relationship between income and rollovers. Individuals in the two separate samples will have more homogeneous family income than in the pooled sample such that a nonlinear relationship between income and rollovers would be weaker. In other words, one would expect lower coefficients for MTRs in the two subsamples than for the full sample if MTRs are not identified.

Tables 8 and 10 present the estimated coefficients of the MTRs by income. They show no consistent pattern as to the magnitude of the coefficients for the two income groups versus the full sample. For example, the coefficients of MTRs are lower in magnitude for the higher-income group than in the full sample in some cases but not in others.

The more interesting result is that the tax penalty had a larger impact on higher-income recipients than on lower-income recipients. An increase of 1 percentage point in the tax penalty raises the probability of rollover among higher-income recipients by 0.9–1.8%. In contrast, it raises the probability of rollover among lower-income recipients by only 0.001–0.6%. This contrast is noteworthy, since the tax penalty raised the tax price of not rolling over LSDs more for lower-income recipients than for higher-income recipients.

These results suggest that the rollover decision of higher-income recipients is more sensitive to changes in the tax penalty than lower-income recipients. One explanation may be that higher-income recipients are less likely to be liquidity constrained. The other explanation may be that they are more likely to receive larger LSDs, which they may classify as assets or future income rather than as current income. If the

behavioral model is valid, then their MPC out of these large LSDs is low and they are more likely to save them in illiquid instruments that reward long investment.

Age

A better test of identification is to estimate difference-in-difference equations that take advantage of the time variation in the tax price due to the imposition of the tax penalty starting in 1987. The Tax Reform Act of 1986 (TRA) imposed the 10% penalty only on younger recipients (i.e., less than than 55 years of age at the time of receipt). Table 11 presents the results from difference-in-difference probit equations that include binary (0,1) variables for the following : (1) whether the recipient was less than 55 in age when he/she received the LSD (LESS55) and (2) whether he/she received the LSD after 1986 (POST86). The equations also include an interaction term equal to the product of these two variables (LESS55)*(POST86), and the amount of the LSD in 1988 dollars (AMTLSP). In other words,

$$Pr(S_i = 1) = \Phi[\beta_0 + \beta_1(LESS55) + \beta_2(POST86) + \beta_3(LESS55)*(POST86) + \beta_4(AMTLSP) + \gamma' z_i], \quad (1.5)$$

where z_i denotes a vector of other variables included in the equations and γ denotes the vector of coefficients corresponding to these variables. Demographic variables such as marital status, years of schooling completed, and gender are included in the vector z_i.

The hypothesis that the tax changes affected only the younger recipients after 1986 translates into the test that the coefficient $\beta_3 > 0$. The estimated coefficients for the interaction term (LESS55)*(POST86) are positive but not statistically significant. The P-value for the one-sided test is 0.20 for both equations, reflecting the insignificance of the coefficient. The size of the coefficient is large; however, there may not be enough observations to estimate the effect of the interaction term with precision.[49]

[49]During 1984–88, only 97 recipients of LSDs were 55 or older at the time of receipt.

We can make some calculations to determine whether these difference-in-difference results imply a tax elasticity similar to those discussed in Section 1.5.6. The computation we want is:

$$\frac{\Delta P^Y - \Delta P^O}{\Delta t^Y - \Delta t^O} \tag{1.6}$$

where ΔP^Y denotes the change in predicted probability between 1984–1986 and 1987–1988 for younger recipients and ΔP^O denotes the change for older recipients. The following table shows the change in the predicted probability of rollover for younger recipients and that for older recipients. The predicted probabilities are for a married male with 14 years of schooling. For the sample of younger recipients, the real amount of LSD was chosen to equal \$6,000. For the sample of older recipients, the real amount of LSD was chosen to equal \$16,000. The real amount of LSD and personal characteristics were chosen to resemble the means for the two samples.

Statistics	1984–86	1987–88
Less than 55:		
Predicted probability of any rollover	0.15	0.19
Mean tax price:		
Using MTR without bracket jumps	29%	33%
Using MTR with bracket jumps	32%	35%
55 or older:		
Predicted probability of any rollover	0.39	0.32
Mean tax price:		
Using MTR without bracket jumps	24%	25%
Using MTR with bracket jumps	32%	30%

As the table shows, the predicted probability of rollover increased between 1984–1986 and 1987–1988 for younger recipients but decreased for older recipients, such that:

$$\Delta P^Y - \Delta P^O = (0.19 - 0.15) - (0.32 - 0.39) = 0.11. \tag{1.7}$$

Not all of this difference of 0.11 can be attributed to the 10% tax penalty that was imposed only on younger recipients. To compute the difference that is attributable

to taxes, we need to normalize the difference of the change in predicted probability by the difference of the change in the tax rate for the two groups. The difference of the change in the tax rate for younger and older recipients is expressed as percentage points, since we are interested in the change in probability of rollover per percentage point change in the tax rate.

We can measure the mean tax price of not rolling over LSDs in two ways. We can use either the MTRs without bracket jumps or the MTRs with bracket jumps to compute the mean tax price. The mean tax price includes the tax penalty for the younger recipients after 1986. The result using MTRs without bracket jumps is:

$$\frac{\Delta P^Y - \Delta P^O}{\Delta t^Y - \Delta t^O} = \frac{0.11}{26} = 0.004. \tag{1.8}$$

The probability of rollover among younger recipients increased by 0.004 for each percentage point increase in the tax rate, relative to older recipients. Thus, the 10% tax penalty may have increased the probability of rollover among younger recipients by 4 percentage points, relative to older recipients. The result using MTRs with bracket jumps is:

$$\frac{\Delta P^Y - \Delta P^O}{\Delta t^Y - \Delta t^O} = \frac{0.11}{36} = 0.003. \tag{1.9}$$

This suggestss that the 10% tax penalty increased the probability of rollover among younger recipients by 3 percentage points more than among older recipients. These crude estimates of the tax elasticity using both measures of MTRs collaborate the findings in Tables 8 and 10; the impact of the 10% tax penalty on rollovers has been small.

1.6 Conclusion

Congress's attempts to raise personal saving via private pensions have often taken the form of tax penalties on consumption. Such penalties serve two purposes. They discourage consumption and presumably encourage saving while raising badly needed tax revenue. In 1982, Congress imposed a 10% tax penalty on early withdrawals from

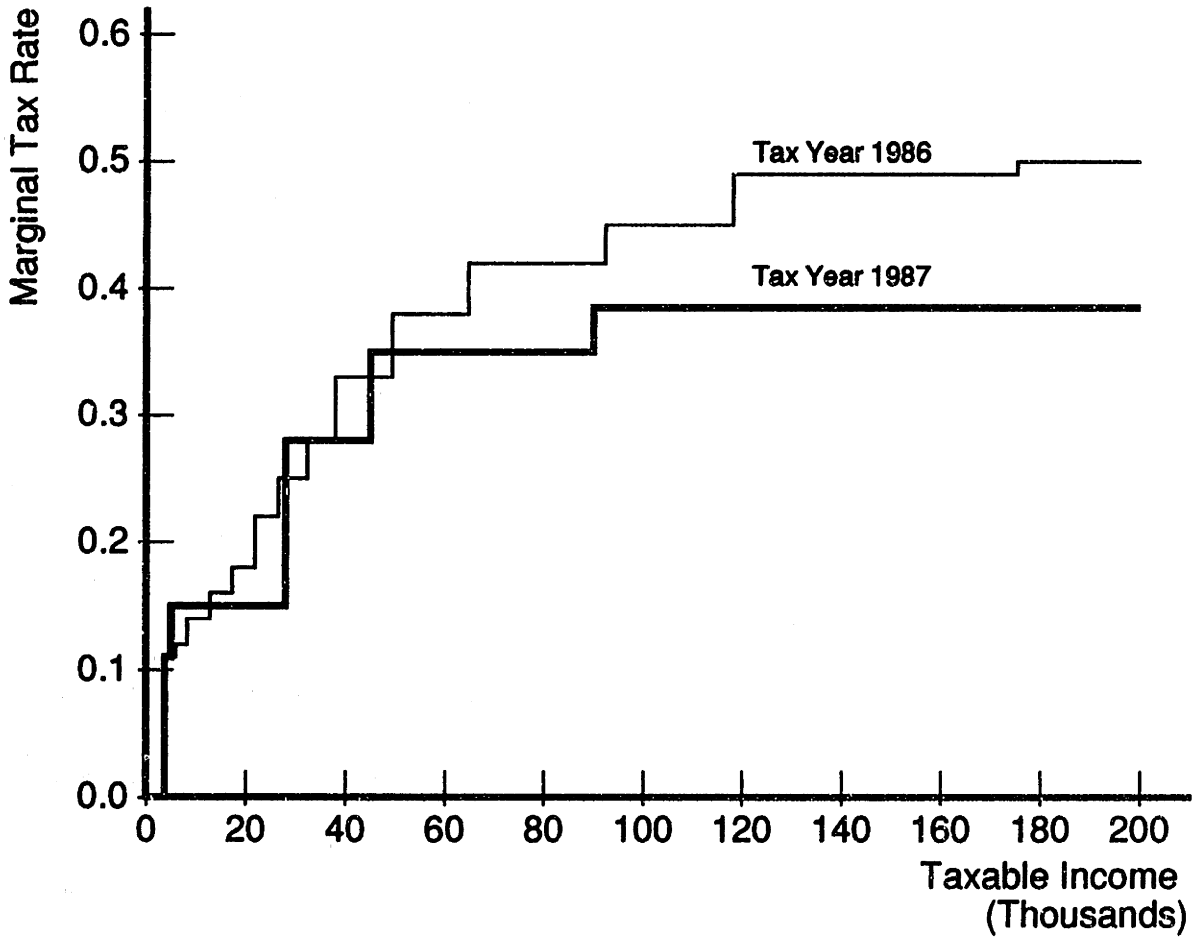
IRAs. In 1986, they imposed a 10% tax penalty on uses of pre-retirement lump-sum pension distributions (LSDs) other than rollovers (i.e., reinvestment in tax-deferred instruments).

This paper is the first to attempt estimating empirically the effect of the 10% tax penalty on uses of LSDs other than rollovers and other changes in federal personal income tax rates that occurred in 1986. An analysis of aggregate data from the U.S. Treasury Individual Tax Model File suggests that the impact of the penalty on rollovers has been small. An analysis of individual-level data from the May 1988 CPS also indicates that the impact of the penalty has been small. The estimates show that the 10% tax penalty raised the probability of rolling over an LSD by at most 11 percentage points. Thus, the evidence from this paper suggests that penalties on consumption may not be effective instruments with which to raise personal saving.

The results suggest several explanations. First, individuals may be liquidity constrained such that they will spend as much of the LSDs as necessary to relax the binding liquidity constraints. Second, individuals' saving decisions may not be "rational," based solely on considerations of liquidity constraints, liquidity, and after-tax yield. They may classify larger LSDs as assets or future income rather than as current income. This classification may determine their decision to save and their choice of saving instruments more than the forementioned considerations. Third, individuals may perceive tax-deferred instruments such as IRAs as being more illiquid than they really are; thus, they invest in non tax-deferred instruments although they incur a tax cost as a consequence.

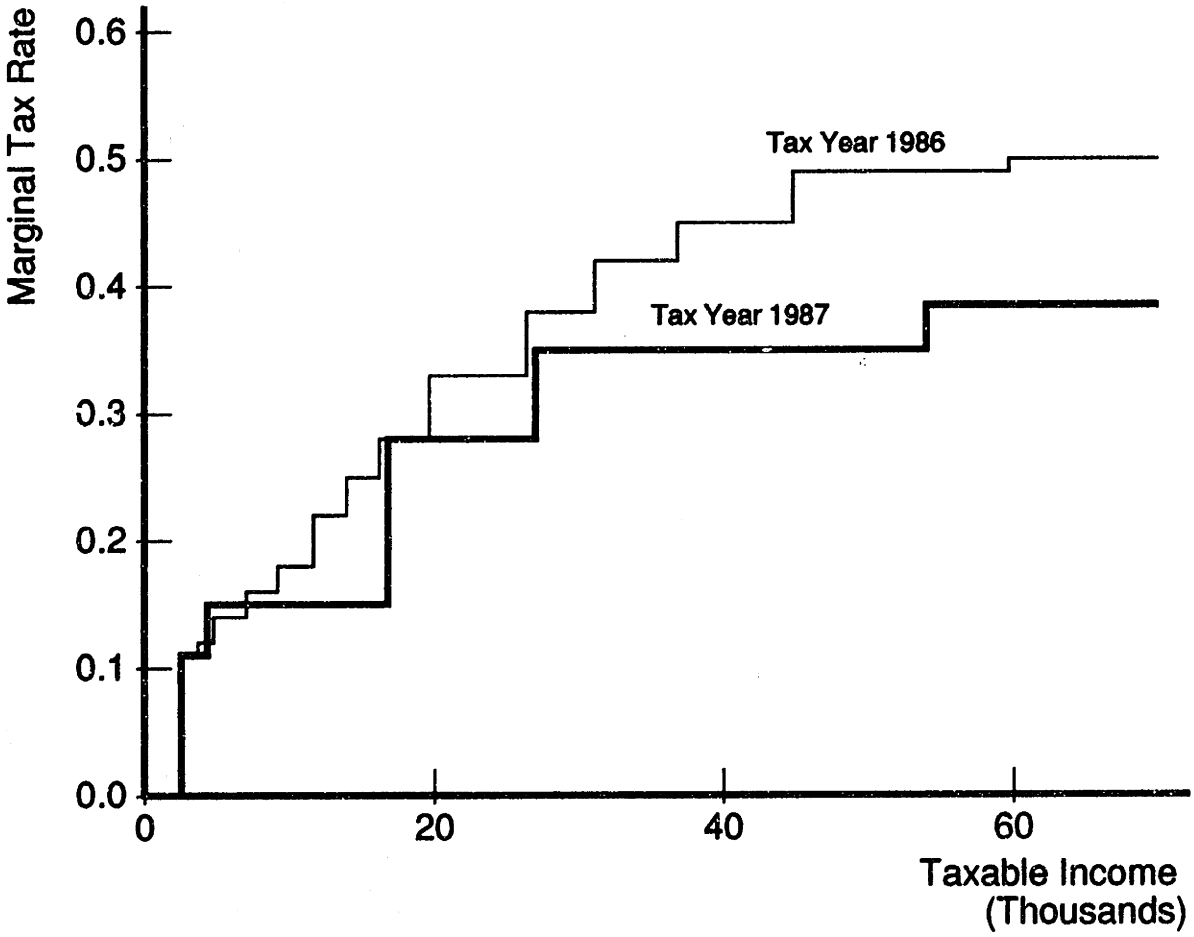
An overwhelming majority of recipients of LSDs (87%) chose not to roll over any of their LSDs. This fact, in conjunction with the small impact of the tax penalty, suggests that the leakage out of retirement savings via LSDs will increase in the future as the trend toward defined contribution (DC) pension plans continues and as the recipiency of LSDs becomes more prevalent.

Figure 1. Income Tax Rates: Married Joint



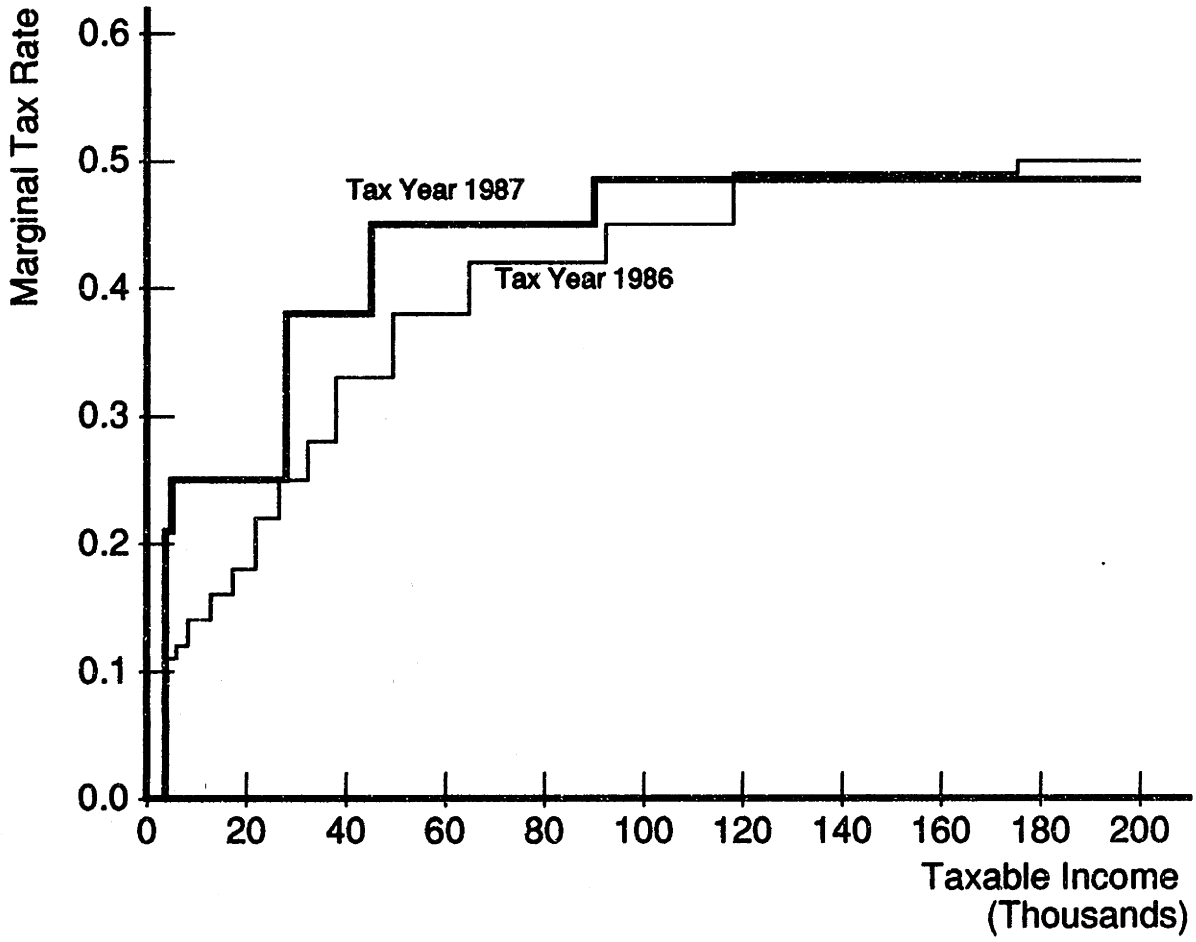
Source: Coopers & Lybrand (1986) [p.2, 166], ACIR (1987)[p.20], ACIR (1986)[p.22].

Figure 2. Income Tax Rates: Single



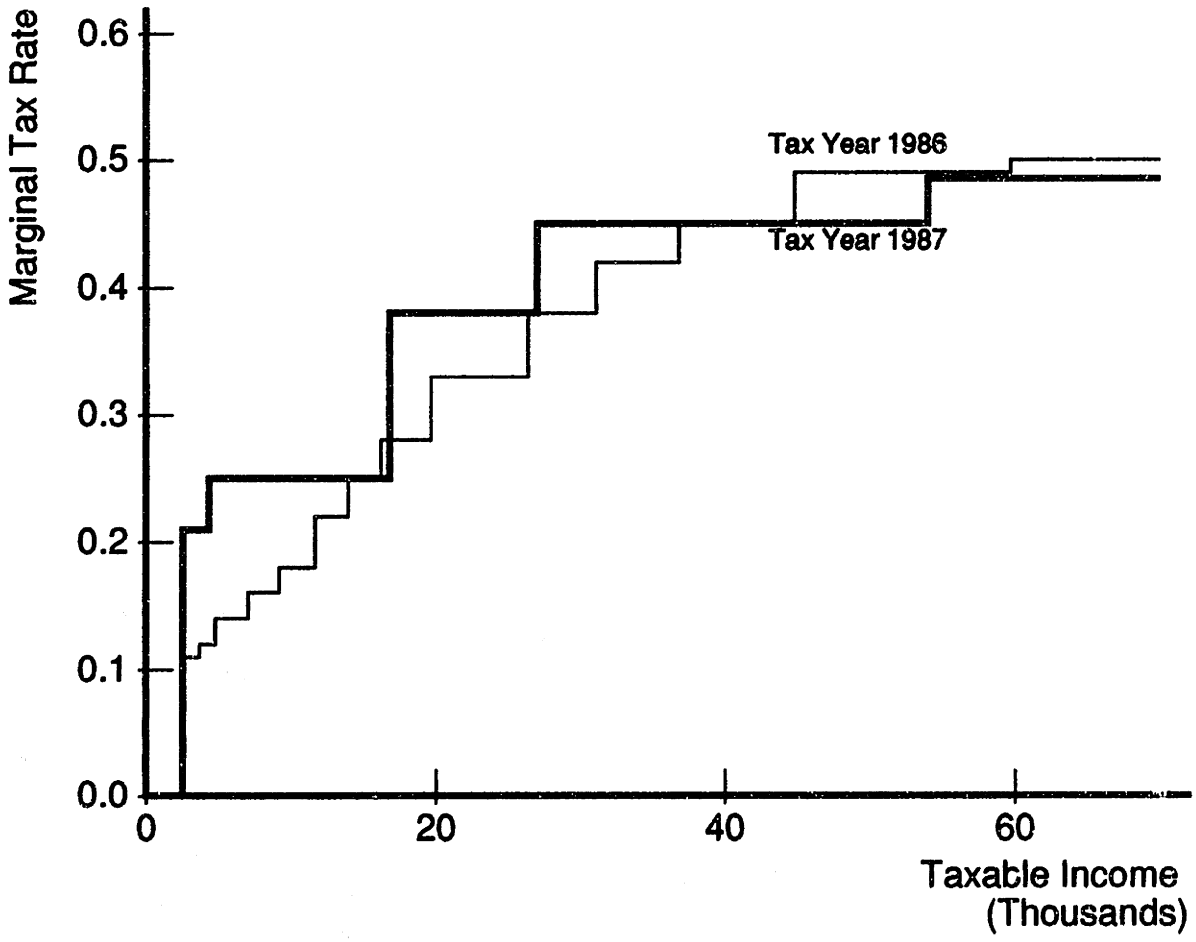
Source: Coopers & Lybrand (1986) [p.2, 166], ACIR (1987)[p.20], ACIR (1986)[p.22].

Figure 3. Marginal Tax Rates on Consumption out of LSDs: Married Joint



Source: Coopers & Lybrand (1986) [p.2, 166], ACIR (1987)[p.20], ACIR (1986)[p.22].

Figure 4. Marginal Tax Rates on Consumption out of LSDs: Single



Source: Coopers & Lybrand (1986) [p.2, 166], ACIR (1987)[p.20], ACIR (1986)[p.22].

Table 1. Recipiency of Lump-Sum Distributions

Characteristics	Total (thousands)
A. Currently in pension plan [percentage of employed adults]	60,314 [52.7%]
B. Eligible for lump-sum distribution [percentage of A]	21,777 [36.1%]
C. Ever previously in pension plan [percentage of employed adults]	19,848 [17.3%]
D. Received lump-sum distribution [percentage of C]	8,478 [42.7%]
Total amount of lump-sum distribution (1988 $)	$42,006,476

All figures have been computed using weights provided in the May 1988 CPS supplement. The sample contains 27,701 observations for adults employed at the time of the interview.

Table 2. Distribution of Recipiency of Lump-Sum Distributions

Characteristics	Recipient-Weighted		Amount-Weighted	
	(thousands)	(percentage)	(billions)	(percentage)
Total	8,478	100%	$42.0	100%
Age when received LSD:				
Under 35	5,201	61.4	15.7	37.4
35–44	2,042	24.1	15.3	36.4
45–54	850	10.0	6.5	15.5
55+	385	4.5	4.5	10.7
1987 Family Income:				
Less than $10,000	344	4.2	1.8	4.3
$10,000–$19,999	1,610	19.6	6.6	15.7
$20,000–$29,999	1,710	20.8	6.6	15.7
$30,000–$39,999	2,042	24.9	9.9	23.6
$40,000–$49,999	1,002	12.2	4.9	11.7
$50,000–$74,999	682	8.3	3.8	9.0
$75,000+	818	10.0	7.6	18.1

All figures in the table have been computed using weights provided in the May 1988 CPS supplement. The sample consists 2,162 workers who reported having received at least one preretirement lump-sum distribution from a prior job.

Table 3. Distribution of Size of Lump-Sum Distributions

Characteristics	Amount of Lump-Sum Distribution						
	Average	$1–$999	$1,000–$2,999	$3,000–$4,999	$5,000–$9,999	$10,000–$19,999	$20,000+
Age when rec'd LSD:							
Under 35	$3,673	46.4%	25.4%	10.7%	10.4%	5.2%	1.9%
35–44	8,546	29.6	19.1	11.7	17.0	13.5	9.1
45–54	9,789	35.3	16.1	11.4	18.8	8.8	9.5
55+	15,449	30.6	14.1	10.5	13.3	12.9	18.6
1987 Family Income:							
Less than $10,000	$6,543	45.0%	21.7%	8.2%	10.2%	8.7%	6.2%
$10,000–$19,999	4,836	44.5	22.9	12.7	8.5	2.4	4.0
$20,000–$29,999	4,751	43.5	24.9	9.3	12.4	6.5	3.5
$30,000–$39,999	5,534	38.5	24.9	12.2	12.9	7.8	3.9
$40,000–$49,999	6,059	37.8	19.5	9.5	17.3	12.2	3.7
$50,000–$74,999	6,786	32.9	19.6	16.5	18.0	6.2	6.9
$75,000+	11,739	32.2	19.0	8.5	16.7	8.8	14.8
All recipients	$5,989[a]	40.5%	22.4%	11.0%	13.0%	7.9%	5.2%
Total amount	2,451[b]	2.2	8.3	8.6	10.9	21.7	40.6

[a] Mean amount of LSD received

[b] Median amount of LSD received

All figures in the table have been computed using weights provided in the May 1988 CPS supplement. Dollar figures are in 1988 dollars. The sample contains 2,160 observations.

Table 4. Uses of Lump-Sum Distributions

Use	Recipient-Weighted		Amount-Weighted	
	(thousands)	(percentage)	(billions)	(percentage)
Tax-deferred instruments:	1,142	13.5%	$9.4	22.3%
Retirement program	944	11.1	7.7	18.4
Insurance annuity	198	2.3	1.7	4.1
Savings account	1,478	17.4	5.1	12
Other financial instruments	532	6.3	4.5	10.6
Start or buy a business	233	2.7	2.5	5.9
Bought house	756	8.9	4.8	11.5
Bought car	310	3.7	1.4	3.4
Paid debt	1,843	21.7	4.9	11.7
Paid educational expenses	355	4.2	1.6	3.7
Paid expenses during unemployment	552	6.5	1.8	4.3
Other	2,250	26.5	7.7	18.4

All figures have been computed using weights in the May 1988 CPS supplement. Because the May 1988 CPS supplement does not provide the exact amount of LSDs allocated to various uses, we can only infer a range of amount allocated to each use. If a recipient reported more than one use, then he/she was assumed to have allocated a minimum of $1 and a maximum of the entire amount of the LSD to each reported use. Summing across these minimum and maximum figures across recipients yields a range of total amount allocated to each use. The figures in the fourth and the fifth column are the median values of these ranges.

Table 5. Tax Revenue from Tax Penalty: CPS and IRS Data

Year	Number Paid Penalty (thousand)		Collected Revenue (million)		Anticipated Revenue (million)
	CPS	IRS	CPS	IRS	
1987	926	876	$360	$364	$97
1988	—	1,524	—	711	209
1989	—	1,653	—	833	241

May 1988 CPS and U.S. Treasury Individual Tax Model File data have been used to estimate the number of individuals who may have paid the tax penalty on LSDs and the tax revenue it generated. Reporting of figures from the CPS is limited to 1987, since the data is incomplete for 1988. The figures in the last column are from *General Explanations of the Tax Reform Act of 1986* by the U.S. Joint Committee on Taxation. They are the Joint Committee's estimates of the revenue increase from the tax penalty on LSDs.

Source: U.S. Treasury Individual Tax Model File (1984–89), SOI (1986, 1987, 1988), U.S. Joint Tax Committee (719), May 1988 CPS.

Table 6. Determinants of Amount of LSD

Explanatory Variables	Coefficients
If female	-2775.77**
	(767.79)
If nonwhite	-1351.73
	(1710.34)
If married	-869.79
	(915.45)
Age when received LSD	349.17**
	(39.96)
Years of schooling	26.57
	(167.24)
Family income	0.08**
	(0.02)
If owned a house	1369.54
	(887.66)
If contributed to an IRA	166.87
	(974.99)
Year dummies:	
1985	-127.29
	(1339.42)
1986	107.22
	(1290.80)
1987	40.03
	(1254.03)
1988	-149.45
	(1520.55)
Constant	-8078.11*
	(3124.23)
R^2	0.15

* Statistically significant at the 10% level.

** Statistically significant at the 5% level.

The dependent variable is the amount of LSD in 1988 dollars. Standard errors are in parentheses. The sample includes 855 observations. The explanatory variables listed above are those based on information reported in May 1988.

Table 7. Effect of Taxes and Penalty on Entire Rollovers

Explanatory Variables		Coefficients
Real amount of LSD		$6.6\text{x}10^{-6}$
		($4.6\text{x}10^{-6}$)
MTR without bracket jumps		-1.56
		(1.24)
Tax penalty		2.44*
		(1.30)
Age when received LSD:	Under 35	-0.22*
		(0.13)
	45–54	0.25
		(0.18)
	55+	0.31
		(0.24)
Family income in 1987:	Less than $10,000	-0.35
		(0.40)
	$10,000–$19,999	-0.66**
		(0.25)
	$20,000–$29,999	-0.20
		(0.19)
	$40,000–$49,999	0.32*
		(0.19)
	$50,000–$74,999	0.49**
		(0.24)
	$75,000+	0.51**
		(0.24)
Years of schooling		0.03
		(0.03)
If female		0.01
		(0.12)
If married		-0.15
		(0.15)
Constant		-0.98
		(0.62)
-Log likelihood		313.45

* Statistically significant at the 10% level.
** Statistically significant at the 5% level.

The dependent variable denotes whether a recipient rolled over an entire LSD. Standard errors are in parentheses. The sample includes 833 observations.

Table 8. Estimated Impact of Taxes on Entire Rollovers:
By Income and Measure of Marginal Tax Rate

Sample	MTR without bracket jumps
Full Sample:	
coefficient of MTR	-1.56
	(1.23)
coefficient of penalty	2.44*
	(1.30)
$\Delta(prob)/\Delta(p)$	0.5%
Lower Income:[a]	
coefficient of MTR	-1.07
	(1.31)
coefficient of penalty	0.51
	(1.63)
$\Delta(prob)/\Delta(p)$	0.09%
Higher Income:[a]	
coefficient of MTR	-0.63
	(1.53)
coefficient of penalty	3.40**
	(1.65)
$\Delta(prob)/\Delta(p)$	0.9%

* Statistically significant at the 10% level.

** Statistically significant at the 5% level.

[a] The base family income bracket is \$30,000–\$39,999. Recipients in this bracket are in both income groups. Those with family income greater than \$39,999 are in the higher income group.

The standard error are in parentheses. The probit equations include the following variables: real amount of LSD, family income brackets, marital status, years of schooling completed, gender, and dummy variables for age brackets.

The estimates for $\Delta(prob)/\Delta(p)$ represent the change in the probability of rollover per 1 percentage point change in the tax penalty on uses of LSDs other than rollovers .

Table 9. Effect of Taxes and Penalty on Any Rollover

Explanatory Variables	Coefficients		
Real amount of LSD	$1.1\text{x}10^{-5}$**	$3.1\text{x}10^{-6}$	$1.1\text{x}10^{-5}$**
	($4.3\text{x}10^{-6}$)	($5.1\text{x}10^{-6}$)	($4.3\text{x}10^{-6}$)
MTR without bracket jumps	-1.27	—	—
	(1.45)		
MTR with bracket jumps	—	3.71**	—
		(1.41)	
MTR with imputed bracket jumps	—	—	1.85
			(1.60)
Tax penalty	2.47*	4.33**	3.15**
	(1.26)	(1.44)	(1.52)
Age when received LSD: Under 35	-0.22*	-0.21*	-0.20
	(0.13)	(0.13)	(0.13)
45–54	0.35**	0.39**	0.33**
	(0.17)	(0.17)	(0.17)
55+	0.46**	0.48**	0.41*
	(0.22)	(0.22)	(0.22)
Family income in 1987: Less than $10,000	-0.47	0.45	0.17
	(0.44)	(0.39)	(0.43)
$10,000–$19,999	-0.55**	0.05	-0.15
	(0.26)	(0.23)	(0.26)
$20,000–$29,999	-0.19	0.14	0.02
	(0.19)	(0.18)	(0.18)
$40,000–$49,999	0.18	0.02	0.07
	(0.18)	(0.19)	(0.19)
$50,000–$74,999	0.26	-0.06	0.05
	(0.25)	(0.23)	(0.24)
$75,000+	0.45	0.08	0.19
	(0.24)	(0.22)	(0.24)
Years of schooling	0.03	0.02	0.02
	(0.02)	(0.02)	(0.02)
If female	$4.2\text{x}10^{-3}$	0.03	0.03
	(0.11)	(0.11)	(0.11)
If married	-0.07	0.20	0.11
	(0.15)	(0.16)	(0.17)
Constant	-0.93	-2.77**	-2.12**
	(0.67)	(0.68)	(0.77)
-Log likelihood	360.52	357.45	360.23

* Statistically significant at the 10% level.

** Statistically significant at the 5% level.

The dependent variable denotes whether a recipient rolled over any of his/her LSD. Standard errors are in parentheses. The sample includes 833 observations.

Table 10. Impact of Taxes on Any Rollover:
By Income and Measure of Marginal Tax Rate

Sample	MTR without bracket jumps	MTR with bracket jumps	MTR with imputed bracket jumps
Full Sample:			
coefficient of MTR	-1.27	3.71**	1.85
	(1.45)	(1.41)	(1.60)
coefficient of penalty	2.47*	4.33**	3.15**
	(1.26)	(1.44)	(1.52)
$\Delta(prob)/\Delta(p)$	0.6%	1.1%	0.8%
Lower Income:[a]			
coefficient of MTR	-0.55	4.52**	0.006
	(1.56)	(1.88)	(1.18)
coefficient of penalty	0.27	2.36	0.006
	(1.56)	(1.67)	(1.74)
$\Delta(prob)/\Delta(p)$	0.06%	0.6%	0.001%
Higher Income:[a]			
coefficient of MTR	-0.66	3.44**	6.68**
	(2.00)	(2.33)	(2.87)
coefficient of penalty	4.09**	6.34*	8.63**
	(1.63)	(2.23)	(2.52)
$\Delta(prob)/\Delta(p)$	1.2%	1.5%	1.8%

* Statistically significant at the 10% level.

** Statistically significant at the 5% level.

[a] The base family income bracket is \$30,000–\$39,999. Recipients in this bracket are in both income groups. Those with family income greater than \$39,999 are in the higher income group.

The standard error are in parentheses. The probit equations include the following variables: real amount of LSD, family income brackets, marital status, years of schooling completed, gender, and dummy variables for age brackets.

The estimates for $\Delta(prob)/\Delta(p)$ represent the change in the probability of rollover per 1 percentage point change in the tax penalty on uses of LSDs other than rollovers.

Table 11. Difference-in-Difference Probits

Explanatory Variables	Coefficients	
Amount of LSD (1988 $)	$1.7\text{x}10^{-5}$** ($4.0\text{x}10^{-6}$)	$1.6\text{x}10^{-5}$** ($4.0\text{x}10^{-6}$)
If less than 55: LESS55	-0.46** (0.24)	-0.53** (0.24)
If after 1986: POST86	-0.18 (0.38)	-0.17 (0.38)
(β_3) (LESS55)*(POST86)	0.34 (0.40)	0.33 (0.40)
Years of schooling	—	0.05** (0.02)
If female	—	0.02 (0.10)
If married	—	0.04 (0.12)
Constant	-0.67** (0.23)	-1.37** (0.39)
-Log likelihood	391.45	388.51
Test: $\beta_3 > 0$ [p values]	0.34 [0.20]	0.33 [0.20]

* Statistically significant at the 10% level.

** Statistically significant at the 5% level.

The dependent variable is binary and represents whether a recipient rolled over any of an LSD to tax-deferred instruments. Standard errors are in parentheses. The marital status and years of completed used in the probits are those reported in May 1988. The sample includes 855 observations.

Appendix A. Bracket Jumps

The following table shows that over 40% of individuals experienced bracket jumps as a result of receiving of lump-sum distributions (LSDs) during 1984–1986. In contrast, the fraction drops sharply after 1986; only 23% of individuals who received LSDs in 1987 experienced bracket jumps and only 14% in 1988. The 1988 figures are incomplete since the data contains information through May 1988 and therefore should be interpreted with caution. Figures for the percentage of the total amount subject to bracket jumps indicate a similar pattern (column 2). Bracket jumps became less prevalent after the Tax Reform Act of 1986 reduced the number of tax brackets.

Year	Percentage of Recipients (1)	Percentage of Amount (2)	Mean Bracket Jump (% points) (3)	LSD-Weighted Mean Bracket Jump (4)
1984	42.6	83.2	6	6
1985	53.9	84.8	5	7
1986	40.9	81.8	7	7
1987	23.1	57.5	11	8
1988	14.4	50.4	8	3

On the other hand, the size of the bracket jump increased after 1986. If an individual experienced a bracket jump prior to 1987, then his/her marginal tax rate increased by about 5–7 percentage points (column 3). If an individual experienced a bracket jump in 1987, then the average increase in the marginal tax rate was 11 percentage points. For 1988, the average bracket jump was 8 percentage points.

The mean bracket jump, such as those in column 3, does not reflect the fact that individuals in the top tax brackets will not experience any bracket jumps. Furthermore, these high-income individuals are precisely those who are more likely to receive the larger LSDs. To capture the absence of bracket jumps among high-income individuals who receive larger LSDs, I computed the LSD-weighted mean bracket jump as follows: $\frac{\sum_i A_i \Delta MTR}{\sum_i A_i}$, where A_i represents the amount of the LSD for recipient i. The figures are in the last column of the table. Once we control for the fact that individuals in the top tax bracket receive larger LSDs and experience fewer bracket

jumps, the difference in the average bracket jump before and after the Tax Reform Act of 1986 is not so great as the mean bracket jump figures in column 3.

In summary, bracket jumps that result from receiving LSDs are not ignorable. A significant fraction of recipients experienced bracket jumps before 1987, while the size of the bracket jumps increased after 1987.

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Chapter 2

Sensitivity of Pension Contributions to Taxes*

2.1 Introduction

Private pensions play a significant role in the accumulation of personal savings in the United States. The annual flow of employer contributions to pensions is sizable. In 1988, employer contributions to pensions constituted almost 7% of personal saving (*Flow of Funds* 71–72). Policymakers have granted private pensions two types of favorable tax treatment, which may have encouraged such a large flow of pension assets. The first type of favorable tax treatment applies to pension contributions: firms can deduct pension contributions from taxable income and thereby lower their tax burden in the current period. The second type of favorable tax treatment is the exemption of earnings within pension funds from corporate taxes. The total tax expenditure arising from both types of favorable tax treatment is considerable. In 1992, the tax expenditure amounted to $48.3 billion (*Budget of U.S. Government*).

Recently, policymakers have debated whether the favorable tax treatment of pen-

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sion contributions and earnings is desirable.[1] In particular, a proposal not to allow firms to deduct pension contributions from taxable income has emerged.[2] The emergence of such a proposal may be due to two factors: (1) the growing federal debt and (2) the experience of other countries. New Zealand, Australia, and Sweden have reduced the favorable tax treatment granted to private pension contributions and/or earnings in 1987, 1988, and 1991, respectively.

While the proposed elimination of deductions for pension contributions would certainly raise badly needed tax revenue, the worthiness of the proposal would diminish if pension contributions decline as a result.[3] If employer contributions are sufficiently sensitive to taxes, then taking away the favorable tax treatment may reduce personal saving.[4]

The purpose of this paper is to estimate the sensitivity of employer contributions to the tax treatment. It focuses on a change in the tax treatment that occurred in 1988. Prior to 1988, employer contributions to defined benefit (DB) plans were exempt from corporate taxes. As of 1988, employer contributions were tax-exempt so long as the value of the assets in the pension fund did not exceed 150% of the **pension liabilities**. Pension liabilities refer to pension benefits firms owe to workers during their retirement. If a pension fund was overfunded by more than 150%, then employer contributions were subject to corporate taxes. This law change is a weaker version of the proposal to tax employer contributions to all pension plans.

The paper proceeds as follows. Section 2.2 provides background information, including a more detailed description of the change in the tax treatment of employer contributions that occurred in 1988. Section 2.3 presents a model of firms' decisions as

[1] Economists offer different views about this issue. On the one hand, economists favor giving the same tax treatment to all forms of compensation under an income tax system such that all fringe benefits are taxed in the same manner as income. On the other hand, some economists advocate a consumption tax system, under which employer pension contributions would not be taxed at all; only workers' consumption from pension benefits would be taxed.

[2] Munnell (1992) presents such an argument.

[3] A decline in contributions may increase the risk of workers' losing their pension benefits and the risk borned by the Pension Benefit Guaranty Corporation (PBGC). A full discussion of these possible consequences is beyond the scope of this paper.

[4] If the decline in pension contributions exceeds the tax revenue, then a net decrease in national saving may result.

regards pension contributions. Section 2.4 describes the dataset, which is based on the Internal Revenue Service (IRS) Form 5500 computer tapes. Section 2.5 describes the methodology used to estimate the tax sensitivity of corporate pension contributions. It also presents the results. Section 2.6 concludes the paper.

2.2 Background

This section describes regulations on the minimum and maximum limits on employer contributions to defined benefit (DB) pension plans. Sponsors of DB plans must comply with these limits to qualify for favorable tax treatment of the pension plans. Noncompliance could lead to disqualification for the favorable tax treatment.[5] The limit on the minimum amount of annual employer contributions to DB pension plans has existed since 1974 when Congress enacted the Employee Retirement Income Security Act (ERISA). These regulations are called **minimum funding standards**. The purpose of the minimum funding standards is to ensure that workers receive their pension benefits. Most DB plans pay pension benefits to workers at retirement, such that whether workers actually receive their benefits depends on employers' adequately contributing to the pension fund.[6] Federal regulations on the maximum amount of deductible annual employer contributions have existed even before ERISA. These regulations are called **full-funding limits**. The purpose of full-funding limits has been to limit the tax expenditure due to the deduction of pension contributions.

2.2.1 Minimum Funding Standards

The Internal Revenue Service (IRS) bases the minimum funding standards on a particular measure of pension liabilities called **accrued liabilities**. Under a DB plan, workers are entitled to pension benefits at retirement where the benefits are computed

[5]Non tax-qualified pension plans do exist, though their number is not known accurately.

[6]Defined contribution (DC) pension plans do not involve the accumulation of pension assets to meet pension liabilities. With DC plans, sponsors contribute to individual accounts for workers. Workers' pension benefits equal the value of the accounts and are usually portable across jobs. This paper focuses entirely on DB plans.

based on workers' salary and/or years of service at the time of separation (i.e., quit, retirement). Firms can use different actuarial methods to estimate the amount of these benefits or pension liabilities. Accrued liabilities are computed based on the current years of service and on estimated future salaries for the workers.[7] Regulations stipulate that employers service the normal costs and any supplemental costs each year, where the normal and supplemental costs are computed based on accrued liabilities. **Normal costs** refer to pension benefits the workers earned during the past year. **Supplemental costs** are typically an amortized amount of any existing funding deficiency. A funding deficiency may exist because the firm did not make adequate contributions in the past,[8] the return on pension assets was lower than anticipated, or the firm granted credit for past services.[9] A different maximum amortization period applies to each of these sources of funding deficiencies. Supplemental costs equal the amortized amount of each of these sources of funding deficiencies, using the maximum amortization periods.[10]

2.2.2 Full-Funding Limits

Whereas the minimum funding standards directly impose a restriction on the minimum amount of contributions, full-funding limits impose an indirect restriction on the maximum amount of deductible contributions. Prior to the enactment of the Omnibus Budget Reconciliation Act of 1987 (OBRA), the IRS based the full-funding limits on accrued liabilities. The full-funding limit on DB plans was that the sum of assets (A_t) and contributions (C_t) for year t could not exceed the sum of accrued liabilities (L_t^A) and the normal cost (NC_t) for year t:[11]

$$C_t + A_t \leq L_t^A + NC_t. \tag{2.1}$$

[7]For more details, see: Warshawsky (1992).

[8]If a firm experiences financial hardship, it can apply to the IRS for a waiver from the minimum funding standards. If granted, the waiver allows the firm to skip pension contributions for a year.

[9]This is common among younger plans. When a firm starts a DB plan, it may grant workers credit for their years of service prior to the formation of the plan.

[10]For a more complete description of changes in the minimum funding standards, see: Alderson and VanDerhei (1992).

[11]The following is based on Hirtle and Estrella (1990).

If a pension plan exceeded this full-funding limit, then additional contributions to the plan were not deductible; however, returns on those nondeductible contributions remained exempt from corporate taxes. Thus, the full-funding limit restricted the maximum amount of contributions that could be made on a tax-exempt basis. Whether this full-funding limit was binding is questionable, because employers had considerable latitude over actuarial assumptions used to compute L^A. They could change the actuarial assumptions to be in compliance with the full-funding limits.

OBRA changed the measure of pension liabilities used to define the full-funding limits. It stipulated that the limits be based on **current liabilities**. Current liabilities or termination liabilities are computed using the current years of service and wages of the workers. Current liabilities is the amount that the firm would owe to the participants (i.e., workers and retirees) if it terminated the pension plan in the current year. Current liabilities never exceed accrued liabilities, because current liabilities do not take into account the future growth of wages of the workers. Employers could no longer change assumptions about future wage growth to comply with full-funding limits, since the full-funding limits were based on current liabilities.

OBRA stipulated that the sum of pension assets and contributions for year t could not exceed more than 150% of current liabilities (L_t^C). The new full-funding limit became:

$$C_t + A_t \leq 1.5(L_t^C) \tag{2.2}$$

If the **funding ratio** (i.e., ratio of pension assets to pension liabilities) exceeded 1.5, then the plan sponsor could not contribute on a tax-exempt basis to the pension fund until the funding ratio declined below 1.5. Without contributions, the funding ratios of pension plans decline over time, because pension benefits owed to workers increase with their seniority. The change in full-funding limits became effective on January 1, 1988.[12] After OBRA, sponsors were allowed to make nondeductible contributions to pension funds with funding ratios over 1.5. OBRA did not change at all the

[12]Because OBRA changed a restriction on the stock of pension assets (i.e., full-funding limit), firms with plans overfunded by 150% or more could not easily take actions in anticipation of the law change. They could not easily take assets out of overfunded pension funds to avoid the loss of deduction for contributions imposed by OBRA.

provisions concerning tax-free buildup within pension funds, such that returns on the nondeductible contributions remained exempt from corporate taxes.

2.3 Model of Corporate Pension Contribution

The regulations on the minimum and maximum contributions do not dictate the precise amount of contributions. Employers have latitude over the exact amount of pension contributions. In this section, we discuss how tax concerns might affect their decisions about the amount of contributions.

2.3.1 Description of the Model

A simple model to explore the effect of the favorable tax treatment on employers' pension contributions follows. Consider a firm that has a DB pension plan for its workers. In order to fulfill the pension obligation, the firm must contribute adequately to the pension fund such that pension assets equal or exceed the amount of pension benefits when the workers retire.[13] Consider how much the firm must contribute, if there were no corporate taxes at all. Suppose the firm wants to make a contribution in period t such that it can pay workers their pension benefits at retirement in period T. Let i represent the nominal interest rate; assume it remains constant over time. The firm would then contribute:

$$C_t = \frac{B_T}{(1+i)^N}, \tag{2.3}$$

where C_t denotes the contribution in period t and B_T denotes benefits owed at period T. The variable $N = (T - t)$ and represents the number of years until workers retire. If there were no corporate taxes, the cost to the firm of providing B_T equals C_t.

The favorable tax treatment of pension plans lowers the cost of pensions in two ways. First, the deduction of employer pension contributions from taxable income

[13]The following discussion is a summary of Section 1 in Feldstein and Seligman (1981) and uses the same notation.

saves employers τC_t in taxes, where τ denotes the marginal corporate tax rate. The deduction reduces the real cost of providing pension benefits (C_t^*) from C_t to $(1-\tau)C_t$:

$$C_t^* = (1-\tau)C_t. \tag{2.4}$$

OBRA did not change the real cost for sponsors of plans with funding ratios lower than 1.5. It raised the real cost for sponsors of plans with funding ratios greater than 1.5:

$$C_t^* = (1-\tau)C_t \quad \text{if } C_t + A_t \leq (1.5)B_T$$
$$C_t^* = C_t \quad \text{if } C_t + A_t > (1.5)B_T.$$

The increase in the real cost for sponsors of plans with funding ratios greater than 1.5 may have induced them to cut back on their contributions. They could postpone contributing until the funding ratio was below 1.5 at which point contributions are deductible.[14]

Pension plans receive a second form of favorable tax treatment. The firm earns the before-tax rate of return i instead of $(1-\tau)i$. The benefit from this favorable tax treatment can be substantial. A Treasury Department study found that the tax benefit can be as high as 42%. In other words, $1 in pension benefits owed to workers costs the firm only $0.58. OBRA did not affect this form of favorable tax treatment. If most of the tax benefit firms gain from pension plans comes from the tax-free buildup and not the deduction for contributions, then firms subject to OBRA may have continued to make contributions to overfunded pension plans although they were not deductible.

The model above has considered one-time contributions to pay for pension benefits. In reality, most firms make quarterly or annual contributions. Firms use actuarial cost methods to determine the exact amount of the contributions. The common actuarial cost methods are: (1) unit credit, (2) entry age normal, (3) frozen initial

[14]The model does not take into account any tax advantages workers may gain from DB plans. If workers desire tax shelters, then they would have preferred that employers start up supplemental DC plans rather than make nondeductible contributions to overfunded DB plans. DC plans typically allow workers to make before-tax contributions, providing explicit tax shelters for the workers.

liability, (4) attained age normal, and (5) aggregate method. The list is in increasing order of the buildup speed of pension assets.[15] The unit credit method produces a slow buildup of pension assets. Contributions under a unit credit method become larger as the workers near retirement. Because it results in pensions funds which are not well-funded in the early years, the unit credit method is the **least conservative method** among those listed. In contrast, the aggregate method leads to a fast buildup of pension assets and is the **most conservative method** among those listed.

2.3.2 Implications for Estimation

The magnitude of firms' loss of tax benefit due to OBRA depended on several factors. Obviously, one factor is the funding ratio. Sponsors of plans with funding ratios of 1.5 or more lost more of their tax benefit than sponsors of plans with lower funding ratios. The former group lost the deduction for contributions due to OBRA.

Among those who lost the deduction, firms' adjustments in response to OBRA affected the magnitude of their loss of tax benefit. One adjustment involves changes in actuarial cost methods. Firms who used more conservative cost methods such as the aggregate method benefit lost more of their tax benefit than firms who used less conservative methods, all else equal. Specifically, firms who sponsored pension plans for primarily young workers and used conservative methods were making large contributions. The loss of deduction for contributions increased the real cost of pension benefits for such firms more than for firms that used less conservative methods.[16] Firms that were making large contributions under a conservative cost method may have switched to a less conservative cost method. This change may have allowed them to make smaller but deductible contributions.

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[15]For a description of how these methods differ in the computation of contributions, see: Applebaum (1992) and Winklevoss (1977).

[16]Firms that make large contributions when the workers are young receive the most tax benefit for another reason. They enjoy tax-free buildup within the pension funds longer than firms that make large contributions when the workers are older. Several officials at the Department of Labor and pension consultants have related to me anecdotal evidence that plans with younger workers were particularly hurt by OBRA.

Sponsors affected by OBRA also had an incentive to change actuarial assumptions used to compute pension liabilities.[17] Firms can change their pension liabilities by altering the assumed interest rate or retirement age. Sponsors of plans that were subject to the loss of deduction had an incentive to increase their pension liabilities by lowering the assumed interest rate or raising the assumed retirement age. These changes would raise the computed pension liabilities, possibly lowering the overfunding below 150% and allowing the firms to make deductible contributions.

The affected firms could also have started defined contribution (DC) pension plans in response to OBRA. Firms could have made before-tax contributions to DC plans to make up for the loss of deduction for contributions to the overfunded DB plans.[18]

In summary, the magnitude of the loss of tax benefits varied across firms according to the funding ratio of the DB plans and a set of adjustments they may have made to offset the effect of OBRA. Section 2.5 presents results on the three forms of adjustment to OBRA: (1) changing actuarial cost methods, (2) altering assumptions used to calculate pension liabilities, and (3) starting new DC plans.

2.4 Data

Data come from the Internal Revenue Service Form 5500 computer tapes for 1987 and 1988. Employers must file Form 5500 annually for every pension plan with 100 or more participants that they sponsor. Employers must file a similar form (Form 5500C) every three years for plans with fewer than 100 participants. Analysis has been limited to larger plans in the Form 5500 dataset. Form 5500 requires the reporting of various financial information about the plans as well as about the sponsoring firms. It contains employer identification numbers (EINs) and plan numbers (PNs), which

[17]Pension benefits owed to workers depend on the turnover rates, workers' age of retirement, mortality rates, wage growth, and seniority at retirement. None of these factors are known with certainty. In addition, the rates of return firms may earn on pension assets in the future are also not known with certainty. Consequently, firms must make assumptions about the values of these factors.

[18]OBRA may have affected pensions in another dimension: plan termination. Possibly, OBRA may have led some sponsors of overfunded pension plans to terminate their overfunded DB plans and revert the excess assets back to the firms. Section 2.5.2 discusses this further.

allow constructing a panel sample of DB plans. Information on employer contribution, investment in different instruments, and earnings from investment are also available. Employers must report the value of pension assets, and the present value of pension liabilities for nonvested, partially vested, and fully vested workers. Sponsors must report the interest rate and retirement age assumed to calculate the liabilities on Schedule B. Such information makes possible the computation of funding ratios.

A caveat about this dataset is the ambiguity between missing and zero values. Sponsors may leave items blank when they intend to report that the items equal zero. A user of the dataset therefore cannot distinguish with certainty a reported missing value from a reported zero value. I have imputed zeros for missing values of the following variables unless doing so proved illogical: (1) employer contributions as reported on Form 5500[19] and (2) the number of fully vested, partially vested, nonvested, and retired participants. I have deleted observations for which employer contributions were negative and imputed missing values with zeros.[20] Assuming that the total number of participants must be greater than zero, I deleted observations for which the reported number of fully vested, partially vested, nonvested, and retired participants equals zero. If a sponsor reported missing value only for some of the categories of participants (e.g., missing value for the number of nonvested participants but positive value for the number of fully vested participants), then I imputed the missing values with zeros to compute the total number of participants.

I have also deleted observations with missing values for assets or liabilities rather than imputing them with zeros. An official at the Department of Labor noted that sponsors frequently attach documents that list the assets and liabilties.[21] These sponsors leave the items for assets and liabilities on Form 5500 and Schedule B blank,

[19]I used the contributions reported on Form 5500 rather than Schedule B. Items on Form 5500 are more accurate, because the IRS edits obvious errors on Form 5500.

[20]Contributions cannot logically be negative; however, sponsors who engaged in asset reversions from overfunded pension plans may have entered negative values for contributions. An official at the Department of Labor stated that there are no guidelines for filling in the contribution item on the Form 5500 if the sponsor engaged in asset reversion. He noted that such sponsors may have reported negative values. In my dataset, only 16 out of 14,024 observations reported negative contributions.

[21]I would like to thank Dan Beller for describing the various idiosyncracies of Form 5500 and Schedule B data.

though the true assets and liabilities are positive. The information on attached documents is not keyed into the Form 5500 and Schedule B computer tapes. Consequently, I chose not to impute missing values for assets and liabilities with zeros. Since I cannot compute the funding ratio for observations with missing values of assets or liabilities, I decided to delete them.

The discussion of this paper will focus only on single-employer DB plans.[22] While multiemployer DB plans were also subject to the tax change in OBRA, sponsors of multiemployer plans face nonfinancial constraints that may influence their pension decisions. In particular, almost all multiemployer plans are union plans that are subject to bargaining. Since union contracts typically last for several years, sponsors of multiemployer plans that were overfunded may be unable to reduce contributions in response to OBRA until the contracts are renegotiated.

In summary, the sample consists of single-employer plans that reported nonmissing values for pension assets and liabilities in 1987 and 1988. The sample contains approximately 14,024 observations. As a starting point, we should examine how many pension plans in the dataset were subject to the law change. We need to compute how many pension plans were overfunded by 150% or more in 1987. To determine whether a plan was overfunded by 150% or more in 1987 requires adjusting for differences in assumed interest rates used to calculate the liabilities. Appendix A describes the procedure used to do this; it is similar to the procedure prescribed by the IRS and used by the PBGC.

Adjusting for differences in assumed interest rates, tabulations indicate that only 28% of single-employer plans were overfunded by 150% or more in 1987 and subject to the law change. This figure is much lower than figures cited in past studies. A study by the Treasury Department estimated that approximately 59% of plans were subject to the law change (*Department of the Treasury* 4). This estimate was based on data from COMPUSTAT, which contains less accurate financial information about pension funds than Form 5500. Using Form 5500 and Schedule B data, Papke (1992)

[22] A single-employer DB plan covers participants associated with one employer. In contrast, multiemployer plans typically cover participants in a union unit who work for more than one employer.

estimates that approximately 71% of single-employer plans were overfunded by 150% or more in 1987. One explanation may be the treatment of missing values of pension assets and liabilities.[23]

2.5 Results

This section presents aggregate and microdata evidence on the effects of the Omnibus Budget Reconciliation Act of 1987 (OBRA). It examines whether sponsors of plans with funding ratios of 1.5 or more reduced pension contributions after the passage of this law. It also examines whether these sponsors made adjustments other than reducing contributions in response to the loss of deduction for contributions.

2.5.1 Aggregate Evidence

If OBRA compelled many sponsors to cut back on contributions to overfunded pension plans, then one would expect a decline in total contributions to defined benefit (DB) plans after 1987. The following table presents employer contribution to DB plans during 1980–89. It shows that contributions declined after 1987.[24] Between 1987 and 1988, contributions declined by about $3.5 billion. This decline is not so surprising once we note that there has been a downward trend in contributions since 1984. As a percentage of personal saving, contributions fell from 8.8% to 6.9% between 1987–88. Again, there has been a downward trend in contributions as a percentage of personal saving since the mid-1980s. The decline in these aggregate figures between 1987–88

[23]When I imputed missing values of assets and liabilities with zeros and assumed that a plan is overfunded if the assets equal or exceed 150% of the liabilities, then I found that 69% of the plans were overfunded by 150% or more in 1987. Although this figure closely matches figures from past studies, it is incorrect. If assets and liabilities both equal 0, then assets certainly equal 150% of the liabilities since both equal 0; however, the plan cannot be considered overfunded. When I assumed that a plan was not overfunded when both assets and liabilities equal 0, I found that only 37% of plans were overfunded by 150% or more in 1987. As mentioned above, funding ratios of plans with missing assets and liabilities cannot be reliably computed since the sponsors may have reported the true assets and liabiilties in attachments to Form 5500 and Schedule B.

[24]The personal saving figures are flow of funds figures and not national income accounts (NIPA) figures. NIPA figures excludes pensions, net investment in consumer durables. etc. Bosworth et al. (1991) discuss the various measures of personal saving.

may not due to OBRA at all but to other factors that have caused the downward trend since that mid-1980s.

Employer Contributions to Defined Benefit Plans

Year	Contributions (billions)	Personal Saving (billions)	Percentage of Personal Saving
1980	$42.6	$213.9	19.9%
1981	47.0	239.0	19.7
1982	48.4	262.8	18.4
1983	46.3	312.5	14.8
1984	47.2	384.4	12.3
1985	42.0	361.1	11.6
1986	33.2	438.2	7.6
1987	29.8	339.4	8.8
1988	26.3	381.0	6.9
1989	21.0	456.5	4.6

Source: *Trends in Pensions 1992*, *Flow of Funds*, unpublished tabulations by the Department of Labor.

The fall in total contributions between 1987 and 1988 may be due to a decrease in the total number of DB plans and/or the per-plan contributions. The following table shows the number of DB plans and the mean contribution during 1980–1988.

Number of Single-Employer Defined Benefit Plans and Mean Contribution by Size of Plan

Year	Fewer Than 100 Participants		100 or More Participants	
	Number (thousands)	Mean Contribution (millions)	Number (thousands)	Mean Contribution (millions)
1980	123.3	$47.3	22.4	$1,325.6
1981	142.2	49.8	22.9	1,402.1
1982	149.4	51.1	23.3	1,423.4
1983	149.0	50.6	23.9	1,302.9
1984	142.7	54.6	23.0	1,356.7
1985	145.3	50.5	22.6	1,170.6
1986	148.0	37.9	22.4	872.1
1987	139.5	30.4	21.4	829.6
1988	123.0	24.2	20.9	735.5

Source: *Trends in Pensions 1992.*

Since the paper focuses on large single-employer plans, the table above shows the number of plans and the mean contribution separately for plans with fewer than 100 participants and for those with 100 or more participants. The table above shows that the number of DB plans has steadily fallen during 1980–88. The table also shows that mean contributions has been declining since 1985. The downward trends in the number of DB plans and in mean contribution started prior to OBRA, such that the effect of OBRA is not apparent from the table above.

If OBRA compelled employers to reduce their contributions to overfunded DB plans, then the foregone tax revenue (**tax expenditure**) due to the deduction for pension contributions should have declined after 1987. The IRS does not provide information on tax expenditure due to the deduction for pension contributions. Instead, they tabulate the total tax expenditure due to the deduction of pension contributions and the tax-free buildup within pension funds. The next table lists the total tax expenditure due to employer pension plans.

Tax Expenditure for Employer Pension Plans

Year	Tax Expenditure (billions)
1982	$45.3
1983	46.6
1984	44.1
1985	48.5
1986	49.0
1987	45.3
1988	44.2
1989	42.8

Source: *Statistical Abstract* for 1982–1991.

The table shows that the tax expenditure did decline after 1987. Between 1987–1988, tax expenditure fell by approximately $1.2 million. This is weak evidence of an effect of OBRA on contributions, since there has been a downward trend in the tax expenditure prior to OBRA; the tax expenditure has been falling since 1986.

2.5.2 Plan-Level Evidence

As mentioned in Section 2.3, OBRA could have induced sponsors of overfunded pension plans to reduce contributions. It could also have induced the sponsors of overfunded pension plans to make the following types of adjustment: (1) changing the actuarial cost methods, (2) altering assumptions used to calculate pension liabilities, and (3) starting DC plans. This section examines plan-level evidence of the effects of OBRA.

Effect of OBRA on Contributions

To determine how much of the decline, if any, in contributions after 1987 was due to the law change in OBRA we need to examine plan-level evidence. If the law change in OBRA compelled sponsors of plans overfunded by 150% or more to reduce their contributions, then one would expect a drop in the mean contribution among these plans but not among plans that were not subject to the law change.

We can test this hypothesis within a regression framework. Consider the following regression equation where the dependent variable is the amount of employer contribution to plan i called C_i:[25]

$$C_i = \beta_0 + \beta_1(\text{IFOVFF}_i) + \beta_2(\text{IF88}_i) + \beta_3(\text{IFOVFF}_i)(\text{IF88}_i) + u_i. \qquad (2.5)$$

The explanatory variable IFOVFF_i is a (0,1) dummy variable for whether plan i is overfunded by 150% or more and therefore subject to the law change in OBRA.[26] IF88_i is also a dummy variable; it equals 0 if the contribution was made in 1987 and 1 if it was made in 1988. The interaction term $(\text{IFOVFF}_i)(\text{IF88}_i)$ equals 1 if both IFOVFF_i=1 and IF88_i=1 and 0 otherwise. The hypothesis is that the coefficient

[25] As mentioned before, I imputed missing values of employer contributions with zeros. To test whether the imputation affects the results, I estimated regressions on a sample with contributions that were reported to be greater than 0. The results do not differ substantially from those described in this section.

[26] I tried other measures of overfunding. I included the funding ratio of plans, a continuous variable. I also tried splines for the funding ratio of plans. Results from equations that included these measures of the funding ratio do not differ much from those presented.

for the interaction term is negative, or $\beta_3 < 0$. In other words, we expect lower contributions to overfunded pension plans that were subject to OBRA in 1988, all else equal.

Table 1 shows the results for this regression. It shows that the estimated coefficient for the interaction term is negative (-252.99) but not statistically different from zero. The tabulation below translates the results for the first equation in Table 1 in terms of means, which may be more meaningful. It shows the mean per-plan contributions for two groups of DB pension plans: plans with funding ratios of 1.5 or more and plans with funding ratios lower than 1.5.[27]

Mean Per-Plan Contribution: By Year and Funding Ratio

Funding Ratio	1987 (thousands)	1988 (thousands)	Between 1987–1988 (thousands)
1.5 or more	\$225.67 (355.59) [1,819]	\$115.35 (595.75) [2,681]	-\$110.32 (693.80)
Less than 1.5	812.75 (166.42) [6,928]	955.42 (286.88) [6,969]	142.67 (331.66)
Difference-in-Difference			-252.99 (769.00)

Standard errors are in parentheses. The number of observations is in brackets and is not in thousands. The sample size for the pooled 1987–88 data above is 13,970.

The table indicates that the mean contribution for plans with funding ratios of 1.5 or more declined by \$110,320 between 1987 and 1988. The mean contributions for plans with funding ratios less than 1.5 increased by \$142,670 between 1987 and 1988. The difference-in-difference estimate shows that overfunded pension plans that were subject to the law change in OBRA reduced their contributions by \$253,000 more than plans that were not subject to the law change. This is evidence that the elimination of the deduction for contributions to plans with funding ratios of 1.5 or more may have induced sponsors of such plans to reduce their contributions; however, the evidence is weak since none of the figures in the table above are statistically significant at the

[27]The funding ratio equals the ratio of the assets to the liabilities of a plan.

conventional levels.[28]

A different dependent variable that may provide more meaningful result is the amount of contributions scaled to the size of the plans. The number of participants is one measure of the size of the plans.[29] The coefficient for the interaction terms is again negative but not statistically significant.[30] The next table presents the regression results in terms of mean per-participant contributions.

Mean Per-Participant Contribution: By Year and Funding Ratio

Funding Ratio	1987	1988	Between 1987–1988
1.5 or more	$547.05 (351.94) [1,770]	$211.86 (589.99) [2,594]	-$335.19 (686.99)
Less than 1.5	1,191.69** (164.43) [4,569]	931.31** (283.63) [4,684]	-260.38 (327.84)
Difference-in-Difference			-74.81 (761.21)

Standard errors are in parentheses. The number of observations is in brackets.
The sample size for the pooled 1987–88 data above is 13,617.

The table above leads to the same conclusion as the results on the mean per-plan contribution. The mean per-participant contribution to plans with funding ratios of 1.5 or more declined by $74.81 more than to plans with lower funding ratios; however, this difference-in-difference estimate is not statistically significant at the conventional levels. Thus, the evidence is weak that the OBRA induced a reduction

[28]To test whether the lack of precision is due to outliers, I estimated median regressions. The constant is fitted to the median of the dependent variable in median regressions; whereas, it is fitted to the mean in OLS equations. The results show that the median contributions to plans with funding ratios of 1.5 or more fell by $22,354 more than those to plans with lower funding ratios; however, the estimates are not statistically significant.

[29]Using the number of participants may introduce an endogeneity bias. The firms cannot perfectly control the number of participants, because regulations mandate coverage of most employees of firms. Nonetheless, profitable firms are more likely to hire workers and make larger per-participant contributions such that they can control the number of participants and the amount of pension contributions.

[30]I have also tried scaling the contributions by plan liabilities. The interaction term is negative but not statistically significant. Plan liabilities are more suitable for scaling than plan assets, since they are less of a control variable for firms. Firms have less control over pension liabilities, which would reflect preferences of workers, than over pension assets.

in contributions among plans with funding ratios of 1.5 or more.

So far, we have not considered the effect of factors other than the law change. The last two equations in Table 1 include the following plan and firm characteristics: (1) the age of the plan, (2) the fraction of young participants, (3) number of total participants, and (4) dummy variables for industries,[31], and dummy variables for actuarial methods.[32] I computed the fraction of young participants as the fraction of total participants who are nonvested or partially vested. All equations include dummy variables for whether the plan was overfunded (IFOVFF) and whether the contribution was made after 1987 (IF88). They also include a term that interact these two dummy variables (IFOVFF)(IF88).

The dependent variable in the third equation is the amount of contribution; whereas, the dependent variable in the last equation is the amount of per-participant contribution. The sample consists of DB pension plans that filed IRS Form 5500 in 1987 and those that filed in 1988. Table 1 shows that the coefficients of the interaction term are negative but not statistically significant in all four equations.

A simple explanation for the results above is that firms that were overfunded by 150% or more in 1987 reduced their contributions in 1988 to reduce the amount of the overfunding, independent of OBRA. In other words, firms' contributions over time resemble mean reversion, with sponsors adjusting their contributions to maintain a pension plan that is roughly near 100% funding. Tables 2 and 3 explore this issue of mean reversion. Table 2 presents estimates from first-difference equations, where the dependent variable is the first-difference of employer contributions. The sample for the first equation consists of plans that filed Form 5500 both in 1986 and 1987. Similarly, the sample for the second equation includes plans that filed Form 5500 both in 1987 and 1988.

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[31]The industries are: (1) agriculture, forestry, and fishing, (2) mining, (3) construction, (4) manufacturing, (5) transportation, communication, utilities, (6) wholesale trade, (7) retail trade, (8) finance, insurance, and real estate, (9) services, and (10) tax-exempt organizations. The base industry in the equations was manufacturing.

[32]The actuarial methods are as follows: (1) unit credit, (2) entry age normal, (3) frozen initial liability, (4) attained age normal, and (5) aggregate method. The base case in the equations was aggregate method.

The results for the first equation indicate that sponsors of plans that were overfunded by 150% or more reduced their contributions between 1986 and 1987 by $241,900 more than sponsors of plans that were not so overfunded. This estimate is statistically significant at the 10% level. The results for the second equation indicate that sponsors of plans that were overfunded by 150% or more reduced their contributions between 1987 and 1988 be $87,650 more than sponsors of plans that were not so overfunded. This result is not statistically significant. That sponsors of plans with funding ratios of 1.5 or more reduced their contributions for 1986–87 and 1987–88 suggests a pattern of mean reversion. More importantly, sponsors of plans with funding ratios above 1.5 reduced their contributions more between 1986–87 than during 1987–88. The estimated coefficients for the last equation in Table 2 support this conclusion.

For the last equation, I pooled the observations for the first and second equations. If OBRA induced sponsors of overfunded pension plans to reduce contributions, then we would expect sponsors of overfunded pension plans to have reduced their contributions more between 1987–88 than between 1986–87. In other words, we expect a negative coefficient for the interaction term (IFOVFF)(IF88). Table 2 shows that the sponsors of plans that were overfunded by 150% or more increased their contributions by $125,660 more between 1987–88 than between 1986–87. This estimate is not statistically significant at the conventional levels.

I also estimated regression with the first-difference in per-participant contribution as the dependent variable. Table 3 presents the results from these equations. It also shows mean reversion in per-participant contributions; sponsors of plans overfunded by 150% or more reduced their per-participant contributions in the following year. Furthermore, they reduced their per-participant contributions more between 1986–87 than between 1987–88. The estimated coefficient for the interaction term (IFOVFF)(IF88) is positive, refuting the hypothesis that OBRA induced sponsors to reduce per-participant contributions to overfunded plans.

Discussion

The insignificance of the the interaction term suggests that OBRA had little, if any, effect on contributions to plans with funding ratios of 1.5 or more. Three explanations for this result are worth discussing. One explanation is that the results may not be robust. Results from equations other than those in Table 1 suggest otherwise. For example, the equations in Table 1 do not control for the actuarial cost methods the firms used. The discussion in Section 2.3 pointed out that the loss of tax benefit from OBRA differed according to the actuarial cost method used by the firms. Equations that include actuarial cost methods show that sponsors of plans with funding ratios of 1.5 or more did not reduce their contributions more than sponsors of plans with lower funding ratios.[33] Equations that include interaction terms of actuarial methods and the fraction of young workers produced the same result. I also estimated equations that include interaction terms of the fraction of young workers and the post-88 dummy. The results indicate that plans that were subject to OBRA did not reduce contributions any more than plans that were not subject to OBRA. Heteroscedasticity-robust equations (i.e., FGLS) also indicate that sponsors of plans that were subject to OBRA did not reduce contributions more than sponsors of plans that were not subject to OBRA.

A second explanation is that tax factors other than OBRA may have induced sponsors of overfunded plans to cut back on their contributions. The Tax Reform Act of 1986 (TRA) lowered corporate marginal tax rates. This reduced the value of the deduction for pension contributions and thereby raised the real cost of pension benefits (Section 2.3). The increase in the tax burden of asset reversions prior to OBRA may also explain the results. The TRA imposed a 10% excise tax, in addition to corporate taxes, on assets reverted to firms.[34] Since 1991, firms have faced a 50% excise tax on reverted assets. Since firms cannot take money out of overfunded

[33] Actuarial methods may be endogeneous. Firms choose actuarial methods, possibly to generate the amount of contributions they want to make. Thus, including actuarial methods in the equations may introduce an endogeneity bias.

[34] Since 1986, the number of reversions has declined dramatically, possibly because of the tax burden. See Alderson and VanDerhei (1992) for more details.

pension plans without incurring a large tax burden, the value of overfunding pension plans as a form of tax shelter may have declined. This would result in a decline in employer contributions to overfunded pension plans prior to OBRA, such that the law change in OBRA itself had little effect.

A third explanation is that OBRA did not substantially reduce the favorable tax treatment of pension plans. OBRA eliminated the deduction for contributions to overfunded pension plans but left intact the tax-free buildup within pension funds. If the tax benefit from the tax-free buildup far exceeds the tax benefit from the deduction, then sponsors of plans with funding ratios above 1.5 may have continued to contribute although the contributions were not deductible; they sought the tax benefit from the tax-free buildup of these contributions within the pension funds.

Other Effects of OBRA

The weak evidence of OBRA's effect on contribution may be due to other forms of adjustment by the pension plan sponsors. As mentioned in Section 2.3, plan sponsors have latitude over the actuarial cost methods and assumptions used to calculate pension liabilities. Sponsors of plans that were subject to OBRA have an incentive to switch from conservative actuarial methods to less conservative methods. Tabulations show that plans with funding ratios lower than 1.5 were just as likely to change actuarial methods as plans with funding ratios of 1.5 or more. Only 14 plans with funding ratios of 1.5 or more changed actuarial methods; this is 0.4% of all plans with funding ratios of 1.5 or more. Similarly, only 0.2% of plans with lower funding ratios changed actuarial methods. The data also indicate that sponsors were as likely to switch from less conservative actuarial methods to more conservative ones as vice versa. These results suggest that sponsors did not change actuarial methods to offset the effect of OBRA.

Sponsors of plans that were overfunded by 150% or more in 1987 could have lowered the interest rates or retirement ages assumed to compute pension liabilities. Such changes in assumptions would increase the amount of pension liabilities, possibly allowing the sponsors to continue making before-tax contributions. These changes

would offset partially the effects of OBRA. Results from IRS Form 5500 suggest that sponsors did not change interest rate or retirement age assumptions to offset the effects of OBRA.

The following table lists the mean assumed interest rate by funding ratio and year. It shows that the mean assumed interest rate increased for all plans. In fact, sponsors of plans with funding ratios of 1.5 or more increased their assumed interest rates more than sponsors of plans with lower funding ratios. Thus, they did not lower the assumed interest rates to offset the effects of OBRA.

Mean Assumed Interest Rate: By Year and Funding Ratio

Funding Ratio	1987 (thousands)	1988 (thousands)	Between 1987--1988 (thousands)
1.5 or more	7.83 (0.20)	8.66 (0.27)	0.83 (0.39)
Less than 1.5	8.09 (0.12)	8.91 (0.22)	0.82 (0.25)
Difference-in-Difference			0.01 (0.46)

Source: 1986–1988 IRS Form 5500. Standard errors are in parentheses.

Sponsors of overfunded plans also did not change their assumed retirement age in response to OBRA. To offset the effects of OBRA, these sponsors could have increased the assumed retirement age used to calculate pension liabilities. The following table indicates otherwise. The table lists the mean assumed retirement age by funding ratio and year. It shows that the mean assumed retirement age decreased among all plans. In fact, sponsors of plans with funding ratios of 1.5 or more reduced their assumed retirement age more than the sponsors of plans with lower funding ratios. Thus, they do not appear to have increased the assumed retirement age to offset the loss of deductibility of pension contributions under OBRA.

Mean Retirement Age: By Year and Funding Ratio

Funding Ratio	1987 (thousands)	1988 (thousands)	Between 1987–1988 (thousands)
1.5 or more	64.12	63.99	-0.13
	(0.05)	(0.05)	(0.07)
Less than 1.5	63.68	63.67	-0.01
	(0.03)	(0.05)	(0.06)
Difference-in-Difference			-0.12
			(0.09)

Source: 1986–1988 IRS Form 5500. Standard errors are in parentheses.

Sponsors of plans that were overfunded by 150% or more could have offset the effect of OBRA by starting up defined contribution (DC) pension plans. Table 4 presents results from a probit equation, where the dependent variable equals 1 if the sponsor of a DB plan started a DC plan in the current year and 0 otherwise. If OBRA imposed a binding constraint on sponsors of overfunded DB plans, then one would expect that they were more likely to start a DC plan. The sponsors could make deductible contributions to DC plans to make up for the loss of deduction for contributions to overfunded DB plans. In other words, we would expect a positive coefficient for the interaction term, (IFOVFF)(IF88). The estimated coefficient for the interaction term is positive but not statistically significant at the conventional levels.

Table 4 also indicates that sponsors of DB plans that were overfunded by 150% or more were less likely to start DC plans; the coefficient for (IFOVFF) is statistically significant at the 10% level. One explanation for this result may be that overfunded pension plans have a higher fraction of participants who are young workers.[35] Young workers are less likely to want supplemental DC plans,[36] which typically are funded partially or entirely with employee contributions. They are more likely to be liquidity

[35]The fraction of participants who are nonvested or partially vested is approximately 44% for plans with funding ratios of 1.5 or more. The fraction is only 35% for plans with lower funding ratios.

[36]Supplemental DC plans refer to DC plans that are established in addition to existing DB plans.

constrained and therefore less likely to want tax shelters in the form of supplemental DC plans.[37]

2.6 Conclusion

This paper has examined the effects of the change in full-funding limits as imposed by the Omnibus Budget Reconciliation Act of 1987 (OBRA). OBRA stipulated that contributions to defined benefit (DB) pension plans that were overfunded by 150% or more would not be deductible from corporate taxable income. OBRA left unchanged provisions concerning the tax-free buildup within pension funds. The deduction for contributions and the tax-free buildup are the two forms of favorable tax treatment given to employer-sponsored pension plans.

Results from the IRS Form 5500 dataset provide weak evidence that the elimination of the deduction for contributions to DB plans that were overfunded by 150% or more induced a reduction in contributions to the affected plans; however, the results are not statistically significant. Results do not indicate that sponsors of the affected plans changed actuarial cost methods, lowered the assumed interest rates, or raised the assumed retirement age. Such changes would allow the sponsors to inflate pension liabilities and thereby lower the overfunding to a level below the 150%. Results provide weak evidence that the sponsors of the affected plans may have started DC plans in response to OBRA; they could make deductible contributions to DC plans to make up for the loss of deduction of contributions to overfunded DB plans.

One explanation for the minor effect of OBRA on pension contributions is that the tax benefit from the tax-free buildup within pension funds may far exceed the tax benefit from the deduction for contributions. If this is the case, then sponsors of plans that were subject to OBRA would have made nondeductible contributions to overfunded pension plans to take advantage of the tax-free buildup. Firms' tax

[37]A simple test of this hypothesis is to include in the probit equation an interaction term of whether a plan is overfunded by 150% or more with the ratio of young workers. We expect the estimated coefficient for this interaction term to be negative. The estimated coefficient is negative but not statistically significant at the conventional levels.

benefit from the deduction versus from the tax-free buildup deserves further research. The results and analysis in this paper may help clarify the current policy debate about eliminating the deduction for employers' pension contributions.

Table 1. Determinants of Employer Pension Contributions

Explanatory Variables	Contribution (thousands)	Per-Participant Contribution	Contribution (thousands)	Per-Participant Contribution
Constant	812.75**	1,191.69**	102.80	1,462.73**
	(166.42)	(164.43)	(233.60)	(299.71)
IFOVFF: If overfunded by 150% or more	-587.08*	-644.64**	-211.99	-606.96*
	(314.24)	(311.17)	(246.77)	(316.60)
IF88: If after 1987	142.67	-260.38	36.71	-249.41
	(233.68)	(231.10)	(179.96)	(230.64)
(IFOVFF)x(IF88)	-252.99	-74.81	-186.91	-191.22
	(416.98)	(413.30)	(320.48)	(411.19)
Age of plan	—	—	-44.61**	7.02
			(6.63)	(8.45)
Ratio of young workers	—	—	-1,427.18**	-2,554.94**
			(343.86)	(441.10)
No. of Participants	—	—	1.93**	—
			(0.02)	
Industry dummies	No	No	Yes	Yes
Sample size	13,970	13,617	13,617	13,617
R^2	0.001	0.001	0.44	0.01

* Statistically significant at the 10% level.

** Statistically significant at the 5% level.

Standard errors are in parentheses. The coefficients and the standard errors for the first and third equations are in thousands of dollars. The sample consists of DB plans that filed IRS Form 5500 in 1987 and those that filed in 1988.

Table 2. Determinants of Change in Employer Pension Contributions

Explanatory Variables	1986–87 (thousands)	1987–88 (thousands)	Pooled 1986–88 (thousands)
Constant	275.61 (241.07)	-101.15 (261.07)	146.12 (197.94)
IFOVFF: If overfunded by 150% or more	-241.90* (193.69)	-87.65 (202.84)	-234.74* (207.85)
IF88: If after 1987	—	—	-111.43 (152.55)
(IFOVFF)x(IF88)	—	—	125.66 (271.27)
Age of plan	-19.43** (7.48)	-0.66 (8.25)	-10.03* (5.62)
Ratio of young workers	-301.63 (386.26)	-514.07 (430.90)	-408.67 (291.87)
No. of Participants	0.27** (0.01)	0.38** (0.02)	0.33** (0.02)
Industry dummies	Yes	Yes	Yes
Sample size	6,474	7,278	13,752
R^2	0.03	0.04	0.03

* Statistically significant at the 10% level.

** Statistically significant at the 5% level.

Standard errors are in parentheses. The coefficients and the standard errors for the first and third equations are in thousands of dollars. The sample for the first equation consists of DB plans that filed IRS Form 5500 both in 1986 and 1987. The sample for the second equation includes DB plans that filed both in 1987 and 1988. The sample for the last equation is the pooled sample of observations used for the first and second equations.

Table 3. Determinants of Change in Per-Participant Contributions

Explanatory Variables	1986–87	1987–88	Pooled 1986–88
Constant	872.74*	-424.30	566.43*
	(456.18)	(297.84)	(308.98)
IFOVFF: If overfunded by 150% or more	-582.25*	-460.40**	-626.89**
	(366.94)	(224.32)	(302.02)
IF88: If after 1987	—	—	-596.77**
			(246.89)
(IFOVFF)x(IF88)	—	—	181.13
			(431.80)
Age of plan	13.94	17.48*	15.23*
	(14.15)	(9.29)	(9.03)
Ratio of young workers	-2,617.63**	344.65	-1,369.83**
	(730.41)	(486.72)	(469.01)
Industry dummies	Yes	Yes	Yes
Sample size	6,454	4,862	11,316
R^2	0.01	0.005	0.007

* Statistically significant at the 10% level.

** Statistically significant at the 5% level.

Standard errors are in parentheses. The coefficients and the standard errors for the first and third equations are in thousands of dollars. The sample for the first equation consists of DB plans that filed IRS Form 5500 both in 1986 and 1987. The sample for the second equation includes DB plans that filed both in 1987 and 1988. The sample for the last equation is the pooled sample of observations used for the first and second equations.

Table 4. Determinants of Starting Defined Contribution Plans

Explanatory Variables	Coefficients
Constant	-0.96** (0.04)
IFOVFF: If overfunded by 150% or more	-0.09* (0.05)
IF88: If after 1987	0.07** (0.03)
(IFOVFF)x(IF88)	0.02 (0.07)
If single-employer plan	0.02 (0.03)
Age of plan	0.001 (0.001)
Ratio of young workers	-0.21** (0.07)
No. of participants	5.9×10^{-6}** (2.9×10^{-6})
Industry dummies	Yes
Sample size	13,617
-Log likelihood	4885.03

* Statistically significant at the 10% level.
** Statistically significant at the 5% level.

The dependent variable is a binary variable that equals 1 if the sponsor of an existing defined benefit (DB) plan started a defined contribution (DC) plan in the current year and 0 otherwise. Standard errors are in parentheses. The sample consists of DB plans that filed IRS Form 5500 in 1987 and those filed Form 5500 in 1988.

Appendix A. Adjusting for Assumed Interest Rate[38]

Sponsors of defined benefit (DB) plans have latitude over the interest rates they assume to compute pension liabilities. The differences in assumed interest rates are of concern, because past studies suggest a relationship between firm profitability and the assumed interest rate. Less profitable firms tend to assume interest rates that are above the mean assumed interest rate.[39] Consequently, an adjustment for differences in assumed interest rates is necessary to obtain more accurate liability figures than those reported.

The following interest rate adjustment is the one prescribed by the Internal Revenue Service (IRS) and used by the Pension Benefit Guaranty Corporation (PBGC) to value liabilities of DB plans.[40] The baseline interest rate for the adjustment is the PBGC interest rate. The table below lists the end-of-the-year PBGC interest rates for 1986–88.

PBGC Interest Rates

Year	Interest Rate
1986	7.5%
1987	8.0
1988	8.0

Source: *Trends in Pensions* (1990), p. 381.

Some notation is in order. **Liabilities** refer to the present value of liabilities. We are interested in the total adjusted liabilities (L^*) which is the sum of the adjusted liabilities owed to retirees and beneficiaries (LB^*) and adjusted liabilities owed to

[38]I would like to thank Joseph Applebaum, the Chief Actuary at the Pension and Welfare Benefits Administration of the Department of Labor for patiently explaining the various actuarial rules of thumb described below.

[39]Thies and Sturrock (1988), Bodie et al. (1985), and Feldstein and Mørck (1983).

[40]The PBGC is the federal agency that administers the federal insurance of DB pension plans in the event of plan insolvency. A description of the interest rate adjustment is in §2610.23 CFR Ch. XXVI (*Code of Federal Regulations*). Previous studies have used this procedure. See: Papke (1992) and Applebaum (1992).

active participants (LA^*):

$$L^* = LB^* + LA^*. \tag{2.6}$$

I have used an actuarial rule of thumb to compute LB^*. A one-percentage change in the interest rate used to value liabilities owed to retirees and beneficiaries changes the total liability by about 6%, such that:

$$LB^* = LB(0.94^A), \tag{2.7}$$

where LB denotes the reported liabilities owed to retirees and beneficiaries. A denotes the difference between the PBGC interest rates ($PBGCI$) and the interest rate the plan sponsor used to value post-retirement liabilities ($POSTI$):

$$A = PBGCI - POSTI. \tag{2.8}$$

The adjusted liabilities owed to non-retired participants (LA^*) consist of those owed to nonvested participants (LN^*) and those owed to partially and fully vested participants (LV^*):

$$LA^* = LN^* + LV^*. \tag{2.9}$$

I used another actuarial rule of thumb in the computation of these adjusted liabilities from reported figures. Approximately 80% of the normal cost of a plan (NC) is due to the accrual of new benefits for non-retired participants, such that:

$$LA^* = [LN + LV + (0.8 \times NC)](0.94)^A \times B, \tag{2.10}$$

where

$$B = \left[\frac{100 + PREI}{100 + PBGCI}\right]^{R-50}. \tag{2.11}$$

$PREI$ is the interest rate the plan sponsor assumed to value pre-retirement liabilities. R is the assumed retirement age. The PBGC uses age 50 to adjust for differences in assumed retirement age. This age adjustment is based on an actuarial rule of thumb; the liability-weighted average age of a population of plan participants is about 50.

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Chapter 3

Moral Hazard Problems Associated with Federal Insurance of Pension Plans*

3.1 Introduction

The savings and loan (S&L) bailout has made painfully clear the heavy cost of the underwriting role of the federal government. Since 1988, the bailout has cost taxpayers over $200 billion. Another example of the high cost of federal underwriting is the growing deficit of the federal pension insurance program. At the end of 1992, the federal pension insurance program faced an accumulated deficit of $2.7 billion. Several have compared the crisis of the federal pension insurance program to that of FSLIC.[1] As in the case of FSLIC, moral hazard problems are thought to threaten the financial solvency of the pension insurance program.

This paper review past studies about moral hazard problems associated with federal pension insurance. It also outlines a framework within which to examine moral

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[1]For example, ABC Nightline (21 December 1992), Abken (1992), Bodie (1992), Donlan (1991), Schmitt and Falk (1993), and Stock (1992).

hazard problems. The paper proceeds as follows. Section 3.2 provides background information about the federal insurance of pensions, as administered by the Pension Benefit Guaranty Corporation (PBGC). The paper includes evidence from a new dataset called the PBGC Termination Case File. Section 3.3 describes the dataset in detail. Section 3.4 examines specific moral hazard problems that the media, policy-makers, and economists have mentioned and analyzed. Section 3.5 concludes with a discussion of policy implications.

3.2 Background

The Pension Benefit Guaranty Corporation (PBGC) insures only defined benefit (DB) pension plans;[2] therefore, a brief description of DB plans is in order. Employers who sponsor DB plans promise to pay their workers pension benefits when they retire. The pension benefits are usually computed as a fraction of final pay or career-average pay and years of service. The legal obligation of the employers to the workers, or their legal pension liability, is the amount of accrued benefits. Accrued benefits refer to pension benefits that workers are entitled to receive at retirement based on current pay and current years of service. Employers must set aside enough funds to ensure payment of accrued benefits to the workers at retirement.

Workers may receive less than the accrued benefits or none at all if the firms go out of business or terminate pension plans without having set aside enough funds. Typically, a termination occurs when an employer announces to the workers that their pension benefits will stop accruing as of a certain date. Note that if the firms had set aside enough funds, then the workers would receive their accrued benefits even if the firms failed or terminated the pension plans. The threat to workers' pension benefits arises from underfunded pension plans. **Underfunded** pension plans are those with liabilities that exceed assets.

A primary motive for Congressional intervention in DB pension plans was and

[2]The PBGC does not insure defined contribution (DC) pension plans. Under a DC plan, the employer and/or the employees contribute to individual accounts for the employees. The workers' pension benefits equal the value of the assets in the accounts.

remains workers' not receiving accrued pension benefits due to firm failure in conjunction with underfunding of pension plans. They have enacted numerous regulations to limit workers' loss of pension benefits since 1974. A description of the legislation follows. Before 1974, firms that sponsored DB pension plans faced few regulations. The purpose of these regulations, enforced by the Internal Revenue Service (IRS), was to minimize tax expenditure; thus, they were not designed to ensure sufficient funding or sound management of pension plans.

In 1974, Congress passed the Employee Retirement Income Security Act (ERISA). This legislation marked the start of intense government intervention in the administration of DB plans. It required employers to notify workers and government agencies of significant events concerning the DB plans such as plan amendments or intent to terminate the plans. Employers were also required to report periodically financial information about the pension funds. All information reported to the government agencies have been publicly available. ERISA also imposed regulations on funding and investment practices. It described legally acceptable levels of minimum annual employer contributions to DB plans. It also prohibited certain investment transactions. For example, it limited investment in an employer's securities to 10%.

Besides imposing more stringent regulations, ERISA established the PBGC to administer the federal insurance of DB pension plans. The PBGC insurance has protected workers from complete loss of pension benefits in case of insufficient terminations. **Insufficient terminations** refer to the termination of underfunded pension plans either due to firm failure.[3] The PBGC guarantees workers' pension benefits up to a limit. As of 1992, the maximum guaranteed limit was $2,352 in monthly pension benefits. The common belief is that this limit is not binding for most workers. On the other hand, an article in the *New York Times* about a strike at Caterpillar suggests that it may be binding for some union workers. One of the union's demands was that

[3]Since 1986, firms could file for insufficient terminations only if they and their controlled group were undergoing bankruptcy or insolvency proceedings. The requirement of verifiable financial distress did not exist prior to 1986. Before 1986, financially healthy firms were allowed to terminate underfunded pensions plans so long as they were willing to transfer a maximum of 30% of corporate net worth to the PBGC for the amount of the underfunding.

the average pension benefits be raised to $2,000 a month (Hicks).

The PBGC insures both single-employer and multiemployer DB plans.[4] The insurance program for multiemployer plans does not face financial difficulties, primarily because the level of insurance coverage is low.[5] This paper concentrates on the insurance of single-employer plans. The following description of the PBGC pertains to the single-employer pension insurance program.

The PBGC is a self-financing government corporation. In other words, it does not receive any tax money from the federal government for its operations. It raises revenue by collecting annual premiums from firms that sponsor the insured pension plans.[6] The current premium structure is a kinked schedule. All private sponsors must pay the same flat fee. Sponsors of underfunded pension plans must pay, in addition to the flat fee, a variable premium that is related to the amount of the underfunding. This variable premium is capped such that the marginal premium cost of additional underfunding is zero after a certain point. Since 1990, the flat premium has been $19. The variable premium has been $9 per $1,000 of unfunded vested pension liabilities, with a cap at $53. These premium rates are for each participant in a plan. The maximum total premium is currently $72 per participant.

Assets received from firms that undertake insufficient terminations also provide revenue for the PBGC. ERISA gave the PBGC a claim of up to 30% of the net worth of firms that undertake insufficient terminations. The actual value of the claim can be less than 30% of the firms' net worth, because the priority of the PBGC during bankruptcy proceedings is ambiguous and depends on the discretion of the bankruptcy judge.[7]

In summary, the PBGC has three sources of revenue: (1) premiums, (2) assets recovered from firms that undertake insufficient terminations, and (3) investment

[4]Participants in a single-employer plan work for the same employer, whereas those in a multiemployer plan work for different employers but are typically in the same union unit.

[5]The terms of the multiemployer insurance differ from those of the single-employer insurance. I will discuss the differences later in the paper.

[6]Law mandates that the PBGC insure all tax-qualified pension plans.

[7]See: Lockhart (1991) for a detailed description of the priority of various PBGC claims. In September 1991, a bankruptcy judge in the case of the PBGC v. LTV decided that the PBGC is an unsecured creditor (Schmitt and Falk 9).

earnings from the assets. The PBGC uses its revenue to pay operating expenses, to pay pension benefits to workers who were involved in past insufficient terminations, and to build up a reserve against future claims. On a cash flow basis, the PBGC has had a slight surplus. The cash-flow accounting gives a misleading picture of the financial status of the PBGC. It does not take into account PBGC's future liabilities due to insufficient terminations that have occurred. Each time an insufficient termination occurs, the PBGC incurs more future liabilities owed to workers who have not yet retired.

Table 1 presents PBGC's annual deficit from insufficient terminations, by year of the terminations. The figures are from the PBGC Case Termination File; a description of this dataset is in the next section. The last row shows the total accumulated deficit. As of 1990, the PBGC had an accumulated deficit of $2.1 billion. By the end of 1992, the accumulated deficit had increased to $2.7 billion (*Annual Report 1992*).

3.3 Data

The dataset for analysis is the PBGC Termination Case File.[8] It is a list of single-employer DB pension plans that terminated with insufficient assets to cover guaranteed benefits. The dataset includes insufficient terminations that occurred between 1974 and 1990. It contains information about the plans at the time of insufficient termination. The following information is available in the dataset: (1) the exact date of insufficient termination,[9] (2) claims made on the PBGC, (3) assets, benefits, and the number of participants as of the termination date, (4) employer identification numbers (EINs),[10] (5) pension plan numbers, and (6) pension plan names. The dataset contains 1,541 observations.

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[8]I would like to thank Richard Ippolito and Bill Jaines of the PBGC for kindly providing the data.

[9]The termination date is usually considered to be the date of plan termination proposed in a Notice of Intent to Terminate filed with the PBGC by the employer. For more detail, see section 2623.2 of the *Code of Federal Regulations*.

[10]IRS assigns a unique EIN to each employer. EINs are analogous to social security numbers for individuals.

That these plans terminated with insufficient assets does not necessarily imply that all made positive claims on the PBGC. Claims equal the guaranteed pension benefits minus pension assets minus any recoveries the PBGC makes in bankruptcy courts. Table 1 shows the recoveries made by the PBGC as well as the claims. It also shows the total number of participants who were involved in insufficient terminations for each year during 1974–1990. By 1990, approximately 308,000 participants of DB pension plans were involved in insufficient terminations. During 1974–1990, 399 single-employer plans which covered union workers underwent insufficient terminations.

Information on the union status of the plans that underwent insufficient terminations is not available on the dataset. I have attempted to impute the information in two ways. First, I did a word search on the plan names. If a plan name contained phrases such as "plan for bargaining employees," "union plan," "local 361," or abbreviations of well-known unions such as "UAW" then the plan was assumed to cover union workers. Otherwise, it was assumed to cover nonunion workers. Note that this procedure will underestimate the true number of plans that cover union workers (hereafter, union plans).[11]

Second, information on plans' union status from the 1976 Employee Benefit Survey (EBS) and 1988 IRS Form 5500 computer tapes was match merged onto the PBGC Termination Case File by EINs and pension plan numbers. These datasets provide information on the union status of plans that existed in 1976 or in 1988. They do not offer any information on the union status of plans that started after 1976 and terminated before 1988. Match merging information on union status from these two datasets will also yield an underestimate of the true number of union plans.[12] Thus, the percentage of union plans in table 2 is a lower bound on the true percentage of union plans. Table 2 shows that about 26% of plans that underwent insufficient terminations covered union workers. The fraction of insufficient terminations involving

[11]From this word search, I found 204 plans or 13% of the plans in the dataset whose names suggested they covered union workers.

[12]Data from the 1976 EBS yielded identification of 190 plans that covered union workers; and from the 1988 Form 5500, 14 plans.

union workers has increased over time.

Table 2 also presents figures on the average "size" of DB plans that have undergone insufficient terminations. Several measures of the size of plans come to mind. The average assets and liabilities of plans convey a sense of the financial size of plans. The average number of participants in plans is another measure of the size of plans. By financial measures, the size of the plans that have undergone insufficient terminations has increased dramatically over time. The average claim, assets, and benefits have all increased over time. The average number of participants has also grown over time. Since average figures can be sensitive to outliers, I also tabulated median figures. Table 3 shows that the median size of plans that have undergone insufficient terminations has increased over time. The median (i.e., 50 percentile) claims, assets, and number of participants have grown over time.

3.4 Moral Hazard Problems

This section examines moral hazard problems associated with the PBGC insurance. It reviews the existing literature on the subject, including the little empirical evidence that is available. It includes evidence from the PBGC Termination Case File whenever appropriate. The purpose of this section is to provide a framework which may aid future empirical research.

Firms' or workers' actions are moral hazard problems of the PBGC insurance if they satisfy two conditions: (1) the actions increase the probability or the amount of a claim against the PBGC and (2) they are motivated by the existence or terms of the PBGC insurance. The second condition is crucial to our understanding of how much distortion the PBGC insurance has caused. It distinguishes moral hazard problems that existed before the establishment of the PBGC from those that have arisen due to the PBGC insurance. I will refer to the former as **old moral hazard problems** and the latter as **new moral hazard problems**. The PBGC insurance may have changed the severity of old moral hazard problems as well as induce new moral hazard problems. Sections 3.4.1 and 3.4.2 examine possible new moral hazard

problems that have been cited. They examine separately the moral hazard problems arising from firms' actions and those arising from workers' actions. Section 3.4.3 discusses the severity of old moral hazard problems before and after the establishment of the PBGC.

3.4.1 Firms

The existing literature cites the rapid depletion of pension assets prior to insufficient terminations, investment of pension funds in risky assets, and filing for bankruptcy prior to insufficient terminations as possible moral hazard problems arising from firms' actions. Closer examination shows that the depletion of asets prior to insufficient terminations and risky investment may not be new moral hazard problems. In contrast, filing for bankruptcy prior to insufficient terminations may be a new moral hazard problem.

Depletion of Pension Assets

VanDerhei (1990) presents strong evidence of depletion of pension assets prior to insufficient terminations. He finds that underfunding increases rapidly prior to insufficient terminations. He compares the funding ratios of plans that were terminated between 1981–1985 with those of plans that were not terminated during this period. Five years prior to termination, the terminated plans had funding ratios that were 50% the funding ratios of plans that were not terminated. At the time of termination, the terminated plans had funding ratios that were only 17% the funding ratios of plans that were not terminated. Lockhart, the executive director of the PBGC, cited similar evidence at a Congressional hearing. He stated that plans which are 60–80% funded five years before termination are only 40% funded when they are terminated (Karr A3).[13]

Data from the PBGC Termination Case File confirm this observation. The following table shows that the funding ratio and amount of underfunding in plans that

[13]Low funding ratios prior to insufficient terminations do not prove the existence of a moral hazard problem. I discuss this point later in this section.

undergo insufficient terminations. The funding ratio at the time of insufficient termination has ranged between 44–54% over the years. What may be of interest is the downward trend. The funding ratio at the time of insufficient termination has declined over time. Concurrently, the amount of underfunding has increased over time.

Mean Funding Ratio and Underfunding

Year	Funding Ratio	Underfunding (thousands)
1974–1979	0.54	$875
1980–1984	0.50	1,418
1985–1990	0.44	4,699

Note: The amount of underfunding is in thousands of 1990 dollars.

While the figures above and the evidence mentioned seem compelling, they do not necessarily imply that failing firms are taking actions to dump underfunded pension plans on the PBGC. Financially weak firms often offer attractive early retirement packages to older workers in order to reduce their workforce. Such packages would draw down pension assets and result in underfunding (or increase the underfunding) as firms near failures and the pension plans undergo insufficient termination. The upward trend in the mean underfunding may be due to the increase in failures of larger firms. The table below lists the mean liability of firms that have failed. It shows that the average size of failed firms has increased over time.

Mean Liability of Failed Firms

Year	Liability (thousands)
1974–1979	$358
1980–1984	502
1985–1990	755

Source: Dun & Bradstreet (1990)

The depletion of pension assets prior to insufficient terminations is not a new moral hazard problem. Failing firms had an incentive to underfund pension plans even before the PBGC insurance existed. Prior to ERISA and the establishment of the PBGC, workers could make a claim only on pension assets if their firms filed for bankruptcy or liquidation. Workers had no rights to the firms' other assets if the pension plans were underfunded. Consequently, other creditors of the firms had an incentive to underfund the pension plans prior to filing for bankruptcy or liquidation.

This is valid, assuming that firms did not pay workers substantial compensating differentials for risk of loss of pension benefits.[14] If the firms paid compensating differentials, then other creditors of the firms may not have had an incentive to underfund the pension plans. Payment of higher compensating differentials would offset the gains from underfunding.

Several facts suggest that workers did not received such compensating differentials prior to 1974. First, information about the financial status of pension plans were not publicly available prior to ERISA. Thus, workers could not easily ascertain their risk of loss of pension benefits.[15] Second, workers can incur a considerable cost when they quit from jobs with pension plans. Once they quit, their pension benefits remain frozen in nominal value as of that date. This can result in a substantial loss of pension benefits, since workers do not receive pension benefits until retirement. If they move to jobs that offer pension plans, then their pension benefits at the new firm would be less than at the old firm since they start out as nonvested participants. Such losses in pension benefits may have imposed a substantial moving cost to workers. Knowing workers face this moving cost, firms may have offered little or no compensating differentials for risk of insufficient termination of their pension plans. Third, the labor market can impose little "discipline" on failing firms. Failing firms do not fear being unable to attract workers or having to pay higher compensation

[14]A full discussion of compensating differentials for risk of loss of pension benefits is beyond the scope of this paper. At present, we do not have solid empirical evidence that compensating differentials exist for having pension plans at all.

[15]Since detailed information about pension plans have been publicly available since 1974, workers are more likely to have demanded compensating differentials for risk of loss of pension benefits after 1974.

to workers in the future. These facts suggest that failing firms had an incentive to underfund their pension plans prior to 1974.

The establishment of the PBGC insurance did not eliminate the incentive of firms to underfund pension plans prior to failure. It transferred some of the risk associated with such an occurrence from the workers to the PBGC. Since 1974, if a firm failed with an underfunded pension plan, the PBGC and the participants in the plan have shared the loss.

Risky Investment of Pension Assets

Drawing on the similarities between the situation of the PBGC insurance and FSLIC, some have pointed out that failing firms have an incentive to invest pension funds in risky assets just as failing S&Ls have an incentive to invest in risky assets.[16] The argument is that failing firms would gain from the upside of such a strategy. If the strategy resulted in a loss, then they could make a claim against the PBGC. In other words, they have "nothing to lose."

A few studies have examined whether financially weak firms invest pension assets in riskier assets to exploit the PBGC insurance. At first glance, data do not support this hypothesis. A tabulation by Papke (1992) shows that the fraction of pension assets invested in stocks rises with the funding ratio.[17] This is evidence against the hypothesis that underfunded pension plans would invest the most in stocks, which are riskier than corporate bonds and government securities. Of course, a tabulation does not control for various factors that could affect the fraction of pension assets invested in stocks. Thus, Bodie and Papke (1992) examine the issue more closely. They present regression results that show underfunded pension plans invest a higher fraction of their pension funds in risky assets; however, this results is not statistically significant at the 5% level.

The anecdotal evidence suggests that firms fear losses from risky investment of

[16]Bodie (1991) makes such an argument.

[17]An endogeneity bias may explain this tabulation result. A firm may invest in equity when the stock market returns are high in order to raise its funding ratio. Portfolio mix of pension assets and the funding ratio are both "control" variables of the firm.

pension assets. Case studies show that failing firms actually invest their pension funds in safer assets as their financial status deteriorates.[18] One explanation for this behavior is that failing firms do not know the date of failure with certainty. Because of this uncertainty, failing firms may want to invest pension funds in safer assets to minimize the probability of having to make large contributions in the future which may drive the firms into failure.

Investment of pension assets in risky instruments by failing firms is not a new moral hazard problem of the PBGC insurance. Failing firms had the same incentives to pursue risky investment of pension funds before the PBGC insurance existed. ERISA transferred some of the risk and loss associated with the risky investment from the workers to the PBGC.

The situation of the PBGC differs from that of FSLIC in two ways. First, unlike failing S&Ls, firms have little gain from the upside of risky investment. Asset reversions are costly, such that firms cannot readily take out assets from pension funds.[19] The gain for the firms primarily takes the form of lower pension contributions in the future. If the firm is financially weak and uncertain of its future prospects, the value of such a gain is probably small. Second, unlike S&Ls, firms' real activity typically do not center around investing in assets. In other words, investment of pension assets does not constitute the inherent business activity of firms. Therefore, firms do have something to lose from risky investment of pension assets. Losses from risky investment which require large pension contributions may actually drive a firm into failure, though its real activity would not result in a firm failure.[20] This may explain the anecdotal evidence that financially weak firms seek safe investment of pension funds.

[18]An official at the PBGC cited LTV and several other cases as examples of this behavior.

[19]Since 1986, firms must pay an excise tax, in addition to corporate taxes, on the amount of pension assets reverted back to the firms. Currently, the excise tax is 50%.

[20]If a firm cannot pay currently due pension benefits to its retirees, then the PBGC is required to force an insufficient termination of the pension plans, take over the pension assets, make a claim against corporate assets, etc.

Timing of Insolvency Filing

Recently, attention has focused on the interaction between pension regulations and bankruptcy laws. ERISA gave the PBGC claims on a maximum of 30% of the net worth of firms that fail with underfunded pension plans. This term of the insurance changed the incentives of failing firms as regard their pensions, because it changed the nature of the pension agreement. Prior to ERISA, responsibility for a pension agreement did not extend to corporate assets. ERISA extended financial responsibility for a pension agreement to corporate assets via this term of the PBGC insurance. This change may have given rise to a new moral hazard problem.

The moral hazard problem is that failing firms have an incentive to file for bankruptcy or liquidation before they terminate their underfunded pension plans. By doing so, other creditors of the firms can minimize the amount of firms' net worth given to the PBGC. It pushes down the priority of the PBGC as a creditor. The PBGC is basically an unsecured creditor during insolvency proceedings. Thus, after the firms settle the claims of other creditors, they may have little or no net worth against which the PBGC can make a claim.

To date, no study has focused on this moral hazard problem. Indirect evidence comes from Hirtle and Estrella (1990). They use actuarial methods to value the future liabilities of the PBGC. They examine the effect of various policies on the future liabilities. They conclude that giving PBGC a claim on a higher percentage (i.e., higher than 30%) of firms' net worth after they have filed for bankruptcy does not have much of an impact on the PBGC's future liabilities. In contrast, if the PBGC could terminate underfunded pension plans before the firms file for bankruptcy, then the PBGC's future liabilities would decrease significantly.[21] They attribute the importance in timing to the fact that firms have little or negative net worth by the time other creditors are satisfied such that the PBGC makes small or no recovery once the firms file for bankruptcy. This importance in timing suggests that other creditors

[21]They note that this may not be politically feasible. Forcing financially weak firms to pay for underfunded pension plans may drive them into insolveny, causing unemployment and other undesirable consequences.

have an incentive to enter insolvency proceedings before terminating underfunded pension plans.

The indirect evidence from the PBGC Termination Case File suggests that this moral hazard problem may not be severe. The following table shows the amount of PBGC's recoveries and the recoveries as a fraction of the underfunding in the pension plans. It shows that the amount of recoveries has increased over time. More importantly, the ratio of recoveries to underfunding has fluctuated over time. If the PBGC insurance gave rise to a new moral hazard problem concerning recoveries in bankruptcy proceedings, then one might expect the moral hazard problem to worsen over time. In other words, one might expect the ratio of recoveries to underfunding to fall over time. The table shows no clear upward or downward trend in the ratio of recoveries to underfunding.

Mean Recoveries by the PBGC

Year	Amount (thousands)	As Fraction of Underfunding
1974–1979	$237	0.48
1980–1984	298	0.27
1985–1990	1,705	0.48

Note: The amount of recoveries are in thousands of 1990 dollars.

3.4.2 Workers

The literature on moral hazard problems arising from workers' actions has focused on workers' negotiating for increases in pension benefits in lieu of wages.[22] If workers in failing firms successfully pressure the firms to raise pension benefits up to the maximum PBGC guaranteed limit, then the PBGC insurance has given rise to a new moral hazard problem.

[22]Of course, both workers and firms must agree to the actual settlement to skew compensation more toward pension; thus, these moral hazard problems arise from both firms' and workers' actions. I chose to classify them as moral hazard problems from workers, because such settlements primarily benefit the workers.

A study by Marcus et al. (1987) of steel firms describes examples of such behavior. One anecdotal evidence they mention concerns the 1986 negotiations between the major steel companies and the United Steel Workers (USW). The negotiations resulted in a 10% wage cut but increases in pension benefits (Marcus et al. 17).[23] Steel companies were experiencing financial difficulties and were downsizing during this period. The workers faced less job security.

If the workers sought compensating differentials for this decrease in job security, then they would have sought an increase in compensation in the form of pension benefits guaranteed by the PBGC rather than in wage increases for two reasons. First, the financially weak firms could not pay the wage increases. The increase in pension contributions due to more generous pension benefits is less costly than wage increases, because the companies can service the increase in pension benefits over a number of years. Furthermore, financially weak firms can obtain waivers from the IRS to skip pension contributions for a year. Second, workers cannot be certain that they will receive wage increases promised for the remainder of the union contracts, since the firms could close before the contract expires. However, workers would receive the increased pension benefits so long as the benefits were below the maximum benefit level guaranteed by the PBGC if the firm fails. Thus, the anecdotal evidence about steel companies suggests that workers sought compensating differentials in the form of higher PBGC-guaranteed pension benefits rather than wages. Firms would agree to this arrangement since they did not bear the full cost of promising higher pension benefits. This arrangement may have allowed the firms to retain valuable workers who otherwise would have quit.

While such anecdotal evidence is compelling, it does constitute solid evidence that the PBGC insurance has induced workers to skew compensation packages away from wage increases and toward pension benefit increases. More convincing evidence would be a comparison of compensation packages before and after the establishment of the PBGC. To date, no study has examined compensation packages (i.e., mix of wages and pension benefits) before and after 1974. Lack of data may be one explanation.

[23]Pension benefits are typically increased by making the pension benefit formulas more generous.

The only evidence related to this topic comes from Niehaus (1990). He compares the generosity of pension benefits before and after 1974. He finds that benefit formulas became more generous in single-employer pension plans after 1974 but not among multiemployer plans. The PBGC began insuring single-employer plans in 1974 but did not insure multiemployer plans until 1980. Thus, his finding is prima facie evidence that the PBGC insurance may have induced workers and firms to skew compensation toward higher pension benefits.[24] Of course, this finding may not be due to the PBGC insurance at all. For example, firms that sponsored single-employer plans may have earned more profits and offered higher pension benefits than firms that sponsored multiemployer plans.

To test whether the PBGC insurance caused single-employer plans to increase benefits, Niehaus examined whether underfunded single-employer plans were more likely to raise benefits than fully funded or overfunded single-employer plans. The idea is that workers in underfunded plans would benefit more from the PBGC insurance, since underfunded plans are more likely to make a claim against the PBGC. He does not have data on the funding status of the plans. Instead, he has data on the union status of the plans. Single-employer plans that cover union workers are more often underfunded than those that cover nonunion workers. He uses the union status as a proxy for plans that were likely to be underfunded. He presents weak evidence that single-employer plans that covered union workers were more likely to increase benefits than single-employer plans that covered nonunion workers.

Indirect evidence from the PBGC Termination Case File provides weak evidence of a moral hazard problem from union workers. The following table shows that amount of mean per-participant claim and underfunding in plans that underwent insufficient terminations by the union status of the plans (i.e., whether a plan covered union or nonunion workers). It shows that insufficient terminations of union plans poses a bigger threat to the financial health of the PBGC than those of nonunion plans.[25]

[24]His results constitute difference-in-difference estimates. The multiemployer plans before and after 1974 serve as the "control group," while the single-employer plans serve as the "treatment group."

[25]Ippolito (1988) estimates that about 95% of the transfer from PBGC to workers has gone to

The mean per-participant claim and underfunding are larger for union plans that undergo insufficient termination than for nonunion plans that undergo insufficient termination.

Mean Per-Participant Claim and Underfunding by Union Status

Year	Claim		Underfunding	
	Nonunion	Union	Nonunion	Union
1974–1979	$3,083	$3,038	$4,852	$5,602
1980–1984	4,260	7,065	5,717	7,970
1985–1990	4,740	5,687	10,232	11,082

Note: The dollar figures are in thousands of 1990 dollars.

One flaw of the tabulation above is that it does not control for industry. Unionization and firms' financial health are both correlated with industry. For example, unionization is high in the steel, auto, and airline industries. These are also industries with large financially weak firms.[26] Thus, the tabulation above by union may be reflecting industry-related financial health of firms. Unfortunately, the PBGC Termination Case File has no information on industry.

The mean per-participant claim may be higher for union plans for three reasons. First, the union plans may cover older workers than nonunion plans. Since older workers are likely to have earned higher pension benefits, the failure of firms with union workers are more likely to results in underfunded pension plans. Second, firms that sponsor union plans may have stronger creditors than firms that sponsor nonunion plans. As an unsecured creditor, the PBGC would then recover less from firms that terminate underfunded union plans. Third, the PBGC may recover less from union plans because firms that sponsor union plans may delay terminating underfunded pension plans longer than nonunion firms. This may be a new moral hazard problem of the PBGC insurance. Workers' pension benefits under a defined benefit plan grow with time, such that delaying the termination of plans will increase pension liabities.

union participants.

[26]Ippolito (1989) notes that the largest claims made on the PBGC have been by firms in three industries: steel, automobile, and airlines.

Workers in failing firms may pressure firms to delay terminating underfunded pension plans, if the PBGC will insure the higher pension benefits.

3.4.3 Before and After PBGC

The analysis so far has shown that the incentive of financially weak firms to underfund pension funds or to invest pension funds in risky assets has not disappeared after 1974. These old moral hazard problems remain. The only difference is that workers and the PBGC have shared the risk and losses associated with such actions since 1974; whereas, workers bore all the risk and losses prior to 1974. The discussion has also shown that the PBGC insurance may have given rise to new moral hazard problems, such as firms' filing for bankruptcy or liquidation before terminating underfunded pension plans or workers' skewing compensation toward pension benefits that are insured by the PBGC. If old moral hazard problems remain and new moral hazard problems have emerged, then has the severity of moral hazard problems associated with defined benefit (DB) plans increased after ERISA? The following discussion focuses on this question.

To compare the magnitude of the moral hazard problems associated with DB plans before and after ERISA, we need some kind of a measure of moral hazard problems. This measure should reflect how much pension benefits were promised but not paid to workers involved in insufficient terminations. It should also reflect any losses incurred by the PBGC. One measure is the expected loss from an insufficient termination to society as a whole. The expected loss is:

$$E(L) = pL, \tag{3.1}$$

where $E(L)$ denotes the expected loss; p, the probability of an insufficient termination; and L, the loss per insufficient termination.

Before ERISA, the social expected loss equaled the expected loss for workers involved in the insufficient terminations. Very little data is available on insufficient terminations prior to 1974. One source is a Treasury Department study of insufficient

terminations that occurred in 1972. In that year, approximately 19,400 participants lost an average of $2,500 in pension benefits from 546 insufficient terminations of single-employer plans (BNA). Approximately 27.5 million workers had pension plans (Skolnik). Thus, the per-worker probability of an insufficient termination was 0.0007. The per-worker expected loss for that year was (0.0007)($2,500) or $1.75.[27]

After ERISA, the social expected loss from insufficient terminations has equaled the expected loss for workers and the PBGC. The PBGC Termination Case File has information on losses incurred by the PBGC (i.e., claims made on the PBGC) but no information on losses incurred by the workers involved in the insufficient terminations. Workers whose pension benefits exceed the maximum PBGC guaranteed limit would receive the amount of the maximum guaranteed benefit in insufficient terminations; thus, they would suffer a loss of pension benefits. Consequently, from the PBGC Termination Case File, we can compute the expected loss based only on losses for the PBGC. Whether this measure underestimates or overestimates the social expected loss is unclear. On the one hand, it does not take into account workers' loss of pension benefits that are not insured by the PBGC. This may result in figures that underestimate the social expected loss. On the other hand, if workers push up pension benefits to the maximum PBGC gurauranteed level, then the figures may overestimate the actual social loss. The figures cited below are therefore crude estimates of the actual social expected loss.[28]

The following table shows the expected loss of pension benefits by time periods. The per-plan expected loss and the per-participant expected loss differ in the specific measures of the probability and the average loss. The per-plan expected loss is based on the probability that a single-employer DB plan undergoes insufficient termination

[27]If workers received compensating differentials prior to insufficient terminations for the risk of loss of pension benefits, then the per-worker expected loss would have been lower. Whether workers received compensating differentials is unclear.

[28]The figures may suffer from a self-selection bias. The mean expected loss is computed for plans that underwent insufficient termination. The sample does not include plans that were terminated but were not underfunded. Underfunding can be considered a control variable of the firms and workers, who have an incentive to maximize the size of claim made on the PBGC. Consideration of a sample of all plans that were terminated, whether underfunded or not, may result in less biased figures for the mean expected loss.

and the average per-plan claim made on the PBGC. The per-participant expected loss is based on the probability that a worker in a single-employer DB plan is involved in an insufficient termination and the average per-participant claim made on the PBGC.

Mean Expected Loss of Pension Benefits

Year	Per-Plan	Per-Participant
1974–1979	$638	$1.73
1980–1984	873	3.86
1985–1990	2,164	5.07

Note: The dollar figures are in 1990 dollars.

The table indicates that the per-participant expected loss from insufficient terminations during 1974–1990 exceeded the per-participant expected loss in 1972 ($1.75). Furthermore, the expected loss has steadily increased over time. This suggests that the severity of moral hazard problems associated with DB plans may have increased after ERISA and the establishment of the PBGC insurance; however, this is weak evidence since factors other than the PBGC insurance can explain the results above. For example, the per-plan expected loss may have grown over time because the probability of failure of large firms has increased.

3.5 Conclusion

The issue of moral hazard problems associated with the PBGC insurance has just begun to receive the serious attention of researchers. The potential for important future research is great. More work is needed to quantify the magnitude of moral hazard problems associated with the PBGC insurance. In particular, the two "new" moral hazard problems described in the paper deserve further study. The terms of the PBGC insurance may have created new moral hazard problems that had not existed before 1974. For example, firms may file for bankruptcy or liquidation before terminating underfunded pension plans to minimize the amount of corporate assets given to the PBGC. Workers in financially weak firms may seek compensating differentials

for lack of job security in the form of higher pension benefits insured by the PBGC rather than higher wages. The results in this paper suggest that the severity of moral hazard problems associated with defined benefit (DB) plans has increased since 1974. Further research is necessary to determine whether this is true.

This paper has not examined in detail distortions that may arise from the structure of PBGC premiums. Because the premiums are not risk-based, several have noted that the premiums result in cross-subsidization. The healthy firms pay PBGC premiums that implicitly benefit financially weak firms. The magnitude of this cross-subsidization is unknown.

The discussion of the financial solvency of the PBGC has focused solely on the insurance of single-employer DB plans. The insurance program for multiemployer DB plans has a healthy surplus.[29] A careful consideration of why the multiemployer program has succeeded may yield insights as to how to improve the single-employer program. When the PBGC began insuring multiemployer plans in 1980, the regulations changed dramatically the nature of the pension agreement. The terms of the multiemployer insurance made the pension agreement more legally binding such that firms could not costlessly renege on promised pension benefits. The PBGC does not pay the cost of insufficient terminations of multiemployer plans. Rather, when a multiemployer plan cannot pay benefits to retirees that are currently due, they can obtain a loan from the PBGC to pay at least guaranteed benefits to retirees. The PBGC is therefore a secured creditor. Failing or failed firms must satisfy PBGC's claim for the loans and thereby their pension obligations. In light of the current financial difficulties of the single-employer insurance program, whether the terms of the multiemployer insurance are desirable or politically feasible to incorporate into the single-employer insurance deserves more consideration and research.

[29]At the end of 1992, the accumulated surplus was $235 million (*Annual Report 1992*).

Table 1. Insufficient Terminations: Totals by Year

Year	Plans	Claims (millions)	Assets (millions)	Benefits (millions)	Recoveries (millions)	Participants (thousands)	Union Plans
1974	43	$11	$8	$20	$0.9	5	9
1975	130	37	32	85	16	22	19
1976	149	35	38	100	26	19	34
1977	116	54	43	108	11	18	23
1978	95	27	24	56	5	12	31
1979	87	54	35	94	5	13	19
1980	104	47	93	216	75	20	27
1981	136	124	105	241	12	27	41
1982	145	249	240	510	20	37	38
1983	127	140	115	259	5	18	39
1984	81	20	17	41	4	6	18
1985	118	699	310	1,037	27	47	36
1986	72	27	100	403	276	18	17
1987	65	245	88	406	73	19	26
1988	40	231	28	285	26	6	10
1989	20	24	41	122	57	8	7
1990	13	82	764	859	12	14	5
TOTALS	1,541	2,106	2,082	4,841	653	308	399

Observations with missing year of plan termination, claims, assets, benefits, or number of participants have been deleted. Figures by year of termination may not sum to the totals for all years due to rounding.

Source: PBGC Termination Case File (1990), 1988 IRS Form 5500 Tapes, and 1976 Employee Benefit Survey (EBS).

Table 2. Insufficient Terminations: Means By Year of Termination

Year	Claims (thousands)	Assets (thousands)	Benefits (thousands)	Participants	Fraction of Union Plans
1974–1979	$298	$280	$684	139	0.22
1980–1984	814	897	1,909	165	0.27
1985–1990	2,459	3,768	7,679	296	0.31
All Years	1,365	1,349	3,138	200	0.26

Observations with missing year of plan termination, claims, assets, benefits, and number of participants have been deleted.

Source: PBGC Termination Case File (1990), 1988 IRS Form 5500 Tapes, and 1976 Employee Benefit Survey (EBS).

Table 3. Insufficient Terminations: Quartiles By Year of Termination

Year	Claims (thousands)	Assets (thousands)	Benefits (thousands)	Participants
1974–1979:				
25 percentile	$ 0	$ 19	$ 54	18
50 percentile	1	65	128	46
75 percentile	76	207	412	128
1980–1984:				
25 percentile	0	21	82	21
50 percentile	50	97	222	48
75 percentile	249	340	777	137
1984–1990:				
25 percentile	16	39	171	20
50 percentile	84	176	502	60
75 percentile	371	584	1,320	166

Observations with missing year of plan termination, claims, assets, benefits, and number of participants have been deleted.

Source: PBGC Termination Case File (1990), 1988 IRS Form 5500 Tapes, and 1976 Employee Benefit Survey (EBS).

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