

An Empirical Analysis of Risk-Related Insurance Premiums for the PBGC

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Abstract

In 1986, one component of the single-employer plan termination insurance program was altered in an attempt to assure its financial integrity. A year later, the Pension Benefit Guaranty Corporation proposed that the basis for computing premiums for plan sponsors also be changed and the basic philosophy of the proposal was incorporated in the Omnibus Budget Reconciliation Act of 1987. This article develops probability and severity models for large single-employer defined benefit sponsors. Estimates of the liability that underfunded plans impose on the PBGC are obtained from combining the results of the two models and calculations of insurance premiums are presented.

Introduction

In 1974, the Employee Retirement Income Security Act (ERISA) established a plan termination insurance program for the majority of defined benefit pension plans in the United States to ensure that at least a certain level of participants' benefits would be paid without regard to the funded status or continued existence of the sponsor's pension plan. The extant literature is replete with articles pointing out the perverse financial incentives created by this program (e.g., Sharpe, 1976; Treynor, Regan and Priest, 1976; Treynor, 1977; and Harrison and Sharpe, 1983) and, since its inception, the deficit generated by the single-employer component of this system had grown to as much as \$3.8 billion. In 1986, one of the major defects associated with the

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original design was corrected when the Single Employer Pension Plan Amendments Act (SEPPAA) changed the insured event from that of, in essence, any plan termination to a termination accompanied by a specified event for the plan sponsor.¹

This change effectively limited the insurable event to an insufficient² termination due to bankruptcy by the sponsor, thereby virtually eliminating the opportunity of an ongoing sponsor to exchange the unfunded vested liabilities of the plan for 30 percent of its net worth (an option existing under the original provisions of ERISA). However, it did nothing to change the premium structure from a flat dollar amount per participant.

Congress recently redressed this shortcoming in part by enacting a *variable rate premium* structure that will relate the sponsor's annual premium to the plan's underfunding (as measured on a termination basis). Although this change will factor the plan's potential severity into the determination of the annual premium, it falls short of a *risk-related premium* structure that would characterize the insurance if it were written in the private sector. Such a structure would base annual premiums not only on the potential severity but also the probability of an insured event taking place (i.e., bankruptcy of a sponsor with an underfunded plan). The new premium system also differs from a free market approach in that it includes a maximum charge of \$50 per participant.

The idea of risk-related premiums for the plan termination insurance program is not new. In his seminal work on the establishment of a guaranty fund for pension plan benefits insurance, McGill (1970, p. 76) made a provision to reflect the probability of plan termination in the premium rate if

¹ The PBGC must now determine whether the necessary distress criteria have been satisfied before a voluntary termination may take place. Basically, these criteria are met if each person who is a contributing sponsor or a substantial member of the sponsor's controlled group meets the requirement of any of the following: (1) liquidation in bankruptcy or insolvency proceedings, (2) reorganization in bankruptcy or insolvency proceedings, or (3) termination required to enable payment of debts while staying in business or to avoid unreasonably burdensome pension costs caused by a declining workforce.

The second criteria was technically modified in 1987 when the Omnibus Budget Reconciliation Act of 1987 (OBRA) required, as a prerequisite to distress termination pursuant to a bankruptcy reorganization, that the court determine that, absent termination, the employer will be unable to pay its debts pursuant to a plan of reorganization and will be unable to continue in business outside the chapter 11 reorganization process [ERISA Section 4041(c) (2) (B) (ii) (III)]. However, when combined with the new minimum funding standards for underfunded plans, it is quite likely that the courts will make this determination almost automatically.

² A defined benefit pension plan termination is referred to as insufficient if the market value of plan assets is less than the present value of all benefits guaranteed by the PBGC. Although a plan's guaranteed benefits will be closely related to its vested benefits, they will differ due to the maximum monthly limitation on insured amounts (currently \$2028.41) and ERISA Section 4022(b) which provides for the gradual phase-in of insurance coverage to make the program less subject to abuse from newly established or recently liberalized plans. Vesting is a legal concept that defines what percentage, if any, of the participant's accrued benefits attributable to employer contributions are nonforfeitable. Since the implementation of ERISA, the longest period of service that could be required for 100 percent vesting has been 15 years.

the burden appeared to be consequential. Congress, however, initially set the PBGC premium rates at \$1.00 per participant.³

Although PBGC was provided the opportunity under ERISA Section 4006 to modify this initial premium structure, no action was taken until Congress mandated under SEPPAA that PBGC investigate alternative premium bases upon which some or all projected future program costs could be allocated on a variable rated or risk-related computation. In response, the PBGC (1987, p. 55) produced a proposal for a variable rate premium structure that provided the basic structure of the legislative changes under the Omnibus Budget Reconciliation Act of 1987 (OBRA).⁴

The new single-employer plan termination insurance program increased the flat rate premium to \$16.00 per participant and added a funding charge equal to \$6 per \$1,000 of underfunding, defined as the difference between the present value of vested benefits and the market value of plan assets.⁵ A maximum premium rate (combined flat rate and funding charge) was set equal to \$50 per participant.⁶

Although PBGC (1987) contained a schedule of 1987 premium assessments that would have been collected if the *proposed* variable rate premium had been in effect, no empirical work has yet been conducted on the implicit subsidies produced by this system or the alternative approaches to distributing this subsidy.⁷ Moreover, no empirical work has attempted to estimate the potential premiums distributions under a risk-related premium system. This article shows that the economic premium that characterized the insurance system in 1985 was approximately \$65, compared to the \$8.50 established in 1986 and the \$25 estimated by the PBGC in 1988. It also shows that owing to the omission of the risk factors, the imposition of a maximum charge, and the mismeasurement of severity, the pricing model enacted by Congress, while substantially different from a flat rate charge, generates a premium distribution that is dramatically different from one that would be set in a free market.

³One early version of the bill would have required an initial three-year premium in which the rate per dollar of unfunded vested liability could be increased up to twice the normal level if certain funding tests were not met. A later version provided the authority to prescribe different uniform premium rates after the initial three-year period based upon experience, expectation of continuation of the plan sponsor, expectation of the voluntary continuation of the plan, and other relevant factors. The final House version of the bill based its rate on a combination of a plan's unfunded insured benefits and its total (whether or not funded) insured benefits; however, the conferees accepted the Senate's position of a flat rate per participant for the initial year.

⁴See VanDerhei (1988a) for a detailed discussion of the PBGC proposal.

⁵In measuring vested benefit for purposes of this provision, the statutory valuation rate is 80 percent of the annual yield on 30-year Treasury securities for the month preceding the month in which the plan year begins [ERISA Section 4006(a) (3) (E) (iii) (III)].

⁶For plan years beginning before 1993, the cap is reduced by \$3.00 for each year the plan made the maximum deductible contribution between 1982 and 1987, [ERISA Section 4006(a) (3) (E) (iv) (II)].

⁷VanDerhei (1988b) simulates the premium distributions under OBRA; however, no analysis of the subsidies is provided.

Previous Research

The theory of risk-related premiums for guaranty funds is well established in the insurance literature. Cummins (1988) has recently developed risk-based premium formulas for insurance guaranty funds, and a number of studies have used option pricing approaches to evaluate the worth of deposit insurance (Merton, 1977, Marcus and Shaked, 1984 and Ronn and Verma, 1986). However, pricing the insurance coverage represents only part of the regulatory approach to perceived problems for these insurance schemes.

The Federal Deposit Insurance Corporation monitors the banks it insures and is able to take corrective action in the case of a weak financial institution. The National Association of Insurance Commissioners subjects insurers to similar scrutiny and the various state insurance commissioners may take steps to rehabilitate a company determined to be in a hazardous condition. PBGC, on the other hand, is limited by ERISA Section 4042 (a) (4) to a (theoretical) ability to terminate a pension plan if it appears that "the possible long-run loss of the corporation with respect to the plan may reasonably be expected to increase unreasonably if the plan is not terminated." Its inability to control the plan sponsors' actions, particularly those not directly involving the pension plan, leaves PBGC more vulnerable to adverse financial consequences arising from an inequitably designed premium system.

Although PBGC has conducted a number of internal studies relating to this topic⁸ there appears to be relatively little academic research on the proper pricing of plan termination insurance. Pesando (1982) conducted a study at the time the Canadian government was considering the adoption of a plan termination insurance program along the same lines as the new system enacted under OBRA (i.e., one in which the sponsor's premium is based solely on the insurance system's current exposure). In his model, workers participating in defined benefit plans hold contracts to receive a *certain* pension benefit. They sell put options on the sum of the equity in the firm and the assets in the pension plan with a striking price equal to the pension benefit. Pesando argues that the appropriate insurance premium under the termination in such a scheme is the value of the pension put, a value that is not decreased by additional contributions. He concludes that establishing premiums solely on the basis of some measure of unfunded liabilities is clearly inadequate.

Using option pricing models, Marcus (1983) calculated the present value of PBGC liabilities for 87 of the Fortune 100 companies based on their 1982 annual reports. The aggregates of these liabilities (assuming termination can only take place under bankruptcy) varied from zero to \$5.29 billion, depending on the growth rate and discount rate assumptions.⁹ Although this

⁸ See Munnell (1982) for an excellent review of this literature.

⁹ Unfortunately, Marcus compared present values of PBGC liability for ongoing plans with the PBGC reserves for benefits (\$1.14 billion at the end of fiscal year 1982) and concluded that "the PBGC reserve calculations are wildly optimistic." The reserve for guaranteed benefits is actually the present value of the PBGC's expected payout for those firms that have already terminated. A

was an interesting application of option pricing models to the PBGC's problems, it suffered from two limitations. The inputs necessary to estimate the present value of PBGC insurance (e.g., the correlation between the fund assets and the firm's value) are virtually impossible to determine and, as a result, Marcus used one standard set of "reasonable guesses" for all firms included in his empirical work. Moreover, this calculation does not provide a solution to the correct amount of annual risk-related premium because the firm may survive longer than one year.

Marcus made two suggestions to convert the present value into an annual premium. First, the expected time to termination could be calculated and used to annuitize the present value into an annual rate. Second, the entire present value could be charged as a premium in the first year of the new system. If the present value of the PBGC liabilities due to the sponsor increased during the year, the next year's premium would consist of the difference between the two values. If the present value decreased, the sponsor would receive a refund equal to the difference.

The pragmatic difficulties associated with (1) computing the expected time to bankruptcy for financially secure firms or (2) requiring firms to pay the entire present value of PBGC insurance in a lump sum (a value calculated to be as high as 27 percent of vested benefits for Chrysler in 1982) would make this an untenable approach for pricing plan termination insurance.

A more direct approach is to set a premium equal to the product of the risk of an insufficient termination, times the amount of exposure. For the sake of simplicity, this article estimates a premium solution for a single year, 1985. To solve for a multiperiod model, account must be taken of the variance in market asset and liability values which can dramatically affect exposure over the time period. In addition, in a multiperiod model, account must be taken of the conditions under which premiums can be reset if risk characteristics change. For example, it may be decided that the insurer should not have the ability to increase the premium *rate* per dollar of underfunding when the insured begins to show signs of financial distress. Modifications of the model to account for these factors are left for future research.

Data

The sample for this study consists of all defined benefit pension plans with more than 100 participants that were both (1) sponsored by a firm on the Compustat tapes and (2) underfunded on a termination basis in at least one year in the period 1980 to 1984, inclusive.¹⁰ This sample period was selected because these are the only five years in which the required set of actuarial information is available for all plans filing Form 5500. The 100 participant

valid basis of comparison would have been the present value of expected future premiums for ongoing plans.

¹⁰The procedure used to standardize reported liabilities to the statutory valuation rate is described in Ippolito (1986, p. 65).

screen was due to the nature of the reporting requirements for small plans.¹¹

This sample was then matched with the Form 5310¹² files containing information for each defined benefit pension plan terminating prior to 1987. These files provide information on the date of the termination, the reason for terminating (e.g., bankruptcy), the present value of pension benefits guaranteed by the PBGC, the market value of plan assets, and the amount of employer's liability recovered. This provided the necessary information for defining the dependent variable in both the probability and severity phases of the estimation process. The dependent variable for the probability model was given the value of one if the plan terminated between 1981 and 1984 in a manner that would have satisfied the OBRA definition of an insurable event, and zero otherwise.

Due to core constraints, a 20 percent sample of underfunded plans that did not terminate during this period was used as the control group for the first phase of the estimation procedure in this study. Similar to Ohlson (1980), only one year of information was used for each plan in the control sample. The year of any given plan in the control group was chosen by a random procedure.

This process resulted in a sample size of 1580 plans, 99 of which resulted in a termination during the sample period.

Methodology

The premium charged for a sample plan (P) in this article is:

$$P = p * s$$

where p is the probability of plan termination under the OBRA definitions, and s is the expected severity at the time of the termination. The latter value is not observed prior to the claim but is assumed to be a function of the plan's current funding ratio defined as the ratio of the market value of plan assets to the present value of benefits guaranteed by the PBGC.

Estimation of the Probability Model

A multiple logistic methodology is used to measure the quantitative relationship between the likelihood that a sponsor will terminate an underfunded plan in the next year due to bankruptcy of the plan sponsor and characteristics of the plan sponsor and the pension plan. A standard application of the methodology is not appropriate in this study due to deliberate oversampling of the treatment group. Manski and Lerman (1977)

¹¹ Pension plans with fewer than 100 participants at the beginning of the plan year are exempted from a full annual report on Form 5500 for that year.

¹² The administrator of a terminating pension plan must file a termination report with both the Department of Labor and the PBGC. It appears that IRS Form 5310 (Application For Determination Upon Termination—Notice of Merger, Consolidation or Transfer of Plan Assets or Liabilities) is used to comply with this provision.

show that, if ignored, the choice-based estimation sample will result in asymptotically biased coefficient estimates. Therefore, the weighted exogenous sample maximum likelihood function (L^{WESML}) was maximized, where:

$$L^{\text{WESML}} = \left(\frac{\alpha_p}{\alpha_s} \right) \sum_{n=1}^{N_1} \ln \left[\frac{\exp(X'_{1n} \beta)}{1 + \exp(X'_{1n} \beta)} \right] + \left(\frac{1 - \alpha_p}{1 - \alpha_s} \right) \sum_{n=1}^{N_0} \ln \left[\frac{1}{1 + \exp(X'_{0n} \beta)} \right]$$

and:

α_s = the proportion of failed firms in the sample

α_p = the proportion of failed firms in the population

N_1 = the number of sample plans that terminated in the designated time period

N_0 = the number of sample plans that did not terminate in the designated time period

X_{in} = a vector of independent variables ($i = 0, 1$), and

β = a vector of coefficients.

The basic objective of this study was to determine whether a risk-related premium system based on publicly available information was feasible for the plan termination insurance program. Therefore, similar to the study of deposit insurance premiums by Avery et al (1985), no attempt was made to select predictors on the basis of rigorous theory.¹³ Instead, a threshold maximum-likelihood backward elimination procedure for the probability model was implemented on several variables already found to be significant in the prediction of firm bankruptcy.

The method adopted for screening variables is based upon the absolute value of the t-test for each estimated parameter when all factors are included in the model simultaneously. This technique provides a traditional method of obtaining information on the explanatory ability of each of the factors without performing sequential tests. Moreover, it has been demonstrated by Menotti et al (1977) that removing all factors with an absolute value of t below an arbitrary threshold produces a subset of major risk factor values that gives large indices for both statistical significance and discriminatory power. Using a threshold of 2.326 (corresponding to a 1 percent significance level) for the t-test, four predictor variables were identified. The variables were defined as follows: current assets/current liabilities, net income/total assets, $\ln(\text{total assets/gnp price-level index})$, and $\text{FYRAVE}/(\text{FYRAVE} + \text{preferred stock @ redemption value} + \text{long term debt})$, where FYRAVE denotes the five-year average of the total market value.

The first two variables represent obvious indications of the firm's short-term financial solvency. The size variable has been found to be significant in several bankruptcy studies, supporting the notion that small

¹³ Although some theoretical work has been done in this area (e.g., Santomero and Vinso, 1977) it is safe to say that the state of the art in bankruptcy prediction precludes such a procedure. See Zavgren (1983) for a review of the bankruptcy prediction literature.

firms have a higher failure rate. A natural log transformation was applied to normalize the distribution of the variable. The fourth variable is based on the capitalization variable used by Altman et al (1977) in their development of ZETA analysis. A five-year component was used to smooth out temporary market fluctuations.

At this point two additional types of variables, unionization of the plan and industry of the sponsor, were included in the analysis. Ippolito (1986, p. 201) found that both the percentage of employees unionized and industry growth from 1972 through 1981 were significantly related to the probability of firm failure for sponsors offering defined benefit pension plans from 1978 through 1983. In the current study, both influences were tested through the use of dummy variables. The unionization variable was set equal to one if the plan was specified as a union plan on the EBS-1 filing and zero otherwise. The industry test consisted of a vector of dummy variables based upon two-digit SIC codes.

Initial results indicated that only the SIC code for the primary metal industry was statistically significant at the 1 percent level. Dummy variables for the other industries were deleted and the results are displayed in Table 1. This table displays the multiple logistic estimation results when the occurrence of an insufficient termination due to bankruptcy in the sample period is the dependent variable. All four variables suggested by the previous literature have the correct sign and remained significant at the five percent level (using a one-tail test). The primary metal industry variable was significant at the one percent level; however, after controlling for the other factors, the unionization variable was not statistically significant.

Table 1
Regression Coefficients for Probability Model

	Coefficient	Coefficient/ Standard Error
Current assets/current liabilities	-1.46	6.81
Capitalization ¹	-2.99	4.01
Ln(total assets/gnp price-level index)	-0.12	1.93
Net income/total assets	-3.39	6.55
Unionization	-0.40	1.49
Primary metal industry ²	3.88	5.42
Five-year probability of termination in sample: ³	.063	

¹ Capitalization is defined as $FYRAVE/(FYRAVE + \text{preferred stock @ redemption value} + \text{long term debt})$, where $FYRAVE$ = five year average of the total market value.

² Plans sponsored by firms in the industry characterized by a two-digit SIC code equal to 33.

³ Sample was deliberately stratified to overrepresent terminated plans.

Estimation of the Severity Model

The second phase of the estimation process focused on the prediction of the dollar value of the claim against PBGC, given that a plan had terminated with assets insufficient to cover its guaranteed benefits. A first order approximation of this amount could be provided by the plan's unfunded vested liability, valued at the PBGC close-out rate. Although this value would tend to overestimate the unfunded guaranteed benefits,¹⁴ it has an advantage over more precise estimates in that it may be computed from readily available information in the previous year. If there were no adverse selection exercised against the PBGC, this might be an adequate approach. However, the use of certain flexibilities permitted under ERISA has apparently resulted in extensive defunding by a minority of plan sponsors in recent years.

Ippolito (1989) demonstrates that plans were defunding prior to termination though the use of funding waivers; modification of interest rates used for actuarial valuations; non-payment of required contributions; lump sum payouts to highly paid; shutdown benefits; and increase of benefits.¹⁵ The ability of plan sponsors to defund their pension plans prior to termination, as demonstrated by a monotonically decreasing average standardized funding ratio, is presented in Table 2.

Table 2

Average Standardized Funding Ratios: Plans Resulting in PBGC Net Claims¹

Year Prior To Termination	Average Standardized Funding Ratio	Adjusted for Average Funding Ratio in Sample
0	0.17	0.27
1	0.28	0.45
2	0.34	0.53
3	0.43	0.68
4	0.46	0.72
5	0.49	0.77
Sample Size 148 ²		

¹ Based on Form 5500 information from 1980-1984, inclusive, and Form 5310 information from 1981-1985, inclusive.

² Maximum size available for year 1. The sample size decreases for each succeeding duration from termination.

Funding ratios were standardized through a two-stage technique. First the liabilities were adjusted from the value determined by the reported interest rate to the PBGC close-out rate at the time of the valuation using the

¹⁴ This is due to the maximum monthly limitation on PBGC guaranteed benefits and the 20 percent phase-in rule under ERISA Section 4022(b) described earlier.

¹⁵ Empirical estimates on the impact of the first two approaches are provided in the Appendix. For additional results on 33 large terminations, see United States General Accounting Office (1987).

standardization technique developed by Ippolito (1986, p. 65). Second, all funding ratios for the 148 terminated plans with sufficient information were divided by the average funding ratios for all plans in that year to control for fluctuations in the value of pension assets.

The results show that, at the time of termination, the average funding ratio for terminated plans was only 17 percent of the average funding ratio for all plans in that year. However, five years prior to terminating, the average funding ratio for these plans was nearly 50 percent of the average funding ratio for all plans. Intermediate values support the notion of a systematic scheme of defunding.

Given the demonstrated potential for defunding prior to termination, the severity for an insured plan was defined as: $\text{Severity} = \max [0, 1 - (F - d)]L$ where L = plan liabilities for vested benefits (standardized at the PBGC close-out rate),

F = the plan's current funding ratio for vested benefits (based on standardized liabilities), and

d = the expected (maximum) deterioration in the funding ratio prior to termination.¹⁶

The value of d was estimated in this study by multiplying the difference between the average standardized funding ratio in the fifth year prior to termination and the year of termination ($0.4880 - 0.1715 = 0.3165$) by the average funding ratio for all plans over the sample period (1.60) for a value of 0.506. This means that over the period of this sample, the average plan that terminated reduced its funding ratio prior to termination by approximately 50 percentage points, independent of change in asset ratio and interest rates.

Analysis of Premium Estimates

Given the estimated models in the previous section, risk-related premiums were determined for each of the sample firms represented in the 1984 Form 5500 data base by computing the plan-by-plan product of probability and severity. The probability was calculated by applying the estimated coefficients in Table 1 to the sponsor's financial, industry and union characteristics in 1984. Severity values were computed for each plan from its 1984 Form 5500 data. Based on empirical data, any plan with a (standardized) funding ratio in excess of 1.506 would be exempted from the risk-related premium scheme for that year.

The risk-related premiums were based exclusively on expected future claims. No attempt was made to include additional charges to accommodate amortization of previous deficits or to load for administrative expenses. Although these components would obviously need to be added to a final version of a risk-related premium system, the computation of a pure premium

¹⁶Note that this procedure implicitly assumes that the plan has not started on its assumed five-year path of defunding. To the extent that this assumption is not valid (e.g., the plan terminates one year after inception of risk-related premiums), it may be necessary to consider the utilization of premium rebates.

will allow a direct comparison to the funding charge in the new variable rate premium system. A total of 665 plans had sufficient information on both Compustat and the 1984 Form 5500 data base to compute the risk-related premium.

The plans for which information was obtained had in excess of 2.4 million participants (about ten percent of the single-employer pension plan universe). The aggregate risk-related premium would have been \$157.7 million. The premium distributions are presented in Table 3 which categorizes the sample firms by their risk-related premium per participant. The first row gives the number of plans in each category. It appears that the plans fall into three major groups. The first group (no risk-related premium) comprises the majority (62 percent) of the sample.¹⁷ The second group (\$0.01 to \$100 per participant) consists of 28 percent of the sample. The third group (more than \$100 per participant) consists of only 9.6 percent of the plans (19 percent of the participants) in the sample but would have generated more than 95 percent of the aggregate premium. The average premium per participant for this group was \$753.

Table 3
Estimated Risk-related Premiums for 1985
Based On 1984 Annual Reports and 1984 Form 5500s

		Risk Premium Range Maximums						
	TOTAL	\$0.00	\$10	\$25	\$50	\$75	\$100	\$100
<i>Estimated Market Prices</i>								
1. Number of plans	665	62.4%	15.9	4.2	3.4	2.8	1.5	9.6
2. Number of participants	2.4m	68.1%	6.2	2.5	1.2	2.0	0.6	19.0
3. Risk-related premiums	\$157.7m	0.0%	0.1	0.6	0.7	2.0	0.9	95.4
4. Exposure ¹	\$4,644	0.0	5,436	2,802	5,196	8,258	13,506	31,603
5. Default Risk Per Plan	9.8	7.5	3.0	8.7	9.8	14.8	9.6	34.8
6. Default Risk ² Per Participant	12.1	10.1	2.8	8.4	7.7	9.7	7.5	23.2
7. Average Risk Premium	\$65.59	\$0.00	2.18	16.35	37.05	60.39	87.03	753.05
<i>OBRA Variable Rate Premium</i>								
8. Premiums ³	\$34.9m	49.0%	5.0	1.8	1.0	1.7	1.3	39.8
9. Absolute Subsidy (%)	77.8	N.A. ⁴	-788.0	33.7	69.7	80.5	68.9	90.7
10. Relative Subsidy (%)	0.0	N.A.	-3897	-198	-36	-12	-39	58

¹ Per participant; includes a cushion for pre-termination defunding.

² Per 1,000.

³ This includes a per-participant charge of \$10.50.

⁴ Since plans in the zero risk premium category pay no risk premium, the amount of subsidy, divided by zero, is undefined.

⁵ Since plans in the zero risk premium category pay no risk premium, the amount of subsidy, divided by zero, is undefined.

¹⁷ The plans in this group would pay lower premiums under the risk-related premium system than under the pre-OBRA flat rate system (\$8.50 per participant), even after taking into account the fact that a portion of the pre-OBRA premium was designated for deficit amortization and administrative expense.

The reasons for the large average per-participant premiums in the last category can be inferred from rows 4 and 6. Although the average severity for each plan in the sample is less than \$5,000, the average severity in the highest premium class is over \$30,000. Moreover, the average probability of termination on a participant-weighted basis is 12.1 per 1,000 for the entire sample but it is almost twice as large in the highest premium category.

For the sake of comparison, the new OBRA variable rate premium system¹⁸ was applied to the data assuming that had it been in effect at that time. The OBRA schedule would have generated \$34.9 million in exposure-related premium, only 25 percent of the estimate. This difference may be interpreted in part as a measure of Congress' continuing reluctance to charge a sufficient price for this insurance.

Row 8 presents the premium distributions that would have been generated in 1985 under the new system imposed by OBRA. Assuming the risk-related premiums estimated in this article represent the true cost of protection, the aggregate subsidy from this system was 77.8 percent for the sample plans (Row 9). As expected, the largest absolute subsidies were received by firms in the highest risk-related premium category. Only two categories (i.e., those representing firms with a risk-related premium less than \$10 per participant) experienced a negative subsidy under OBRA; however they account for 78 percent of all plans and 75 percent of all participants.

Row 10 provides the relative subsidy received from the variable rate premium system relative to the risk-related premium. These values are calculated as $1 - (\text{AGGPBGC} / \text{AGGPREM})$ where AGGPBGC is defined as the aggregate premium for each class if the variable rate premium system were imposed in a manner such that the aggregate premium for the sample was equal to \$157.7 million (the sample aggregate under risk-related premiums) and AGGPREM is the aggregate premium collected under the risk-related premium system. Note that no risk-related premium would be charged for firms in the first column, hence the subsidy calculation is not applicable for this group. With the exception of the category with the smallest number of plans (risk-related premiums between \$75.01 and \$100.00), this value is a monotonically increasing function of the premium class. The results indicate the extent to which plan sponsors that would otherwise pay a low premium under a risk-related premium system, subsidize those who would pay the highest risk-related premiums if a variable rate premium system was used to generate the expected costs of the sample plans.

Nineteen plans from eleven different sponsors that would have generated risk-related premiums greater than \$500 per participant are listed in Table 4. Eight of these plans (five sponsors) were affiliated with the primary metal industry.

¹⁸The premium estimates for the PBGC's proposed system include a per-participant charge of \$10.50 which was not earmarked to retire the existing deficit.

Table 4

All Plans with Risk-Related Premium/Participant Greater Than \$500

Per-Participant Premium	Primary Industry of Sponsor
\$504	Rubber & miscellaneous plastics
588	Electronic computing equipment
588	Primary metal
600	Rubber & miscellaneous plastics
625	Rubber & miscellaneous plastics
638	Rubber & miscellaneous plastics
705	Primary metal
751	Chemicals & allied products
783	Primary metal
802	Primary metal
880	Sugar refining
958	Malt breweries
1,003	Primary metal
2,021	Air transportation, certified
2,498	Primary metal
3,180	Primary metal
3,273	Primary metal
8,065	Primary metal
8,532	Primary metal

All Firms With Average Risk-Related Premium/Participant Greater Than \$500

Average Per-Participant Premium	Primary Industry of Sponsor
504	Electronic computing equipment
588	Primary metal
601	Rubber & miscellaneous plastics
701	Primary metal
758	Chemicals & allied products
880	Sugar refining
958	Malt breweries
1,003	Primary metal
1,150	Primary metal
2,021	Air transportation, certified
7,068	Primary metal

Implications

Although the variable rate premium approach introduced under OBRA may solve some of the economic problems the PBGC has faced in the last few years, it is possible that the remaining adverse selection potential may prove to

be financially devastating in the long run. This section explores the potential limitations of both the variable rate premium system and a risk-related approach, provides insights into the theory and implementation of pricing plan termination insurance, and speculates on long term implications of pension plan benefits insurance without risk-related premiums.¹⁹

Limitations of a Variable Rate Premium

Although the variable rate premium approach partially corrects the problems associated with the original flat rate system, there are additional factors that may need to be considered. First, it may be inequitable for financially secure sponsors of underfunded plans to pay the same rate per dollar of unfunded liability as a sponsor undertaking more risky endeavors (thus possessing a higher ex ante probability of bankruptcy). Second, sponsors with a high probability of bankruptcy are able to offer pensions to their employees at a subsidized price in terms of the sum of their expected payout (discounted by the probability of bankruptcy in addition to the usual actuarial factors) and the price of the insurance coverage. As such, they will have a tendency to offer more pensions (and lower wages and non-pension employee benefits) than they would have if their pension plan benefits insurance premiums were equal to the expected value of their insurance claim. Finally, as Pesando (1982) points out, a variable rate premium system creates an incentive to seek out forms of risk to the PBGC that do not enter into the premium calculation. For example, under a variable rate premium, a sponsor of an underfunded plan has an incentive to borrow money and increase the level of assets in the pension plan. However, the interest on the additional debt may prove to be too costly and cause the sponsor to enter into bankruptcy proceedings. If the underfunded position is not entirely eliminated, the PBGC would be left to pay the remaining unfunded liabilities that otherwise might have been funded if the sponsor remained solvent.

Limitations of Risk-Related Premiums

A major problem with any risk-related premium system was addressed by the PBGC (1987): the specter of a federal agency rating thousands of companies. Even though the premium differential of "incorrect" classifications of plan sponsors by the PBGC might not be material (particularly if the funding ratios were high), the rating (if disclosed) might be given very high credibility by the capital markets. As a result, a marginal firm might be effectively eliminated from future borrowing or have their cost of future borrowing increased to the point where they might have to forego necessary capital expenditures.

This may result in inefficiency as sponsors undertake suboptimal transactions in an attempt to provide "window dressing" to their financial statements. This would result in a reclassification of balance sheet or income

¹⁹See VanDerhei (1987) for an expanded version of this discussion.

statement components, depending on the types of information used to assess the sponsor's risk of bankruptcy.

Moreover, the access to financial information on the plan sponsors is neither perfect nor costless, although it might be possible to mandate disclosure of corporate financial statements in a manner similar to the Form 5500s. If that route proves to be infeasible, the likelihood of voluntary disclosure would be increased by providing that any plan with more than a threshold number of participants would be charged a prohibitive rate per dollar of "unfunded" liability unless they submit audited financial statements.

If the premium differentials between classes were large or the system included any subjective classifications, it would be quite likely that the plan sponsors placed in the most expensive risk classifications would find it to be efficient to challenge their classification thus leading to an extensive appeals process.

Of course, the entire exercise of providing a more precise estimate of a sponsor's risk to the PBGC is meaningless if the final premium system is burdened by artificial devices that reduce the variation in premium rates between low-risk and high-risk firms to the point where it fails to have any effect on management behavior.²⁰

Long Term Implications of Pension Plan Benefits Insurance Without Risk-Related Premiums

To reject the viability of a risk-related premium system for pension plan benefits insurance without providing alternatives to offset the lack of market discipline exhibited by the variable rate premium system, is by default a submission to some additional form of government regulation in the future. Although the unfunded liabilities charge may seem to be too trivial to be of any consequence to an existing program with a large annual pension expense, it must be remembered that decisions regarding future benefit liberalizations will be made at the margin.

Thus, while the additional cost resulting from an increase in the present value of vested benefits due to past service may be enough to deter a firm that expects to pay the entire amount, it may not be a sufficient impediment to a marginal firm that is attempting to conserve cash flow by minimizing wages in a tradeoff for larger pension promises. As this scenario progresses and the marginal firms continue to increase promised benefits and subsequently terminate (presumably after at least a portion of the benefits have phased in under ERISA Section 4022 (b) (7)), it is likely that the premium charge will continually be adjusted upward.

²⁰ This is not to say that an overall maximum such as the \$50 per-participant cap included in the new system is not without its merits. First, it would be politically naive to believe that a proposal without such a device would make it through Congress without being assailed by those whose constituents would be most adversely affected. Second, it may be in the agency's best interest to keep the maximum differential within some preconceived range under the assumption that this will minimize the likelihood of disputes and litigation over premium classifications.

At some point, sponsors of underfunded plans that are unlikely to be terminated may have an incentive to increase benefits only when they have sufficient cash to fully fund the present value of the increase. Another option for these sponsors would be to freeze their defined benefit pension plans and move to defined contribution plans, thus resulting in a situation in which the marginal firms represent a growing percentage of PBGC's coverage. Admittedly, one way around this spiral of adverse selection would be to further increase the funding charge for unfunded new liabilities to the point where it would be too costly for any sponsor to increase its unfunded liabilities. However, the externalities of discouraging the substantial economic benefits accruing from a thriving defined benefit pension plan system in our economy may make this an unwise public policy choice.

Conclusions

In 1986, Congress altered one component of the plan termination insurance program in an attempt to assure its financial integrity. In 1987, the PBGC proposed that the basis for computing premiums for plan sponsors covered by the program also be changed and, to a large extent, the basic philosophy of the proposal was incorporated in OBRA. Presumably one of the objectives behind this proposal is to minimize subsidies implicit in the previous (flat rate) structure and hence reduce the potential for adverse selection. Assuming that the risk-related premiums calculated in this article are an appropriate first order approximation for the true expected costs faced by the PBGC, it would appear that while the new price structure was partially successful in attaining this objective, it represents a significant departure for premiums that likely would exist in a private market for pension insurance.

If a methodology similar to the one used here were adopted by the PBGC, it would at the least provide them with a more accurate estimate of their overall premium needs. In addition, it would help them quantify the transfers that are being effected by the current (albeit recently revised) premium structure. Since these transfers can turn out to be important factors in affecting firms' decisions to establish or continue defined benefit pensions, the issue is not without importance for public policy.

It should be noted that this study dealt with the pricing of the single-employer plan termination program assuming the post-OBRA "insurance contract" was not altered.²¹ An equally important line of inquiry focuses on proposals to transform the current plan into a more rational economic insurance system. Ippolito (1989) considers an extension of the current mandatory participation system in which market pricing is not permitted and

²¹ As mentioned earlier, it was much easier to satisfy the definition of an insured event during the sample period. It was necessary to screen the claims that would not be eligible for recovery in the post-OBRA period to prevent an overestimation of probability in the future. However, other OBRA changes (such as the increased minimum funding standards and decreased full funding limitation) could affect severity levels and post-OBRA premiums.

concludes that the most important reform that could be instituted is to restrict the amount of the basic insured benefit and age of first receipt.

Appendix: Measuring The Adverse Selection Impact of Funding Waivers And Interest Rate Assumptions

While defunding can occur in numerous ways, this study provided empirical estimates on the impact of funding waivers and interest rate assumptions. If benefits continue to accrue under the plan while a funding waiver is utilized, it is likely that the present value of guaranteed benefits will grow faster than the market value of assets, thus leading to a larger exposure to the insurance system. PBGC had acknowledged this fact by including a penalty for waivers in their variable rate premium proposal, although Congress chose not to include it in the new system. If the maximum number of funding waivers has already been used, or if a sponsor would prefer to reduce contributions to the plan through less obvious means, the interest rate assumptions could be increased. This would obviously decrease the present value of plan liabilities and lead to a reduction in the minimum required contribution to satisfy IRS Section 412.

Table 5 provides data on this point. Using Form 5500 data, 115 waivers (totalling \$622 million) granted during 1980 and 1981 were identified. The termination behavior of the waiver recipients was then followed through the close of 1987. Twenty-three plans (20 percent) from this group terminated their plans within the sample period. Total claims from these terminations equalled \$136 million; however, only \$26.6 million (19.5 percent) of that amount was due to the 1980 and 1981 waivers. This yields a "loss ratio" over the sample period of 4.2 percent when divided by the total amount of waivers granted. Based on this analysis, it would appear that although most waivers do not result in increased PBGC claims, those that do represent a very significant percentage of the total claims.

Table 5
Funding Waivers in 1980 and 1981:
Portion Realized as PBGC Net Claims Through 1987

Funding Waivers In 1980 and 1981 ¹	\$622,057,506	115
Realized In PBGC Net Claims Through 1987	\$26,622,634	23 ²
Percentage	4.28%	20%

¹ Form 5500 tapes. Only plans with more than 100 participants are included in this analysis. If a plan had a funding waiver in both 1980 and 1981 it was recorded as a single event.

² These claims resulted in a total of \$136 million in net claims for the PBGC.

Another manner of investigating this phenomenon with the available data base is presented in Table 6. Of the 331 plans that made claims against the PBGC from 1983 through 1985, 44 (13.7 percent) had been awarded waivers

between 1981 and 1984. In dollar terms, this represented 13.4 percent of the total claims in those three years.

Table 6

The Portion of PBGC Net Claims Attributable to Waivers (1983-1985)

	Dollar Amount	Number
Net Claims	\$840,707,600	331
Attributable to Waivers	\$113,863,604	44
Percentage	13.4%	13.2%

Evidence on potential manipulation of interest rate assumptions is presented in Table 7. Average standardized interest rates were computed for a sample of 69 terminated plans with an adequate history of Form 5500 filings. The interest rates were standardized by the average reported interest rate for all single-employer defined benefit pension plans in that year. The results demonstrate that the average interest rate for plans that will eventually terminate is within 4 percent of the average in all years except the year immediately preceding termination at which time it increases to over 150 percent of the average.

Table 7

Average Standardized Interest Rates: Plans Resulting in PBGC Net Claims¹

Year Prior To Termination	Average Standardized Interest Rates
1	1.5415
2	1.0385
3	0.9784
4	0.9863
5	1.0021
Sample Size	69

¹ Based on Form 5500 information from 1980-1984, inclusive, and Form 5310 information from 1981-1985, inclusive.

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