Some Perspectives on the Actuarial Adequacy of the Pension Benefit Guarantee Corporation

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Abstract: This paper analyzes the actuarial adequacy of PBGC in providing insurance coverage to employees participating in single employer, defined benefit pension plans. The first part of this investigation examines the micro and macro economic factors that impact the financial stability and actuarial viability of PBGC. A second section discusses externalities that may contribute to suboptimal premiums and adverse selection for PBGC. A linear control model is introduced to analyze the most effective way PBGC might use its $100 million credit line with the Department of the Treasury. In addition, a model based on the economic theory of clubs develops relationships between the size of a pension, its level of benefits and the motivations of employers to fully fund a plan or lay it off to PBGC. Within this framework, this investigation examines how changes in the actuarial discount rate or the actuarial cost method for valuing postretirement obligations may significantly alter PBGC's future claim experience and reserve adequacy. The paper concludes with a discussion of possible funding solutions to address potential inadequacies in PBGC reserves against bankrupt plans in the industrial manufacturing sector of the U.S. economy.

Introduction: Micro and Macro Financial and Economic Factors Impacting PBGC

The Pension Benefit Guarantee Corporation(PBGC), created under the 1974 Employee Retirement Income Security Act, is a quasi-governmental insurer offering coverage to participants in defined benefit pension plans. While PBGC is considered a federal agency under the U.S. Department of Labor, its primary funding is based on income generated from premiums charged to employer sponsors of defined benefit plans. As a federal corporation, PBGC is governed by a Board of Directors consisting of the Secretaries of Labor, Commerce and Treasury. Presently, PBGC provides insurance to 44.4 million workers and retirees in 31,200 private defined benefit plans. The largest number of workers and retirees, 34.6 million, are members of single-employer plans. [1] Consequently, the focus of this study will concentrate on single-employer plans involving individual US companies offering defined benefit plans to workers. During the 2004 fiscal year, PBGC received $1.485 billion in premium income plus $3.251 billion from investments against plan termination losses and actuarial adjustments of $16.495 billion. Net losses on insurance to the single employer plans amounted to $12.067 billion and the capital position ran a deficit of $23.305 billion. As noted in the Chairman's letter to PBCG's most recent 2004 Annual Report, "the Corporation does not have sufficient resources to meet all of its long-term obligations." [2]

Table 1 provides an historical perspective on the long-run financial position of PBGC since 1985. Annual increases in the PBGC capital deficit from 1995 onward grew at a faster rate (53.42%) than during the entire 20 year period from 1985(15.28%). In the period from 1985 to 1995, PBGC experienced deficits of between -$315 million and -$2.897 billion. Following a brief period from 1996 to 2001, when PBGC ran capital surpluses between $869 million and $9.704 billion, the agency faced growing deficits thereafter with the latest 2005 shortfall reported at $22.776 billion.

[1] U.S. Department of Labor, 2004 Annual Report of the Pension Benefit Guarantee Corporation, p. 1.
[2] U.S. Department of Labor, op.cit., pp. 1-2.

Table 1
Net Financial Position of PBGC's Single-Employer Program from 1985 to 2005

Fiscal Year	Assets in Millions	Liabilities in Millions	Net Financial Position In Millions
2005	$56,470	$79,246	-$22,776
2004	$38,993	$62,298	-$23,305
2003	$34,016	$45,254	-$11,238
2002	$25,430	$29,068	-$ 3,638
2001	$21,768	$14,036	$ 7,732
2000	$20,830	$11,126	$ 9,704
1999	$18431	$11,393	$ 7,038
1998	$17,631	$12,619	$ 5,012
1997	$15,314	$11,833	$ 3,481
1996	$12,043	$11,174	$ 869
1995	$10,371	$10,686	-$ 315
1994	$ 8,281	$ 9,521	-$ 1,240
1993	$ 8,267	$11,164	-$ 2,897
1992	$ 6,381	$ 9,118	-$ 2,737
1991	$ 5,422	$ 7,925	-$ 2,503
1990	$ 2,797	$ 4,710	-$ 1,913
1989	$ 3,059	$ 4,183	-$ 1,124
1988	$ 2,422	$ 3,965	-$ 1,543
1987	$ 2,163	$ 3,712	-$ 1,549
1986	$ 1,740	$ 3,766	-$ 2,026
1985	$ 1,155	$ 2,480	-$ 1,325

Annual Increase in the PBGC Deficit 1985-2005:	15.28%
Annual % Increase in the PBGC Deficit 1995-2005:	53.43%

Source: Pension Benefit Guarantee Corporation, Pension Insurance Data Book 2004, "Single Employer Data Tables," Table S-1, p. 26; 2005 PBGC Annual Report, "Financial Statement Highlights," p. 2.

An actuarial and financial approach to adequately funding PBGC insurance coverage requires that the present value of future premiums be sufficient to meet the present value of future obligations to workers and retirees of terminating, defined benefit pension plans. Two critical variables in maintaining the viability of an insurer is the ability to (1) adjust premiums to fully reflect the risks assumed with coverage and (2) alter underwriting and benefit structures to avoid adverse selection. Initially, PBGC charged a flat premium rate per insured worker of $2.60 to $8.50. By 1988, PGBC started charging a flat rate, plus a

variable rate based on the level of under funding in vested plan benefits. Rates in 1988 were $16 per worker with an excess variable premium of $6 per $1,000 of unfunded benefit up to a maximum of $34 per worker. These rates gradually increased to $19 per insured worker and $9 per $1,000 of unfunded benefit without a cap. Table 2 examines the historic premium rates for PBGC coverage from 1985 to 2004.

Table 2
Pension Benefit Guarantee Corporation Historic Premium Rates and Revenues
For 1985 through 2004

Year	Flat Premium Rate	Flat Premium Revenue [In Millions]	% of Total Premium Revenue	Variable Premium Rate	Variable Premium Revenue [In Millions]	% of Total Premium Revenue	Total Premium Revenue
1985	$2.60	$81.7	100.00%			0.00%	$81.7
1986	$8.50	$201.4	100.00%			0.00%	$201.4
1987	$8.50	$267.6	100.00%			0.00%	$267.6
1988	$16.00	$414.4	89.23%	$6/$1000 Unfunded:$34 Max	$50.0	10.77%	$464.4
1989	$16.00	$503.2	83.42%	$6/$1000 Unfunded:$34 Max	$100.0	16.58%	$603.2
1990	$16.00	$509.0	77.24%	$6/$1000 Unfunded:$34 Max	$150.0	22.76%	$659.0
1991	$19.00	$541.0	73.01%	$9/$1000 Unfunded:$53 Max	$200.0	26.99%	$741.0
1992	$19.00	$590.0	67.43%	$9/$1000 Unfunded:$53 Max	$285.0	32.57%	$875.0
1993	$19.00	$605.0	67.98%	$9/$1000 Unfunded:$53 Max	$285.0	32.02%	$890.0
1994	$19.00	$648.0	67.85%	$9/$1000 Unfunded:$53 Max	$307.0	32.15%	$955.0
1995	$19.00	$587.0	70.05%	$9/$1000 Unfunded:$53 Max	$251.0	29.95%	$838.0
1996	$19.00	$600.0	**52.36%**	$9/$1000 Unfunded:No Max.	$546.0	**47.64%**	**$1,146.0**
1997	$19.00	$646.0	60.54%	$9/$1000 Unfunded:No Max.	$421.0	39.46%	$1,067.0
1998	$19.00	$642.0	66.46%	$9/$1000 Unfunded:No Max.	$324.0	33.54%	$966.0
1999	$19.00	$611.0	67.74%	$9/$1000 Unfunded:No Max.	$291.0	32.26%	$902.0
2000	$19.00	$661.0	81.91%	$9/$1000 Unfunded:No Max.	$146.0	18.09%	$807.0
2001	$19.00	$674.0	82.10%	$9/$1000 Unfunded:No Max.	$147.0	17.90%	$821.0
2002	$19.00	$654.0	83.10%	$9/$1000 Unfunded:No Max.	$133.0	16.90%	$787.0
2003	$19.00	$647.0	68.25%	$9/$1000 Unfunded:No Max.	$301.0	31.75%	$948.0
2004	$19.00	$654.0	**44.86%**	$9/$1000 Unfunded:No Max.	$804.0	**55.14%**	**$1,458.0**

Note: In general, variable rates are stated rate/$1000 unfunded vested benefit, with a maximum limit per participant.
However for 1994-95 there was an additional 20% uncapped premium in excess of the $53. From 1995 to 1996 the uncapped portion went up to 60%. After 1996 there wasn't a maximum limit on the variable premium.

Source: Pension Benefit Guarantee Corporation, Pension Insurance Data Book 2004, Table S-37 and S-38, pp. 62-63.

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Total premium revenue remained low during the period from 1985 to 1995 when the majority of PBGC's income was derived from flat rate fees for coverage. However, beginning in 1988 variable premiums, as a percentage of total premium revenue, increased with changes in the amount charged per $1,000 of unfunded, vested benefits and the gradual elimination of the maximum cap. One of the largest years for premium revenue was in 1996, the first year the cap was eliminated when the fund received $1.146 billion. This coincided with the switch in PBGC's net financial position from a negative to positive capital account [i.e., -315 million to +$869 million]. In years 2003 and 2004, when PBGC's capital deficit grew to $22.776 billion, variable premium revenues increased as a proportion of total premium income to 55.14%, a record level of contribution. These results would appear to support two underwriting positions: (1) the flat premium may have to increase to allow for healthier pension plans to support insurance reserves and (2) variable rates need to be revised upward to fully reflect added risk on those plans with under funded benefits. In recognition of these underwriting considerations, the recently passed Deficit Reduction Act of 2005, increases PBGC's flat and variable rate premiums as of the beginning of 2006. Under this act, flat premiums go up to $30 per insured worker retroactive to the beginning of year with future premium increases pegged to the average annual increase in national wages. [3]

From a microeconomic, insurance perspective, PGBC offers a unique form of coverage. Although the policy insures pension benefits for workers participating in defined benefit plans, the premiums are paid by firms sponsoring the pensions. The insured party is not the policyholder or premium payer for the coverage. The insurance is owned by the corporation, on behalf of the insured workers covered by PBGC. Consequently, the managers of the firm decide whether to continue their defined benefit plan and pay premiums, or terminate the pension. Insured workers have little control over these decisions. Plan terminations may occur as the result of bankruptcy or a firm's managerial decision to convert the pension into a defined contribution plan. The latter is considered to be a voluntary termination, as opposed to, the former being an involuntary termination. PBGC's insurance coverage provides guaranteed benefits to retirees who find themselves in involuntarily terminated plans. PBGC's claim liability is based on the value of the plan assets, the level of benefits defined within the terminated plan, the limits of PBGC coverage, and the extent corporate assets may be subrogated to pay guaranteed

[3] Business Insurance, "Congress OKs Hike in PBGC premiums," February 6, 2006, Vol. 40, Issue 6, p. 1. Also see: http://www.house.gov/pence/rsc/lgbullettins06.shtml

benefits. The value of the plan assets will depend on the funding, investment returns, and pension payouts that occurred before a firm's bankruptcy. In some instances, a plan might be fully funded even when the firm files for bankruptcy. However, in most cases the plan assets are considerably less than the actuarial value of the plan's future pension obligations. Whenever this occurs, PBGC recalculates benefits to determine what its obligation is, based on the limits of coverage and the value of the transferred assets in the terminated plan. [4] The lesser of those two amounts serves as the basis for future pension payments to the covered retiree. When PBGC receives pension assets from a terminated plan, there can be a priority to a retirees claim to enhanced benefits. Those employees who have made voluntary contributions to the pension, retirees who have been receiving fixed benefits prior to PBGC taking over the plan, current employees with vested benefits less than the PBGC maximum benefit limits, employees with vested benefits above the PBGC maximum benefit limits, and participants with unvested benefits, all have varying priorities on assets taken in by PBGC after an involuntary termination, according to ERISA law. [5] Although PBGC has a maximum benefit limit should pension assets be insufficient to cover all retiree benefits in a terminated plan, it is possible for these benefit amounts to be enhanced should PBGC be successful in attaching a claim to the corporate assets of the bankrupt firm. However, difficulties with handling assets acquired from terminated plans are significant including, but not limited to: (1) the cost of managing physical assets until a sale can be made (2) determining a fair value of the assets quickly (3) maintaining the value of the assets while an appraisal is being made of whether dispose or retain the property, and (4) dealing with litigation costs associated with enforcing PBGC's right to the property.

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A recent example of the reduction in pension payments to PBGC retirees, from the diminishing value of pension assets, is the United Airlines bankruptcy and pension termination. PGBC became an unsecured creditor in United Airlines when the company shifted $10.2 billion in unfunded pension liabilities to the agency in December of 2002. PBGC reached an agreement, during the United Airlines bankruptcy proceedings, to receive a $5.6 billion claim on the new United Airlines. In February 2006, PBGC sold $2.5 billion of this claim to hedge fund investors and banks for $450 million or $.18 on the dollar. Under PBGC's maximum benefit cap, some of the 120,000 United workers will see large cuts in their retirement income due to the insufficiency of the value of the

[4] Jay A. Jupiter, "The PBGC's Rule on Determining Termination Liability, Journal of Pension Planning and Compliance, (January 1982), Vol. 8, Issue 8, pp. 41-46. Under PBGC rules, an employer is liable to the agency for any plan asset insufficiency up to 30% of the employer's net worth. Net worth at the time of termination may include reorganization value, liquidating value of the employer's tangible and intangible property, the value of equity assumed in a plan of reorganization, or any other factor relevant in determining net worth. See Part 4062- Liability for termination of single-employer plans, PBGC regulations, 29 U.S.C. 1302(b)(3) 1362-1364, 1367, 1368 found in: http://www.pbgc.gov/practitioners/law-regulations-informal-guidance/content/page14767.html

[5] Caroline K. Craig, and Thomas R. Craig, "The Pension Benefit Guarantee Corporation: What Financial Advisers Should Know," Journal of Financial Service Professionals, (March 2004), Volume 58, Issue 2, p. 74. This article provides a good summary of the financial planning factors that may impact the type of retirement income PBGC insurance recipient may receive based on plan assets, time of retirement, and type of annuity benefit received [single life, joint and survivor, annuity certain and life].

pension assets received from the United Airlines bankruptcy.[6] In past bankruptcies, PBGC has received such diverse assets as: "diamonds, a hog slaughtering facility, oil wells, a restaurant, interest in a nuclear fuel reconditioning partnership, and water rights in the Mojave Valley." The agency has hired Pacholder Associates, a Cincinnati special assets manager, to dispose of or manage these assets until sale. [7]

In addition to PGBC's, subrogation rights to pension assets in terminated plans, is the issue of its claim on assets in bankrupt firms who place their unfunded pension plans with the agency. To what extent can PBGC argue that the pension holders in the firm are creditors entitled to a claim in the assets of their bankrupt employer? Private casualty insurance allows an insurer to take salvage after loss to reduce its overall claim costs. Does PBGC have a legitimate right to take salvageable assets to help pay for the costs of pension benefits to retirees in the bankrupt company? If PBGC were to be able to "pierce the corporate veil" between the assets of the company and its unfunded pension liabilities, what would be the priority of claims? Several court cases over the years since 1980 have attempted to address these issues with varying results. The first case to come up in this area involved, Facet Enterprises in 1976, a subsidiary of Bendix Corporation. Bendix wanted to spin off the subsidiary in order to relieve itself from any pension fund obligation to Facet workers by having the separated firm apply to PBGC for claims settlement. In this case, the courts held that Bendix Corporation could not legally absolve itself from the pension obligations by spinning off the bankrupt subsidiary.[8] In 1984, during the rehabilitation of the Baldwin-United insurance subsidiaries the question of priority of claims arose in relation to claims policyholders might have on the assets of the parent company. This issue was resolved when a rehabilitation plan was devised such that the policyholders were completely restored with an interest enhancement to cash values based on investment return and contributions from a number of brokerage firms.[9] More recently was the 1991 case involving LTV Corporation, in which the PBGC sought standing with the bankruptcy court in sharing in the claim on assets in the failing corporation. However in that case, the judge ruled that "PBGC had no more priority than any unsecured creditor." [10] In this instance, the limitation on PBGC's ability

[6] Michael Schroeder, "Pension Insurer Holds a Stake of 23.4% in UAL", The Wall Street Journal, February 15,2006, p. A-10.
[7] Michael Schroeder, op.cit., p. A-10.
[8] A. Frank Thompson, Anju Ramjee, and B. Ramjee, "Pension Valuation and Unfunded Liability Measurement: Financial Management Implications," Proceedings of the Risk Theory Seminar, University of Southern California (May 1984), p.9; Another discussion of this issue may be found in: Lucas and Hollowell, "Pension Accounting: The Liability Question," Journal of Accountancy, October 1981, pp. 57-66.
[9] Stanley Tulin, Daniel McCarthy, and Bruce Ogg, "A Report on the Financial Aspects of the Rehabilitation Plan for National Investors Life Insurance Company, National Investors Pension Insurance Company, Mt. Hood Pension Insurance Company, National Equity Life Insurance Company, Inc. S&H Life Insurance Company, and University Life Insurance Company," Milliman and Robertson, January 1984; and A. Frank Thompson, "Report on an Actuarial and Financial Analysis of the Rehabilitation of the Baldwin United Insurance Subsidiaries," January 1984; Don Andriacco, "Baldwin Annuity Holders May Review Rehabilitation Plan," The Cincinnati Post, January 18, 1984, p. 5B. Dr. Thompson served as financial and actuarial expert for the policyholders in this rehabilitation case and raised the issue of priority of claims in relationship to "piercing the corporate veil," in reference to policyholder interests.
[10] Kim Nauer, "Pension Agency Seeks Higher Claim Status in Chapter 11 Cases," Commercial Law Bulletin, (November/December 1991), Volume 6, Issue 6, p. 10.

to secure assets in LTV to defray the cost of retirement benefits, added to the settlement costs of the unfunded LTV pensions. From a microeconomic perspective, as PBGC claim costs rise, premiums need adjust to reflect the new experience, and healthier pensions will assume a disproportionate cost of the losses from under funded plans. Over time, the increased cost of retaining a defined benefit plan, for financially strong companies, may cause them to convert into a defined contribution plan in order to avoid higher PBGC premium payments. While PBGC recoveries on pension assets has been improving over the past 3 years, gross claim costs have gone up far more than the amounts received from liquidating plan assets. Table 3 provides a picture of claim cost and recoveries for the past 15 years, which shows PBGC's experience in recovering pension costs on terminated plans.

Table 3
Pension Benefit Guarantee Corporation Terminations
Single Employer Plans: Standard and Trusteed
1990 to 2004

			----------In Millions----------		
Year	Standard Terminations	Trusteed Terminations	Gross Claims	Recoveries	Net Claims
1990	11,800	101	$107.7	$7.6	$100.1
1991	8,600	175	$1,536.8	$230.8	$1,306.0
1992	6,670	157	$571.6	$157.7	$413.9
1993	5,320	124	$130.4	$13.3	$117.1
1994	3,950	135	$495.1	$35.0	$460.1
1995	3,870	121	$162.2	$7.1	$155.1
1996	3,809	96	$168.6	$32.0	$136.6
1997	3,497	82	$208.5	$11.8	$196.7
1998	2,475	63	$75.5	$5.9	$69.6
1999	1,969	76	$168.5	$13.1	$155.4
2000	1,882	72	$101.9	$15.3	$86.6
2001	1,565	110	$1,204.3	$183.8	$1,020.5
2002	1,214	177	$3,574.6	$234.6	$3,340.0
2003	1,119	140	$6,393.0	$131.7	$6,261.3
2004	1,189	96	$3,010.6	$325.4	$2,685.2

Source: Pension Benefit Guarantee Corporation, Pension Insurance Data Book 2004, "PBGC Terminations. . .Single Employer Program," Table S-3, p. 28.

In addition to issues related to the value of pension assets received by PBGC from terminated plans, is the adequacy of premium income to meet current benefit and administrative expenses. In order to maintain the short-term solvency of PBGC, premiums should be adjusted to produce revenue income sufficient to meet the current obligations of the corporation. Table 4 provides information and analysis on this solvency issue.

Table 4

Pension Benefit Guarantee Corporation's Premium Revenue and Net Premium Income over Benefits Paid and Other Expenses
1985 to 2005

Fiscal Year	Premium Revenue in Millions	Benefit Payments in Millions	Administrative Other Expenses In Millions	Premiums Less Benefits+Expenses In Millions
2005	$1,451	$3,686	$ 342	-$2,577
2004	$1,458	$3,006	$ 288	-$1,836
2003	$ 948	$2,488	$ 290	-$1,830
2002	$ 787	$1,537	$ 225	-$ 975
2001	$ 821	$1,042	$ 184	-$ 405
2000	$ 807	$ 902	$ 167	-$ 262
1999	$ 902	$ 901	$ 161	-$ 160
1998	$ 966	$ 847	$ 158	-$ 39
1997	$1,067	$ 823	$ 155	$ 89
1996	$1,146	$ 790	$ 150	$ 206
1995	$ 838	$ 761	$ 138	-$ 61
1994	$ 955	$ 719	$ 135	$ 101
1993	$ 890	$ 720	$ 107	$ 63
1992	$ 875	$ 634	$ 97	$ 144
1991	$ 741	$ 514	$ 71	$ 156
1990	$ 659	$ 369	$ 63	$ 227
1989	$ 603	$ 353	$ 45	$ 205
1988	$ 465	$ 357	$ 48	$ 60
1987	$ 268	$ 300	$ 36	-$ 68
1986	$ 201	$ 261	$ 33	-$ 93
1985	$ 82	$ 170	$ 33	-$ 121

Annual % Decrease in PBGC Net Income versus Expenses:1985-2005	16.52%
Annual % Decrease in PBGC Net Income versus Expenses:1995-2005	20.58%

Source: Pension Benefit Guarantee Corporation, Pension Insurance Data Book 2004, "Single Employer Data Tables," Table S-2, p. 26; 2005 PBGC Annual Report, "Financial Statement Highlights," p. 2 and "Statements of Operations and Changes in Net Position," p. 20.

In the years between 1985 and 1995, premium revenues were sufficient to cover current benefits and expenses in all but four years [see graph 1, in Appendix C]. However, after 1995, premium revenues were not enough to fund benefits and administrative expenses in all but two years. From an operations perspective, PBGC will need to increase premium rates significantly more than the pure risk rate, in order to overcome past operating deficits and meet future benefit obligations.

Macroeconomic factors related to interest rates, unemployment, inflation, productivity, and aggregate demand for goods and services will impact PBGC funding and claim cost experience over time. Internally, PBGC invests premium funds prior to their use in paying retiree claims. Part of these invested assets are placed in interest bearing fixed income securities, another portion in equities. In 2004, PBGC's total return on investment was 8%, due in part to a 15% rate of return on equities against a 5.6% rate of return on fixed-income securities.[11] In 2004, PBGC adopted a new investment policy of asset-liability maturity matching that has led to increasing investment in duration-matched fixed income instruments and a decrease in the percentage of PBGC assets in equities to between 15 to 25%.[12] While this policy may limit PBGC's interest rate risk exposure to market interest rates, it may not overcome macroeconomic risks associated with repricing of securities and PBGC liabilities. For example, in 2003 with the termination of plans associated with Bethlehem Steel, National Steel and the U.S. Airlines Pilots due to deteriorating economic conditions in these industries, PBGC saw declining stock prices reduce the value of its assets, while lower market interest rates raised the present value of PBGC's future pension liabilities.[13] The consequence of these two macroeconomic factors was an increase in PBGC's negative net financial position more than two-fold, from -$11.2 billion in 2002 to -$23.3 billion in 2003.

Changes in unemployment and economic conditions within individual industries and geographic areas also dramatically impacts PBGC funding needs. Table 5 shows PBGC's claim distribution by industry type for the years 1975 to 2004. Total claim experience appears heavily concentrated in primary metals, airline transportation, and other manufacturing sectors. Out of the 10 largest PBGC pension fund claims during this period, 5 were steel companies, 4 were airlines and the remaining firm was Kaiser Aluminum. [14] Taken together the three highest industry groups for PBGC claims experience represented 54.93% of all losses paid from 1975 to 2004.

[11] Pension Benefit Guarantee Corporation, 2004 PBGC Annual Report, "Investment Activities," p. 17.
[12] Pension Benefit Guarantee Corporation, op.cit, p. 17.
[13] Federal Reserve Bank of San Francisco, "The Present and Future of Pension Insurance," FRBSF Economic Letter, (August 29, 2003), No. 2003-25, pp. 1-2.
[14] Pension Benefit Guarantee Corporation, Pension Insurance Data Book 2004, Table S-5, p. 20.

Table 5

Pension Benefit Guarantee Corporation Claim Distribution by
Type of Industry and Vested Participant 1975-2004

Industry Description	Total Claims [In Millions]	Distribution	Vested Participants	Distribution
Agricultural, Mining, Construction	$530,441	2.57%	39,321	2.81%
Manufacturing				
Chemical & Allied Products	$118,450	0.57%	9,102	0.65%
Fabricated Metals	$776,463	3.76%	76,154	5.44%
Food and Tobacco	$142,235	0.69%	26,390	1.88%
Machinery and Computers	$840,298	4.07%	79,049	5.64%
Motor Vehicle Equipment	$255,896	1.24%	27,582	1.97%
Paper & Allied Products	$137,795	0.67%	14,784	1.06%
Primary Metals	$10,995,512	**53.26%**	394,148	**28.14%**
Rubber and Plastics	$280,132	1.36%	22,863	1.63%
Other Manufacturing	$1,610,608	7.80%	237,174	**16.93%**
Transportation and Utilities				
Air Transportation	$2,857,632	**13.84%**	138,079	**9.86%**
Other Transportation/Utilities	$677,441	3.28%	62,264	4.45%
Wholesale Trade	$408,187	1.98%	45,146	3.22%
Retail Trade	$363,744	1.76%	121,086	8.64%
Finance, Insurance and Real Estate	$215,136	1.04%	22,945	1.64%
Services	$435,344	2.11%	84,585	6.04%
Total Claim Costs	$20,645,314	100.00%	1,400,672	100.00%

Source: Pension Benefit Guarantee Corporation, Pension Insurance Data Book 2004, "PBGC Claims by Industry Single Employer Program," Table S-19, p. 44.

Since many of these industries are located within specific geographic areas across the US, the concentration of PBGC benefit payments is centralized to states within the Mid-Atlantic and Great Lakes portions of the country. Table 6 provides a breakdown of PBGC benefits paid by region for 2004. In 2004, PBGC paid out $1.015 billion in benefits to program participants in the Mid-Atlantic States of Delaware, Washington D.C., Maryland, New Jersey, New York, Pennsylvania, Virginia and West Virginia. In that same year, PBGC paid out $964 million in benefits to retirees in Illinois, Indiana, Michigan, Minnesota, Ohio and Wisconsin within the Great Lakes region of the country. Retiree payments to these two regions represented 65.87% of PBGC's claim costs in the year 2004.

Table 6
PBGC Pension Benefits Paid by Region for Single Employer Plans in 2004

Region	Total Claims 1975-2004 [In Millions]	Participants [In Millions]	2004 Benefits Paid [In Millions]
New England	$ 965	1.964	$ 140.753
Mid-Atlantic	$ 10,009	7.700	$1,015.801
Southeast	$ 1,150	6.434	$ 472.513
Great Lakes	$ 5,748	7.380	$ 964.213
Midwest	$ 428	1.913	$ 109.631
Southwest	$ 811	3.010	$ 99.261
Rocky Mountain	$ 266	1.063	$ 53.686
Pacific	$ 1,247	4.871	$ 133.687
Totals:	$20,605	34.406	$3,005.863

Pension Benefit Guarantee Corporation, Pension Insurance Data Book 2004, "PBGC Pension Data by Region and State: Single-Employer Program," Table S-50, pp. 76-77.

In addition to claim loss concentration by industry and geographical area, is the rise in significant large loss claims over the past few years. Table 7 provides the distribution of claim costs by terminated single employer plans from 1980 to 2004.

Table 7
Pension Benefit Guarantee Corporation Claim Distribution by Termination
Single Employer Plans 1980 to 2004

Claim Size (x) [In Millions]	Fiscal Year 1980-84 [# Plans]	1985-89 [# Plans]	1990-94 [# Plans]	1995-00 [# Plans]	2000-04 [# Plans]	Total Failures [# Plans]	% of Total
x <$ 1	537	451	532	304	274	2098	72.90%
$1<= x < $10	66	66	137	118	215	602	20.92%
$10<=x< $100	18	15	17	16	85	151	5.25%
$100<=x<$1,000			6		19	25	0.87%
X>= $1,000					2	2	0.07%
Terminations:	621	532	692	438	595	2878	100.00%

Source: Pension Benefit Guarantee Corporation, Pension Insurance Data Book 2004, "Single Employer Data Tables," Table S-6, p. 31.

Up until the period 2000 to 2004, there were few terminating pension plans assigned to PBGC with claim costs exceeding $1 billion. However, during this recent period, 2 plans terminated with costs exceeding the $1 billion threshold with an average claim loss of $2.5 billion. Table 8 shows how just a few large loss claims can dramatically change PBGC's dollar cost of claims While claim loss frequency is still heaviest in loss categories less than $10 million [i.e., 92% of the total distribution in Table 7], the less frequent claims exceeding $1 billion dominate PBGC's loss experience [25.68% of PGBC losses in Table 8] for the period 1980 to 2004. .

Table 8
Pension Benefit Guarantee Corporation Dollar Claim Distribution
Single Employer Plans 1980 to 2004

	Fiscal Year						
Claim Size (x) [In Millions]	1980-84 [In Millions]	1985-89 [In Millions]	1990-94 [In Millions]	1995-00 [In Millions]	2000-04 [In Millions]	Total Loss [In Millions]	% of Total
x <$ 1	$79,609	$75,747	$125,335	$94,796	$86,731	$462,218	2.27%
$1<= x < $10	$193,469	$217,215	$449,072	$307,857	$721,991	$1,889,604	9.28%
$10<=x< $100	$470,456	$424,363	$447,350	$380,580	$2,669,594	$4,392,343	21.58%
$100<=x<$1,000		$982,945	$1,819,858		$5,579,968	$8,382,771	41.19%
X>= $1,000					$5,226,177	$5,226,177	25.68%
Total Claim Costs	$743,534	$1,700,270	$2,841,615	$783,233	$14,284,461	$20,353,113	100.00%

Source: Pension Benefit Guarantee Corporation, Pension Insurance Data Book 2004, "Single Employer Data Tables," Table S-7, p. 32.

Monthly retirement income to PBGC recipients varies significantly by age and gender according to 2004 statistics. Table 9 provides a breakdown of PBGC monthly benefits for 2004 by age and gender. There are 2 ½ times as many male versus female payees and the average monthly benefit is a little over twice as much for males as females. The age distribution is asymmetric for females with a greater proportion of payments being made to those over 70. For males, the greatest proportion of payees is found between ages 65 to 80. Differences in morality may explain part of this variation as females have longer life expectancy and men may retire earlier due to age from manufacturing jobs. Going forward, PGBC's monthly benefit costs may increase as the numbers of women earning salaries comparable to men enter the PBGC system. Another concern would be increases in longevity for men which might raise the proportion of PBGC recipients in the age ranges beyond 75.

Table 9
Pension Benefit Guarantee Corporation Age and Gender
of Monthly Benefits for 2004 Single Employer Plans

Age of Benefit Recipient [x]	Male Payees	Distribution	Average Monthly Benefit	Female Payees	Distribution	Average Monthly Benefit
x < 60	58,692	11.36%	$673	19,718	9.97%	$361
60 <= x < 65	69,475	13.45%	$586	20,966	10.61%	$311
65 <= x < 70	88,349	17.10%	$516	27,872	14.10%	$254
70 <= x < 75	89,884	17.40%	$478	31,480	15.92%	$220
75 <= x < 80	85,853	16.62%	$413	35,196	17.80%	$197
80 <= x < 85	69,953	13.54%	$359	33,336	16.86%	$182
85 and older	54,460	10.54%	$296	29,115	14.73%	$155
Total	516,666	100.00%	$475	197,683	100.00%	$229

Note: There are over 2 1/2 times as many male versus female payees, and the average monthly benefit is a little over 2 times a much.

Source: Pension Benefit Guarantee Corporation, Pension Insurance Date Book 2004, "Single Employer Data Tables," Table S-23, p. 48.

Externalities Associated with the Provision of PBGC Insurance

Economic externalities derived from PBGC insurance is an outgrowth of its social welfare function, to provide retirement income to those who find themselves in bankrupt pension plans. While PBGC has been created to operate as a private insurer, the underwriting, sources of premium income, benefit levels, and reinsurance arrangements are subject to political process more than actuarial considerations. The role of government in determining PBGC benefit and premium structures, and how defined benefit plans are funded, plays a significant part in creating external economies and diseconomies for all defined benefit pension participants. Another factor creating externalities is the method used to account for pension liabilities under Financial Accounting Standards Board (FASB) rules.

PBGC insurance is one segment of the social insurance safety net used to provide a floor of income to US retirees. Benefit income provided by PBGC, along with social security, helps meet retirement expenses for those retirees in bankrupt plans.[15] In the absence of PBGC insurance, another form of welfare to retirees in bankrupt plans would likely be provided through the government. Although PBGC receives premium income to help defray part of its claim costs, the ultimate responsibility for paying claims may rest with the federal government. Currently PBGC has a $100 million line of credit with the Department of the Treasury; however, that amount is likely to increase as claim costs rise

[15] Zvi Bodie, "What the Pension Benefit Guarantee Corporation Can Learn from the Federal Savings and Loan Insurance Corporation," Journal of Financial Services Research, (March 1996),Volume 10, Issue 1, pp. 87-88.

above the assets PBGC has in reserve to meet its retirement obligations. A similar situation played out in the late 1980's when the FSLIC had a $750 million line of credit on its deposit insurance coverage with the Treasury, and that amount was later raised to accommodate the large losses experienced with failing S&Ls.[16] Consequently, the federal government is the insurer of last resort and reinsurer to PBGC's insurance program. Any excess loss above PBGC's reserves to cover pension claims may require federal funding. Unlike other reinsurance agreements in the private market, PBGC's arrangement is unique in that the reinsurer [federal government] may have unlimited liability. Private reinsurers will cap the amount of insured losses they accept on the basis of their own insurance capacity. A significant reason for this relationship rests with the notion of the "too big to fail" theory of government assistance to failing corporations. [17] In the past, federal aid to Chrysler, Lockheed Aircraft, Banks and S&Ls has been motivated by the perceived public need to maintain economic stability, a sound banking system and jobs in various regions of the country. Larger corporations who provided work to many American citizens and were mainstays to the US economy, were considered too important to allow for failure. In the case of the banking industry during the 1980's, the federal government ultimately paid for the losses in FSLIC from failing S&Ls in order to prevent bank runs and re-establish confidence in the deposit insurance system.[18]

The federal government's role as a catastrophic reinsurer to PBGC coverage creates a number of externalities between defined benefit pension participants. First, the role of PBGC in taking premiums sufficient to meet average experience and laying off large loss exposure to the Treasury, allows for moral hazard relationships between PBGC, the Department of the Treasury and corporate sponsors of defined benefit plans. Although PBGC premiums consist of both a flat and variable rate component, the focus on setting premiums appears to be on meeting current claim experience, as shown in Tables 1 and 2. In addition, due to the need to have Congressional approval for rate changes, premiums appear to lag experience when it comes to covering PBGC claim costs. For example, the years when PBGC enjoyed a positive net financial position in Table 1[1996-2001] coincide with the decision in 1996 to raise the variable rate premium to a maximum level on unfunded pension liabilities[Table 2]. Given the circumstances, PBGC will need to

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[16] A. Frank Thompson, "An Actuarial Perspective on the Adequacy of the FSLIC Fund," Office of Policy and Economic Research, Federal Home Loan Bank Board, Research Working Paper No. 102, (1981), pp. 36-37; Thompson, Andrew F., Prasad Medury, A. Ramjee, and B. Ramjee, "An Actuarial Approach to the Analysis of Post Deregulation Thrift Failures in the U.S.A.," *Proceedings of the Actuarial Conference on Financial Institutions Risks Colloquium*, Vol. I(1990), Paris, France.

[17] Eugene F. Brigham and Michael C. Ehrhardt, Financial Management: Theory and Practice, 11th Edition,(Cincinnati, Ohio:Southwestern Publishing, 2005), pp. 815-816.

[18] See discussion of the Financial Institutions Reform, Recovery and Enforcement Act (FIRREA) of 1989, and the Federal Deposit Insurance Corporation Improvement Act of 1991 (FDICIA) in Donald Fraser, Benton Gup, and James W. Kolari, Commercial Banking: The Management of Risk, (Cincinnati, Ohio: Southwestern Publishing, 2001), pp. 42-45. For a analysis of what happens when confidence is shaken in a bank insurer see: Linda E. Bowyer, A. Frank Thompson, Venkat Srinivasan, "The Ohio Banking Crisis: A Lesson in Consumer Finance," The Journal of Consumer Affairs, Vol. 20, No. 2(1986), pp. 290-299.

set a retention limit on those claims that can be paid from premium income based on governmentally approved rates. The theory behind setting a retention limit on PGBC coverage is contained in Appendix A.

Since rates are not charged in relation to the actual cost of coverage consisting of average loss plus a loading for large loss exposure, corporate sponsors pay less than an actuarial defined premium. Therefore, corporate sponsors may feel free to assume higher investment and funding risks to their plans, knowing that ultimately PBGC and the federal government provides coverage against loss at a bargain rate. For example, despite evidence that pension assets invested in equities increase risk and instability for funding defined benefit plans, many US plans have a majority of their plan assets assigned to equities.[19] This type of adverse selection creates externalities amongst corporate sponsors. Healthier corporate plans that have conservatively invested pension assets and little or no unfunded pension liabilities, pay flat premium rates that subsidize riskier pension plans through PBGC insurance.

In some cases, PBGC contributes to the creation of externalities by writing favorable regulations to allow for credits from current increases in corporate pension assets to reduce funding requirements for meeting significant pension under funding. For instance, neither Bethlehem Steel nor US Airways were required to make cash contributions in the years leading up to their pension plan terminations, and surprisingly, notwithstanding the fact that the United Airlines pilots' plan was under funded by nearly $3 billion, the UAL was not required to make plan contributions for 1996 to 2004, the few years prior to plan termination. [20] The impact of such a credit policy allows under funding to remain in place, for plans having significant deficits, while PBGC continues charging premiums below the cost of coverage. Eventually, this externality gets absorbed into higher flat and variable premiums, as Congress recognizes premiums need to be increased in order to meet current claim experience, as occurred after 1996. The PBGC premium increases produce an economic cost to the healthier plans and PBGC itself. Higher premiums add to the corporate cost of providing a defined benefit plan, thereby leading to decisions about plan size and type of benefits offered. Appendix B provides an examination of these external relationships using the economic theory of clubs. As premiums increase, the probability that fully funded pension plans will convert to defined contribution programs and leave PBGC, rises. As the base of support for premium income erodes with the departure of well funded pension plans, the ability of PBGC to increase

[19] Jeremy Gold, "Accounting/Actuarial Bias Enables Equity Investment by Defined Benefit Pension Plans," North American Actuarial Journal, Vol. 9, Issue 3 (July 2005), pp. 1-2.

[20] Pension Benefit Guarantee Corporation, "The Impact of Pension Reform Proposals on Claims Against the Pension Insurance Program, Losses to Participants and Contributions, October 26, 2005, pp. 29-30. The original white paper can be referenced at: http://www.pbgc.gov/docs/wp 040605.pdf

premiums on poorer plans becomes limited. Charging higher PBGC premiums to the remaining unfunded pension plans may only serve to accelerate their path to bankruptcy and assignment of pension liabilities to PBGC. [21]

Accounting and actuarial rules may also contribute to the creation of externalities between pension plan participants, corporate sponsors, PBGC and the federal government as reinsurer. When determining a defined benefit pension liability, accountants rely on actuarial assumptions about future wage rates and an interest assumption to discount future pension obligations back to the present.[22] Actuarially, an unfunded pension liability represents the extent the present value of future benefit obligations exceed the present value of plan assets. An actuarially conservative low discount rate assumption may require greater funding of a pension deficit, while a higher rate assumption may reduce projected unfunded pension liabilities allowing for a lesser funding requirement. In addition, in order to get to a valuation of the pension obligation, assumptions must also be made with respect to future rates of withdrawal, inflation and changes in salary compensation. Under FASB accounting rules, corporate pension sponsors have the flexibility of changing these assumptions which leads to alterations in the pension fund liability. Higher withdrawal rates may result in less long term funding of pension liabilities, if cateris paribus, inflation and salary changes were somewhat benign. On the other hand, if withdrawal rates remained constant over time, but inflation or salary compensation grew dramatically, this might cause pension liabilities to increase dramatically.

In order to address pension funding issues, and the need for accounting transparency with respect to the accuracy of financial statements, FASB promulgated several accounting rules [FASB Statements 5, 35,36,87, 88 and 132; APB Opinion 8] to improve pension reporting.[23] During the early 1980's FASB statements 87 and 88 were issued and these accounting rules allowed corporate sponsors to select from any of five difference actuarial methods for costing the accrued liabilities in a defined benefit plan [Accrued Benefit Cost{unit cost}, Entry Age Normal, Modified Accrued Benefit, Projected Unit Credit and Attained Age Cost]. Depending on which of these methods was selected and how long they remained in place, a firm could show that their pension plan had either a

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[21] The relationship of the size of an unfunded pension liability and limitations to setting risk adjusted premiums is similar to setting variable deposit insurance premiums relative to net worth position for financial institutions such as S&Ls. For a theoretical discussion of this issue see: Thompson, Andrew F., Linda E. Bowyer, and A. Bhattacharya, "Theoretical Propositions on the Effect Minimum Net Worth Requirements have on Insolvency and Bankruptcy for Stock S&Ls," *Invited Federal Home Loan Research Working Paper No. 51*, Office of Policy and Economic Research, Washington, D.C. (March 1985), pp. 1-11.

[22] A. Frank Thompson, Yong H. Kim, and Philip W. Glasgo, "Pension Liability Reporting under ERISA," Employee Benefits Journal, Vol. 8, Issue 1 (March 1983), pp. 1-28.

[23] FASB statements can be accessed at: www.fasb.org on the web. FASB 132 is the latest statement to address accounting for defined benefit pension plans as was issued in 1998 and significantly revised in the area of actuarial costing in 2003.

surplus or deficit depending upon which actuarial assumptions were used for inflation, withdrawals, salary benefit structure and discount rate.[24] Eventually, this difficulty was recognized by the Financial Accounting Standards Board in 2003 when an amended Statement 132 was issued. In that statement FASB moved away from all cost approaches to benefit methodologies in determining plan liabilities. Under the benefit methods, a determination is made of future benefits attributable to employee service in the present reporting year with the cost equal to the actuarial value of those future benefits. This liability represents the difference between the cost of the benefits against the current value of the pension's assets, marked to market.[25]

While adoption of this new reporting requirement may be an improvement over allowing employers to pick and choose from five actuarial cost methods over time, externalities remain with the family of benefit costing methods that may create difficulties for PBGC, plan participants and the federal government as reinsurer. For example, in calculating service benefits, the corporate sponsor will need to make an assumption about the number of expected years of service for each employee. Such an assumption allows a future benefit calculation to be determined on the basis of years of service and the salary benefit formula [e.g. career average, final year's salary, final salary over the past 5 years]. However, corporate sponsors have latitude in what type of assumption might be made with respect to years of service. One method might be to assume an equal distribution of expected future years of service over the workforce [e.g. 100 employees who are expected to leave at a constant rate over 20 years {5 workers each year}]. The amortization of unrecognized prior service costs would be accelerated in early service years under such a configuration. However, should actual withdrawal rates become slower in early service periods than what is projected with the constant rate formulation, the amortization might prove to be too little over time. [26] Higher unfunded liabilities would increase pension plan risks for participants, PBGC insurance, and the excess loss coverage supplied by the federal government through the Treasury's line of credit. Further complicating this type of accounting for pension costs is the flexibility corporate sponsors have in selecting and switching to a new method of recognition for prior service. To follow up, if an employer were to select the straight line amortization approach with averaging over the remaining service period, the unfunded liability might be drawn down much more quickly.[27] It would appear that corporate sponsors might have some incentive to switch plan assumptions with respect to benefit method for recognizing prior service costs, based on their interest in fully funding their plan. The corporate sponsors decision would be independent of PBGC's premium structure, and the federal government's coverage of large losses to insured pensions. A corporate sponsor could switch plan assumptions, reduce unfunded pension liabilities, minimize PBGC premiums and actually have higher risk of plan termination.

[24] Thompson, Kim, and Glasgo, op.cit, 2-7.. This particular article shows how changing actuarial cost methods and/or altering discount or wage rate assumptions pension liabilities can vary dramatically causing the accounting liability to vary significantly over time.
[25] Financial Accounting Standards Board, Statement No. 132 Amended 2003, op.cit., pp. 40-45.
[26] Financial Accounting Standards Board, Statement of Accounting Standards No. 87, 1985, pp. 75-77.
[27] Financial Accounting Standards Board, Ibid., pp. 77-79.

While the revised FASB Statement Number 132 does address some important issues related to fully recognizing pension plan costs, the lack of a requirement for sensitivity analysis on plan assumptions creates further externalities for PBGC and workers.[28] The purpose of sensitivity analysis would be to expose the cost calculations to changes in economic, actuarial and financial variables that impact pension funding liabilities.[29] Sensitivity analysis might allow PBGC to better understand the robustness of the cost calculations to determine its financial risk of acquiring a terminated plan in the future. In addition, without sensitivity analysis to determine key factors that might influence the long-term survival of a pension plan, workers might not be able to assess the strength of their retirement plan in order to make personal choices about other retirement programs [e.g. Roth, Traditional IRA funding].

Perspectives and Conclusions Relating to the Actuarial Adequacy of PBGC

Pension Benefit Guarantee Corporation provides insurance coverage to American workers who participate in defined benefit plans managed by the company's where they find employment. The corporate sponsors offer these plans as a form of deferred compensation to workers, and managers are free to configure their programs and account costs based on current regulations and accounting rules. PBGC prices coverage, receives and invests premiums, at levels below long term claims experience. For the past ten years, PBGC's deficit financial position has been growing at an accelerating rate. During the past two years, PBGC has faced a couple of large loss claims that seem to have greatly increased pension losses and reserve credibility. It does not appear that PBGC's current premium structure will allow it to overcome its $22 billion deficit anytime soon. The current proposed changes, coming out of the recently enacted Deficit Reduction Act of 2006, may reduce the deficit, but as premium rates increase certain externalities may result in lower PBGC funding. For example, higher premiums may encourage better pension plans to voluntarily convert to defined contribution plans thereby escaping the tax. At the same time, higher premiums could increase expenses for already weak plans to the point where the corporate sponsor files for bankruptcy and puts its pension to PBGC.

If PBGC is to remain viable as an insurer and the reinsurer [federal government] have limited exposure to catastrophic loss, the welfare function would have to be decoupled from the insurance coverage. The insurance aspects of PBGC coverage is to protect

[28] Financial Accounting Standards Board, op. cit., p. 27.

[29] Such sensitivity analysis was of significant importance in guaranteeing a return of vested benefits to all policyholders in the case of the Baldwin-United rehabilitation; see: Stanley Tulin, Daniel McCarthy, and Bruce Ogg, "A Report on the Financial Aspects of the Rehabilitation Plan for National Investors Life Insurance Company, National Investors Pension Insurance Company, Mt. Hood Pension Insurance Company, National Equity Life Insurance Company, Inc. S&H Life Insurance Company, and University Life Insurance Company," Milliman and Robertson, January 1984; and A. Frank Thompson, "Report on an Actuarial and Financial Analysis of the Rehabilitation of the Baldwin United Insurance Subsidiaries," January 1984.

workers from loss due to what might be termed normal experience. Pension losses that are predictable, to some extent unchanging over time, can be readily measured with the risks diversified over a large group of workers may be adequately covered through an insurance program. Within PBGC's past loss experience, there have been times when insurance coverage fit this description [e.g. 1980-1995]. In order for there to be discipline between PBGC underwriting, and reserving, premiums for these types of losses would need to be set actuarially based on identifiable pension plan risks. Adjustments would in all likelihood have to be made annually not once every 10 years.

The other, implicit component to PBGC insurance, is the welfare aspects provided by making sure large numbers of pension participants are guaranteed retirement benefits that are sufficient to meet basic retirement needs. This welfare function might best be financed, not under the guise of an insurance premium, but rather a progressive tax. One such possibility would be to develop a tax on gross executive compensation above a threshold amount or the value of executive stock options received at year's end. One could argue that a contributing factor to PBGC current catastrophic loss component may be the managerial decisions made by corporate executives in failing to adequately fund pension liabilities in the plans they control. Laying aside the political ramifications of such a proposal, the extent of the tax would have to be determined on the basis of the amount of catastrophic loss assigned to PBGC, the tax rate and the value of compensation to be taxed.

Appendix A

A Theoretical Model for Determining PBGC's Retention Limit on Insuring Defined Benefit Pension Plans[30]

In order for PBGC to remain viable as an insurer, premiums must be sufficient to cover: (1) current loss experience and (2) claims that can reasonably be expected in the future. A pure risk premium representing the expected value of future losses, funds current claims while the loading is used to provide for administrative expenses and reserving for incurred but not yet reported loss. Before PBGC can determine an adequate premium rate, it must first decide on how much coverage to retain. The retention represents a maximum amount of coverage PBGC can reasonably reserve, based on premiums and investment return. Insuring defined benefit pensions involves two risks: (1) investment risk associated with the return on pension securities and (2) management risk which relates to the ability to adequately set aside funds to meet pension obligations. Each of these risks may depend upon exogenous economic conditions over time. The dynamic and fundamental nature of these risks are such that PBGC may be unable to retain responsibility for catastrophic coverage should large pension losses to entire companies or industries occur. Currently, the PBGC has a $100 million statutory line of credit with the U.S. Treasury Department which could be used to maintain liquidity should there by massive withdrawals to the corporation.[31] To remain viable, PGBC needs to price its insurance in such a way that the agency's capacity to retain insurance will increase with the size of its reserves. A dynamic control model will be used to identify the relationships involved in determining PBGC's retention limit on insuring defined benefit plans.

One way of examining the impact operating capacity has on insurance retention is to view PBGC as a primary insurer seeking to cede [transfer] excess loss insurance to an outside reinsurer [U.S. Treasury Department]. In addition to quantifying the connection between retention limit and PBGC reserve size, such a model may prove useful in determining a suitable credit line for excess coverage. PGBC's investment funds can be divided into two parts. One consisting of technical reserves R' to meet current claim experience. The other fund represents longer term, free reserves R'' used to meet

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[30] This material is based on results first reported in, A. Frank Thompson, Anju Ramjee, and B. Ramjee, "Pension Valuation and Unfunded Liability Measurement: Financial Management Implications," Proceedings of the Risk Theory Seminar, University of Southern California (May 1984), and cited in Linda J. Martin, and A. Jeremy Ifflander, Pension Fund Perspectives, Financial Analysts Journal, Vol. 40, No. 4(July/August 1984), pp. 10-11. The control model is an extension of one first developed in A. Bensoussan, E. Gerald Hurst, Jr. and B. Naslund, Management Applications of Modern Control Theory, (Amsterdam: North Holland Publishing, 1974), pp. 111-129.

[31] Federal Reserve Bank of San Francisco, FRBSF Economic Letter, "The Present and Future of Pension Insurance,"No. 2003-25, August 29, 2003, p. 2; also found in: http://www.frbsf.org/publications/economics/letter/2003/el2003-25.html

unexpected adverse loss away from expected results.[32] R'' directly relates to the amount of insurance PBGC can absorb in its risk portfolio.

Let, $K_1(t)$ = the amount in R' at time t.

$K_2(t)$ = the amount in R" at time t.

These two reserve funds will earn individual interest rates of return δ_1 and δ_2 over time. Thus,

$\delta_1(t)$ = the short-term interest rate on funds held in K_1,

$\delta_2(t)$ =the long-term rate on fixed income investments in K_2,

$\delta_3(t)$ =the long-term rate capital appreciation rate on funds in K_2.

If F[x(t)] represents the cumulative claims distribution function, then the technical reserve for meeting expected claims is:

$$d(t) = \int_0^{\infty} [\, x(t)]\, F'[x(t)]\, dt$$

where $x(t) = K_1(t) + K_2(t) + P(t)$ and $P(t)$ = PBGC premium income in period t while d(t) represents PBGC's demand for cash to meet claims in period t, $[d(t) \varepsilon [0,\infty)]$. The controller is u(t), the amount of insurance coverage PBGC cedes to the U.S. Department of the Treasury through credit line in time t. $|u(t)| < M$, where M is an upper bound on the amount of credit that PBGC can draw upon in any time period. In this case M would be equal to $100 million. The set of state equations area as follows:

$$\dot{K}_1(t) = \delta_1(t) \cdot K_1(t) - d(t) + u(t) - \alpha\,|u(t)| + \delta_2(t) \cdot K_2(t) \qquad (1)$$

$$\dot{K}_2(t) = \delta_3(t) \cdot K_2(t) - u(t) \qquad (2)$$

According to equation (1), a change in the technical reserve, $\dot{K}_1(t)$ results from:

(i) a short term interest return $\delta_1(t) \cdot K_1(t)$
(ii) a decrement d(t) based on the payment of claims at time t
(iii) an increase (or decrease) by using the credit line u(t)
(iv) a payment of transactions costs for the use of the credit line $\alpha\,|u(t)|$, and
(v) a short term return on fixed income assets $\delta_2(t) \cdot K_2(t)$.

[32] Let F(x) = the cumulative claims distribution function which represents the probability that the amount of claims paid under PBGC insurance will not exceed the random variable x. $R' = \int_0^{\infty} x\, F'(x)\, dx$ the technical reserve and R'' = a safety reserve, an amount held in addition to R' used to meet contingent losses greater than expected claims.

Differential equation (2) represents changes to the long term safety reserve, $K_2(t)$ from:

(i) an increase (or decrease) in the long-term value of safety reserve assets $\delta_3(t) \cdot K_2(t)$, and
(ii) a decrease caused by the use of the PBGC credit line with the U.S. Department of the Treasury [-u(t)].

PBGC's objective is to maximize the amount of money in reserve to meet its claim experience, therefore the goal is to maximize the functional $[K_1(t) + K_2(t)]$ with respect to the controller u(t) over time subject to the state equations (1) and (2). The canonical representation of this system is given as:

$$\text{Max } \{ [1,1] \cdot \vec{K}(t)\}$$

SUBJECT TO:

$$\dot{\vec{K}}(t) = A \cdot \vec{K}(t) + b \cdot u(t) + c \qquad (3)$$

Where:

$$\vec{K}(t) = [K_1(t) , K_2(t)]' ,$$

$$A = \begin{bmatrix} \delta_1(t) & \delta_2(t) & 0 \\ 0 & 0 & \delta_3(t) \end{bmatrix}$$

$$b = [1 - \alpha , -1]' \text{ , and } c = [-d(t) , 0]' ,$$

with claims experience d(t) exogenously defined. PBGC wants to find the optimal decision rule $u^*(t)$ from a set of rules $\{u_i$, for all i = 1,2,3, . . . n$\}$, which leads to a maximum value for $[K_1(t) + K_2(t)]$ at terminal time T [the length of PBGC's planning horizon].

Selecting any $u_i(t)$ leads to some terminal value for $[K_1(t) + K_2(t)]$. The set of admissible controls $u_i(t)$ is bounded by M, and the state system is linear in u(t) and $\vec{K}(t)$ which guarantees a unique solution. The Hamiltonian can be defined as:

$$H[K_1(t), K_2(t), p_1(t), p_2(t), u(t),t] = \qquad (4)$$

$$p_1(t) \{ \delta_1(t) \cdot K_1(t) - d(t) + u(t) - \alpha |u(t)| + \delta_2(t) \cdot K_2(t)\}$$

$$+ \quad p_2(t) \{ \delta_3(t) \cdot K_2(t) - u(t)\}$$

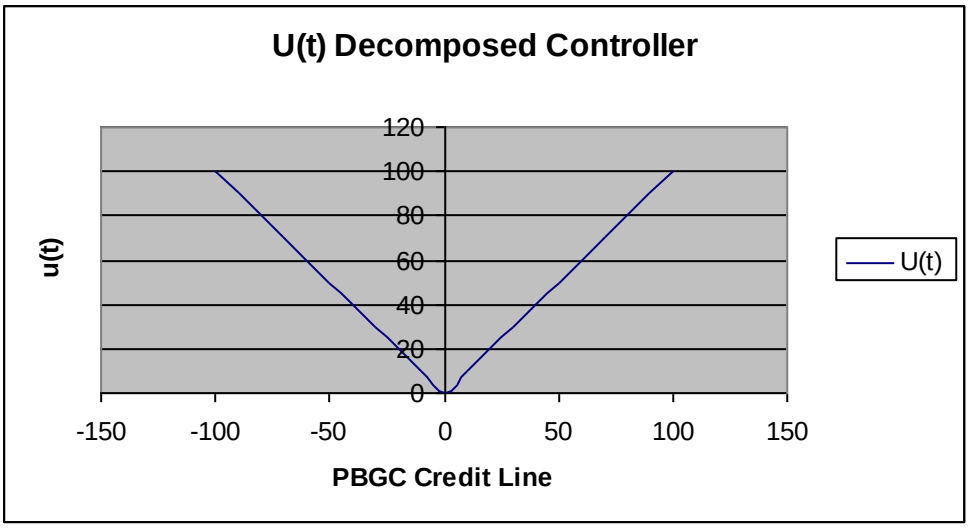
where $p_1(t)$, and $p_2(t)$ are co-state or shadow price variables. Applying Pontryagin's maximum principle, an optimal policy can be obtained from the linear system of equations defined by:

$$\frac{\partial H[K_1(t), K_2(t), p_1(t), p_2(t), u(t),t]}{\partial u} = 0$$

The controller u(t) can take on both positive or negative values depending on whether PBGC is using or restoring its $100 million credit line in time t. Since |u(t)| is a discontinuous function, it is not possible to directly differentiate H. However, by suitably defining u(t) a derivative can be obtained over a finite interval. Let:

$$u(t) = u^+(t) - u^-(t) \quad \text{for all } u^+(t) >= 0,\ u^-(t) >= 0,\ u^+(t) \cdot u^-(t) = 0$$

The decomposed controller u(t) has the following graphical configuration:



$u(t) = u^{+}(t)$, whenever PBGC is using their credit line with the Treasury,
$u(t) = u^{-}(t)$, whenever PBGC is restoring its line of credit with the Treasury,
$u(t) = 0$, whenever PBGC is able to meet all its claim experience through premium income and is not using the line of credit with the Treasury. Under this new formulation the Hamiltonian is redefined as:

$$H[K_1(t), K_2(t), p_1(t), p_2(t), u(t), t] \qquad (5)$$

$$= p_1(t) \{ \delta_1(t) \cdot K_1(t) - d(t) + [u^{+}(t) - u^{-}(t)] - \alpha [u^{+}(t) - u^{-}(t)] + \delta_2(t) \cdot K_2(t) \}$$

$$+ p_2(t) \{ \delta_3(t) \cdot K_2(t) - [u^{+}(t) - u^{-}(t)] \}$$

Maximizing the functional H with respect to $u^{+}(t)$ and $u^{-}(t)$:

$$\frac{\partial H}{\partial u^{+}(t)} = [1 - \alpha] p_1(t) - p_2(t) \qquad (6)$$

$$\frac{\partial H}{\partial u^{-}(t)} = -[1 - \alpha] p_1(t) - p_2(t) \qquad (7)$$

Since H is linear in $u^{+}(t)$ and $u^{-}(t)$ the solution defines an on-off or what is known as a bang-bang switching policy where:

$$u^{+}(t) = \begin{cases} M & \text{if } \dfrac{\partial H}{\partial u^{+}(t)} > 0, \; [1 - \alpha] p_1(t) - p_2(t) > 0 \\ 0 & \text{if } [1 - \alpha] p_1(t) - p_2(t) \leq 0. \end{cases}$$

$$\bar{u}(t) = \begin{cases} -M \text{ if } \dfrac{\partial H}{\partial \bar{u}(t)} > 0, \; -[1-\alpha]\, p_1(t) - p_2(t) > 0, \\ 0 \text{ if } -[1-\alpha]\, p_1(t) - p_2(t) \leq 0. \end{cases}$$

PBGC will utilize the credit line whenever $[1-\alpha]\, p_1(t) > p_2(t)$ and will attain more insurance capacity by restoring the line when $p_2(t) > [1-\alpha]\, p_1(t)$. The values of the co-state or shadow variables $p_1(t)$ and $p_2(t)$ may be found by examining the system of adjoint equations defined to be:

$$\dot{p}_1(t) = \frac{-\partial H}{\partial K_1(t)} \qquad (8)$$

$$\dot{p}_2(t) = \frac{-\partial H}{\partial K_2(t)} \qquad (9)$$

$$\dot{p}_1(t) = -[\delta_1(t)\, p_1(t)] \qquad (10)$$

$$\dot{p}_2(t) = -[\delta_2(t)\, p_1(t) + \delta_3(t)\, p_2(t)] \qquad (11)$$

Solving (10) for $p_1(t)$:

$\dfrac{\dot{p}_1(t)}{p_1(t)} = -\delta_1(t)$ and integrating both sides over the closed interval $[t,T]$

$\int_t^T [\dot{p}_1(t)/\, p_1(t)]\, dt = -\int_t^T \delta_1(t)\, dt$, which implies that

$\ln[p_1(t)]_t^T = -\int_t^T \delta_1(t)\, dt$, and

$$p_1(t) = e^{\int_t^T \delta_1(t)\,dt} \quad \text{given that } p_1(T) = 1. \qquad (12)$$

Substituting equation (12) into (11):

$$\dot{p}_2(t) = -\delta_2(t)\, e^{\int_t^T \delta_1(t)\,dt} - \delta_3(t)\, p_2(t) \qquad (13)$$

Using the boundary condition that $p_2(T) = 1$ and an application of the variation of parameters formula on this nonhomogeneous linear differential equation:[33]

$$p_2(t) = e^{\int_t^T \delta_3(t)\,dt} - \int_t^T \delta_2(t)\, e^{[\int_t^T \delta_1(s)\,ds + \int_t^T \delta_3(u)\,du]}\,dt \qquad (14)$$

This model describes a risk retention policy for PBGC consistent with the goal of optimizing insurance capacity over time. Given PBGC's retention limit M, claims experience d(t), a time optimal policy for using the Treasury line of credit on an excess loss basis is defined by equations (6), (7), (12), and (14). Since M and d(t) are exogeneous variables, PBGC can perform sensitivity analysis on the optimal solution by varying these two parameters to determine their impact on K(t). Testing of a solution in this way will indicate how dramatically PBGC's retention limit (M) may change as a result of increasing or decreasing claim experience [d(t)]. Such analysis may provide an indication of the adequacy of the size of the retention limit based on number and size of recent claims.

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[33] See: www.cbu.edu/~wschrein/media/DE/Errata04.pdf#search='variation%20of%20parameters%20formula The theorem is as follows: The solution of:

$\dot{x} + a(t)x = q(t)$, $x(t_0) = x_0$ is given by the variation of parameters formula:

$$x(t) = z(t, t_0)x_0 + \int_t^T z(t,s)\,ds, \text{ where } z(t,s) = e^{-\int_t^T a(u)\,du}$$

Appendix B

Analysis of the Externalities Involved in Providing Defined Benefit Pension Benefits[34]

Pensions are a method of compensation between firms and workers, whereby external benefits are exchanged for services. Employees provide work in return for deferred compensation in the form of retirement benefits. Workers accept this form of remuneration as long as there is reason to believe that benefits received in the future exceed foregone salary today. Workers would not accept this relationship if there was reason to believe the employer might default on retirement obligations. Firms will continue to maintain a defined benefit pension plan, as long as, the costs of providing benefits do not exceed productivity gains from offering the additional compensation. Pension plans are a voluntary means for employers to pay workers an implicit wage in the form of retirement income. Tax law relating to the expensing of pension costs, and deferral of taxes on pension asset accumulations allow employers to provide additional income to workers at lower cost. On the other hand, if the cost of the pension plan exceeds the firm's budget constraints for such benefits, then the plan may either be restructured or eliminated. Recent benefit reductions for pensioners in the Airline industry are indicative of these motivations for changing plan structure. Alternatively, large asset accumulations to a pension plan over time may motivate restructuring. In this case, if the present value of the plan's future obligations is significantly less than the cost of freezing benefits, annuitizing pension benefits, and converting to a new plan, the company may make the change and book all asset gains as an extraordinary income item. In the mid-1990's companies such as IBM completed these conversions to free up cash on the balance sheet. Consequently, tax policy, funding arrangements, investment risk, and salary considerations may create externalities between employees as beneficiaries of a pension, and employers who are providers.

Employee defined benefit pensions depend on two factors. The type of benefit paid to workers based on company employment, and the number of employees who share in the pension fund. Consequently, a worker's utility function may be described as:[35]

$$U^{pb} = U^{pb}[B_1, B_2, \ldots . B_N, N]$$

$$U^{pb} = U^{pb}[B_1, N] + U^{pb}[B_2, N] + \ldots \; U^{pb}[B_N, N] \qquad (1)$$

[34] This material is an updated version of analysis originally presented in: A. Frank Thompson, Anju Ramjee, and B. Ramjee, "Pension Valuation and Unfunded Liability Measurement: Financial Management Implications," Proceedings of the Risk Theory Seminar, University of Southern California (May 1984).

[35] James M. Buchanan, and William Craig Stubblebine, "Externality," Economica, (November 1962), pp. 371- 372.

Where: U^{pb} = a twice differentiable, separable utility function,
B_i = the amount of deferred retirement benefits accorded to worker I,
N = the number of members in the defined benefit plan.

The firm's cost function may be denoted as:

$$F^{pc} = F^{pc}[(B_1,N), (B_2,N), \ldots (B_N,N)$$

$$F^{pc} = F^{pc}(B_1,N) + F^{pc}(B_2,N) + \ldots + F^{pc}(B_N,N) \qquad (2)$$

Where F^{pc} is a twice differentiable, separable function. Given these functional relationships, an analogy may be made between a defined benefit pension plan and an economic club.[36] The cost of providing pension benefits to the group depends on the benefits to each worker based on their activities, B_i , and the number of pension participants, N. The addition of new workers will affect the cost of providing benefits. The larger the membership in the pension, the lower the cost of any single member, given the firm's funding constraint. The size of the pension (economic club) determines the level of benefits that may be supplied to workers. Membership in the pension is an externality for both the employer and employee. The employer provides deferred compensation in the form of retirement benefits that are contingent number of participants, length of employment, number of withdrawals, type and cost of benefits based on salary. The worker's benefits are determined related to pension fund claims which depend on management's ability to maintain the solvency and health of the defined benefit plan.

Given these relationships, we can form a Lagrangean to determine the conditions for maximizing the utility of pension plan participants, subject to the firm's funding constraint.

$$L = U^{pb}[B_1, N] + U^{pb}[B_2, N] + \ldots U^{pb}[B_N, N]$$
$$+ \lambda \{\bar{F} - [F^{pc}(B_1,N) + F^{pc}(B_2,N) + \ldots + F^{pc}(B_N,N)]\} \qquad (3)$$

where F is the least upper bound on the amount a firm would be willing to absorb in pension costs [i.e., pension expense, plus premium on PGBC insurance].

[36] The following analysis is based on the economic theory of clubs, see James M. Buchanan, "An Economic Theory of Clubs," Economica, (February 1965), pp. 1-14.

First order maximization conditions are:

$$\frac{\partial L}{\partial B_i} = \frac{\partial U^{pb}[B_i, N]}{\partial B_i} - \lambda \frac{\partial F^{pc}(B_i,N)}{\partial B_i} = 0 \qquad (4)$$

For all I = 1,2,. . . .,N

$$\frac{\partial L}{\partial N} = \sum_{i=1}^{N} \left[\frac{\partial U^{pb}[B_i, N]}{\partial N} - \lambda \left[\frac{\partial F^{pc}(B_i,N)}{\partial N} \right] \right] = 0 \qquad (5)$$

The set of equations described by (4) implies that:

$$\frac{\partial U^{pb}}{\partial B_i} = \frac{\partial F^{pc}}{\partial B_i} \qquad \text{for all i,j = 1,2,. . .,N} \qquad (6)$$

$$\frac{\partial U^{pb}}{\partial B_j} \qquad \frac{\partial F^{pc}}{\partial B_j}$$

the marginal rates of substitution for benefits B_i and B_j must equal the marginal rates of substation of the pension costs for those same benefits in exchange.[37] Marginal differences between B_i and B_j may be due to higher wages, alteration in benefit formulas or greater productivity of one worker over another. Further, using (4) and (5) [based on equality of λ:

$$\frac{\sum_{i=1}^{N} \frac{\partial U^{pb}[B_i, N]}{\partial N}}{\sum_{i=1}^{N} \frac{\partial F^{pc}(B_i,N)}{\partial N}} = \frac{\frac{\partial U^{pb}[B_i, N]}{\partial B_i}}{\frac{\partial F^{pc}(B_i,N)}{\partial B_i}} \qquad (7)$$

[37] $\frac{\partial u^{pb}}{\partial B_i} = \lambda \frac{\partial F^{pc}}{\partial B_i}$, $\frac{\partial u^{pb}}{\partial B_j} = \lambda \frac{\partial F^{pc}}{\partial B_j}$ implies,

$$\frac{\frac{\partial u^{pb}}{\partial B_i}}{\frac{\partial u^{pb}}{\partial B_j}} = \frac{\lambda \frac{\partial F^{pc}}{\partial B_i}}{\lambda \frac{\partial F^{pc}}{\partial B_j}} \Longrightarrow \frac{\frac{\partial u^{pb}}{\partial B_i}}{\frac{\partial u^{pb}}{\partial B_j}} = \frac{\frac{\partial F^{pc}}{\partial B_i}}{\frac{\partial F^{pc}}{\partial B_j}}$$

which leads to:

$$\frac{\sum_{i=1}^{N} \frac{\partial U^{pb}[B_i, N]}{\partial N}}{\frac{\partial U^{pb}[B_i, N]}{\partial B_i}} = \frac{\sum_{i=1}^{N} \frac{\partial F^{pc}(B_i,N)}{\partial N}}{\frac{\partial F^{pc}(B_i,N)}{\partial B_i}} \qquad (8)$$

so that the marginal rate of substitution in a pension with N participants receiving benefit B_i must equal the marginal rates of substitution of the cost of providing benefit B_i in the group.

The implication from conditions (7) and (8) is that the firm will be motivated to add new workers up to the point where the marginal benefits from providing employment just equals the marginal costs incurred in funding the extra retirement income. As a consequence, factors that increase pension costs may directly impact the firm's hiring decisions and its capital to labor ratio. If pension costs increase either due to changes in benefit levels, increases in PBGC premiums, or alteration of the actuarial cost method, firm's may seek to reduce the number of members in the pension (economic club). Recent labor force reductions at US Airways, United Airlines, Delta, GM and Ford may serve to illustrate this relationship.

To better understand these externalities, consider the following classical maximization problem:

$$\text{Max } [\Phi(L,K)]$$

Subject to: $C(L,K) = \gamma K + \{\beta_1 + (1-t)[\beta_2 + \beta_3]\}L$

Where: $\Phi(L,K)$ is a twice differentiable production function which describes the technical relationships between capital, K and labor, L. $C(L,K)$ is a linear, differentiable function of cost based on capital and labor as inputs of production. γ = the payment per unit of capital. β_1 = the direct wage to each unit of labor. β_2 = the pension funding expense per unit of labor and β_3 = the cost of the PBGC premium per unit of labor. t = the firm's marginal tax rate, so that all pension costs are adjusted for taxes.

The Lagrangean is:

$$V = \Phi(L,K)] + \lambda [\overline{C} - \gamma K - \{\beta_1 + (1-t)[\beta_2 + \beta_3]\}L] \qquad (9)$$

where $\overline{C}$ = represents the least upper bound on the firm's cost budget.

Maximizing L with respect to K and L yields the following marginal rates of technical substitution:

$$\frac{\partial V}{\partial K} = \frac{\partial \Phi(L,K)]}{\partial K} - \lambda(\gamma) \quad (10)$$

$$\frac{\partial V}{\partial L} = \frac{\partial \Phi(L,K)]}{\partial L} - \lambda\{\beta_1 + (1-t)[\beta_2 + \beta_3]\} \quad (11)$$

Equations (10) and (11) imply that:

$$\frac{\frac{\partial \Phi(L,K)]}{\partial L}}{\frac{\partial \Phi(L,K)]}{\partial K}} = \frac{\{\beta_1 + (1-t)[\beta_2 + \beta_3]\}}{\gamma} \quad (12)$$

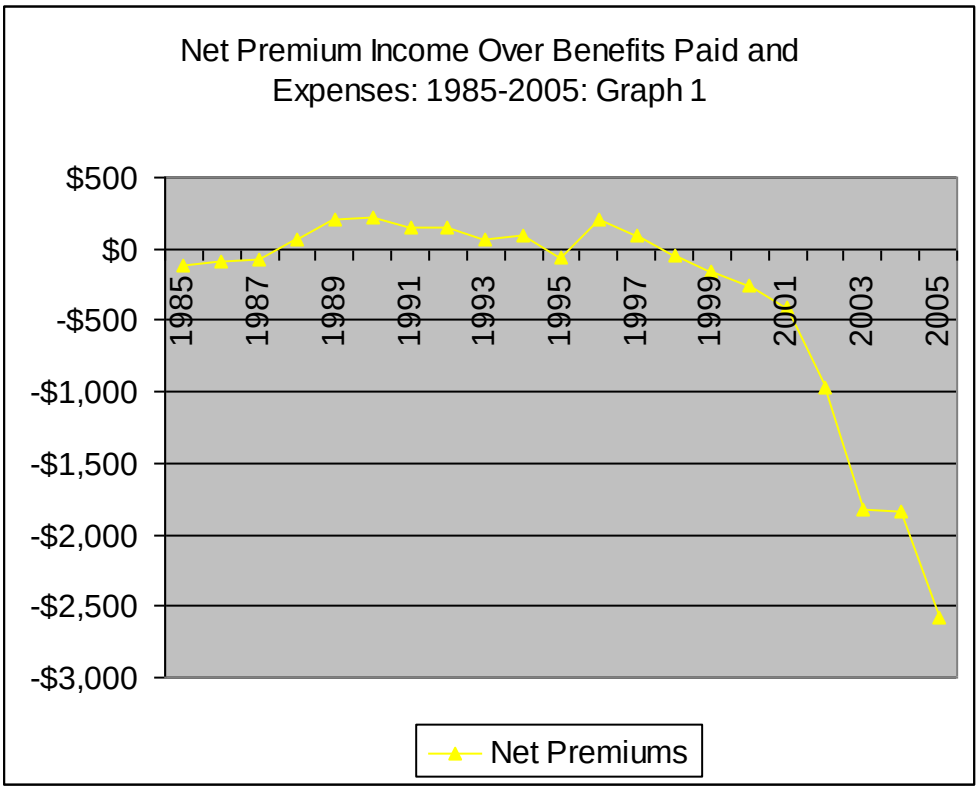
so the marginal rates of substitution of capital for labor equals the ratio of their prices in production. The firm operates up to the level where the return to each factor of production equals its marginal product. Rearranging (12), multiplying means times extremes we obtain:

$$\frac{\partial \Phi(L,K)]}{\partial L}\gamma = \frac{\partial \Phi(L,K)]}{\partial K}\{\beta_1 + (1-t)[\beta_2 + \beta_3] \quad (13)$$

which provides insight into the substitution of capital for labor based on their input costs. If you fix labor costs and labor productivity in (13), then any increase in the cost of capital γ requires an commensurate increase in the marginal productivity of capital, otherwise there will be substitution of labor for capital. By the same token, should the factor cost of labor $\beta_1 + (1-t)[\beta_2 + \beta_3]$ go up, with fixed capital productivity and capital costs, then there must be added gains to the marginal productivity of labor or else capital will be substituted for the more costly labor input. The application of equation (13) relates to a firm's choices with respect to funding a pension plan as deferred compensation. If β_1, β_2 or β_3 rise, then the firm will require either increasing labor productivity, or seek to reduce pension participants, substituting capital for labor. Examples of such decision making would be the layoffs in the airline and automotive industries in 2004 and 2005. Alternatively, firm's faced with an increase in either their actuarial funding cost, β_2 or the cost of PBGC premiums, β_3 may seek to reduce or eliminate these expenses by converting the defined benefit plan to a defined contribution plan and not be burdened by funding the costs of future benefits or the uncertainty of future PBGC premiums. Pension plan conversions by IBM and Rockwell International in the 1990's are examples of such financial management decisions. Note also, that higher corporate taxes would increase the value of the pension fund expenses and thereby

promote the usefulness of a defined benefit plan to the firm. If the firm is in a high tax bracket, the impact of expensing pension contributions and PBGC premiums lessens a company's out of pocket pension costs. However, lower corporate taxes has the opposite effect and may contribute to a company's exit from defined benefit plans. The lowering of corporate tax rates in the 1980's and 1990's may have contributed to the conversion of adequately funded defined benefit pensions into defined contribution 401-K plans. From a public policy standpoint, the external relationship between corporate tax rates and its influence on defined benefit plan expenses should be considered when considering the overall health of PBGC. Conversion of adequately funded, defined benefit pensions, into 401K plans over the past 10 years have eroded PGBC's ability to collect premium income. The better plans have left the PBGC insurance system, leaving a larger proportion of inadequately funded pensions to pay premiums. However, the distressed plans cannot afford the increased premiums, β_3 which motivates them to declare bankruptcy and put the pension liability to PBGC.

Appendix C


Net Premium Income Over Benefits Paid and Expenses: 1985-2005: Graph 1
$500
$0
-$500
-$1,000
-$1,500
-$2,000
-$2,500
-$3,000
1985
1987
1989
1991
1993
1995
1997
1999
2001
2003
2005
Net Premiums