

PENSION PLAN TERMINATION FORECASTING

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I. Background

In September 1974 the Employee Retirement Income Security Act, ERISA, was signed into law. The Act made many changes in the law governing pension plans to protect employee benefit rights. Title IV of ERISA created the Pension Benefit Guaranty Corporation, PBGC, with the primary responsibility of assuring that, up to a limit, benefits are paid when due from most private defined benefit pension plans. The programs of the PBGC might be viewed as an insurance system.

The PBGC currently administers two substantially different insurance programs. One of these, covering single employer pension plans, has been in effect since enactment of ERISA. A second, covering multiemployer pension plans, became fully effective in September 1980 with the passage of the Multiemployer Pension Plan Amendments Act of 1980. These two programs are described in sections II and III.

One of the fundamental needs of the PBGC in the implementation of its charter and the management of its affairs is the ability to develop reliable estimates of the number of terminations and the amount of future claims against it. Such estimates are critical to the design of effective programs and the setting of appropriate premium rates. The numbers and size of expected claims and the characteristics of cases are all critical factors in PBGC management planning.

II. The Single Employer Program

A. General

Currently, this program covers approximately 80,000 plans containing in the neighborhood of 25 million participants. The total unfunded vested liabilities $\frac{1}{2}$ in these plans have been estimated to be somewhere around \$50 billion which provides some proxy for the gross claims exposure of the program. It is also estimated that liability of the plan sponsors would be about \$40 billion in the event of plan termination, resulting in a net PBGC exposure of under \$10 billion.

Since the beginning of the program in 1974 approximately 30,000 single employer plans have terminated, but only about 700 have actually resulted in a claim against the program. The majority of the claims are associated with plan sponsors having financial difficulties which in some instances lead to bankruptcy and subsequently to reorganization or the liquidation of the firm. The claims against the program through 1980 are driven by a relatively few large cases; about 70 percent of the total claim is accounted for by 10 percent of the insufficient terminated plans.

B. Program Characteristics

To be qualified for favorable tax treatment, a pension plan is required to be funded in advance of the actual payment of benefits to plan participants. The actuarial methodology involved in determining funding requirements typically seeks to establish relatively level contributions. The present value of that stream of contributions into the pension trust should equal the present value of prospective payments of pension benefits to plan participants. Defined benefit pension plans are typically established and subsequently

amended to provide benefits based on prior service. Because the financial obligations associated with such promises are usually quite large, they are usually funded over a number of years. This, and in some cases adverse operating experience (e.g., poor earnings on assets accumulated in the fund), frequently results in the assets accumulated by the plan at any given point in time being substantially less than the present value of benefits promised. The PBGC was established to assure that the portion of these promises which have become vested will be fulfilled.

If a pension plan terminates, the plan's sponsoring firm is liable to the PBGC for any underfunding of guaranteed benefits. However, this liability is legally limited to 30 percent of the net worth of the firm. Claims against PBGC result when the net worth of the employer is insufficient to cover any plan asset deficiency upon termination of the plan. Most generally, this situation is associated with firms facing bankruptcy or severely adverse business conditions. In these cases there is often no alternative to plan termination as the firm may be hard pressed to meet funding requirements or may be nearing or involved in liquidation.

III. The Multiemployer Program

A. General

A multiemployer plan is essentially a collectively bargained plan to which contributions are made by more than one employer. Currently, there are approximately 2,000 of these plans covering some 8 million participants. Approximately 500,000 employers are engaged in making contributions to these plans.

The pension benefit guaranty program enacted under ERISA in 1974 was originally envisioned to cover these plans with the same structure of benefit guarantees as covers single employer plans. Due to special problems presented by multiemployer plans, coverage in the original act was made discretionary. During this discretionary period (1974-1980) coverage was granted to participants of five such plans. Concern regarding the soundness of this program also arose. Consequently, a new program was enacted with the passage of the Multiemployer Pension Plan Amendments Act of 1980.

B. Program Characteristics

The current multiemployer program differs substantially from that covering single employer plans. The most important difference is the event which brings the insurance program into play. This event is not plan termination but rather financial insolvency, or the inability of the plan's sponsors to continue contributions. When plan insolvency occurs, the PBGC provides loans or grants sufficient to meet the payment of guaranteed benefits. However, before such aid is provided, another provision of the law requires a multiemployer plan to reorganize.

A plan's financial health is also safeguarded by another provision in ERISA that imposes a liability on employers who withdraw from the plan. The withdrawal liability provision tends to insulate the program against claims which otherwise might be precipitated by such withdrawals. How-

ever, this source of payment of the unfunded liability is only secured to the extent that the employer continues in business and generates profits and cash flows sufficient to support the required contributions. Absent sufficient profits and cash flow the employer can be expected to become insolvent and the remaining employers will incur the added burden unless additional employers can be activated into the plan. The major exposure for this program is presented by declining industries where the contribution base is not being maintained at a level sufficient to fund the unfunded liability.

IV. Data

Lack of data is the greatest obstacle to investigating the factors determining PBGC liabilities associated with single employer pension plans. Pension plans are required to report annually information concerning the value of assets, liabilities, income, expenses, number of participants and various other characteristics. While such information provides insight into the PBGC's gross exposure, it does not include sponsor-related information needed to estimate employer liability or the likelihood of a claim.

These determinations require data on the sponsor's net worth and financial strength relative to the pension liability. This kind of financial data is available from the Compustat division of Standard and Poor's for about 6,000 firms listed on the New York, American, Regional and Over-the-Counter stock exchanges. Unfortunately, these data on plan sponsors are not linked with the financial data on their plans. We have been looking into ways in which this linkage might be accomplished. ^{2/}

Data limitations also affect PBGC's ability to model multiemployer plans. The financial health of a multiemployer plan is not as much a function of the financial vitality of the individual contributing employers as the trends in the industry, or sector of an industry within which the plan operates. In other words, the stability of a multiemployer plan is not generally dependent on any one sponsor continuing in business but on the general level of output and/or employment of the sponsors taken as a whole.

Existing sources may be able to provide the key items needed to study PBGC exposure due to multiemployer pension plans. For example, the long-term input-output forecasting model from Chase Econometrics provides output and employment forecasts for some 200 industries. These forecasts would be useful in any attempt to project the likely ability of multiemployer plans in the relevant industries to meet various levels of required contributions. A forecast of required contributions can be generated by using an available actuarial method to estimate the age and service profile of plan participants, and then translating these profiles into required contributions.

V. Studies of Liabilities Due To Single Employer Terminations

The passage of ERISA in 1974 was followed by a wave of terminations of single employer defined benefit pension plans. Terminations surged from 2,700 in 1975 to 7,200 and 6,500 in the following two years and then receded to 4,500 in 1978. This wave heavily influenced PBGC operating statistics during the period. Most notably, it buoyed upward

the present value of liabilities in terminated plans administered by the PBGC. These liabilities tripled in three years, rising from \$144 million in 1976 to \$425 million in 1979. During this period assets increased from \$127 million to \$332 million so the resulting deficiency of assets rose sharply.

In order to forecast future PBGC claim experience the PBGC has conducted several studies which can be considered alternative forecasting exercises. Perhaps the most basic study is an annual investigation, "Analysis of Single Employer Defined Benefit Plan Terminations." It has been undertaken for the last four years in order to discover the characteristics of terminating plans. This is the first step in understanding the nature of terminations and in laying the groundwork for efforts to predict them. The PBGC has found that, although 97 percent of terminated plans were small (less than 100 participants), the great bulk of participants in all terminated plans belonged to the few large plans that terminated. This finding is consistent with the fact that 94 percent of the 25 million participants in single employer plans belong to relatively large plans.

Most of these terminations did not involve claims against the PBGC. Such claims arise only when assets are less than the present value of benefits promised by the employer and guaranteed by PBGC. These insufficient plans account for only two percent of all terminations but they cause the increasing asset-deficiency figure discussed above. Further analysis of insufficient plans reveals that 86 percent of their participants were in large plans and 98 percent were in plans closing due to business reasons such as adverse business conditions, business liquidations or plant closings. This strong tendency of insufficient terminations to be associated with adverse business conditions suggested that it might be fruitful to link terminations to some measures of the business cycle.

In a second study, termination experience was collected quarterly rather than annually in order to obtain more time series data to calibrate with behavior over the business cycle. Quarterly terminations were matched with various quarterly indicators of business activity over several years. The national rate of unemployment was found to be the best predictor of quarterly terminations within the sample period examined. However, when the sample period was extended in an updated investigation, the linkage between terminations and the unemployment rate weakened appreciably. The difficulty of finding a good macroeconomic variable to predict terminations might have been due to the ERISA-induced wave in terminations that dominated the 1975-77 data. The wave may have swamped any other causal economic forces having impact on terminations.

Although the analysis of the time series data on terminations did not succeed in identifying a consistently reliable predictor of their volume, parallel work was proceeding on a third study to identify, at a given point in time, the set of firms most likely to have an incentive to terminate their pension plans. The idea was to identify a set of firms, using various definitions of financial incentive, and then to sum up their unfunded vested pension liabilities (in excess of

some fraction of net worth) in order to obtain an upper bound estimate of the PBGC's claim exposure. Of course, the upper bound of claims would be reached only if all the financially troubled firms failed (assuming that no firms failed who were outside the set identified as troubled).

Data on 6,000 firms, compiled by Standard and Poor's Compustat Division, were subjected to a double screen designed to identify firms having a financial incentive to terminate their plans in 1978. The first screen caught companies with a low ratio of profits to assets. These firms were then screened a second time to identify those with a relatively high ratio of pension expense to sales.

Fifty-two firms were found with both relatively high pension expenses and relatively low profit rates. The unfunded vested liabilities of this group totalled \$6.5 billion. However, employers are legally liable for guaranteed amounts up to 30 percent of their net worth. Subtracting this liability, based on 1978 net worth, the net exposure was \$4.0 billion. Of course, this figure, being based on the net worth of ongoing firms, assumes that they do not declare bankruptcy. Such a declaration could cause a substantial drop (in some studies a 40 percent reduction) in the market value of the firm's net worth. Because of this bankruptcy effect on net worth, PBGC exposure might have been more than \$4.0 billion (up to the UVL total of \$6.5 billion) had all of the firms failed.

In the ensuing year, 31 of the 52 companies continued to have similar expense and profit traits. These firms were joined by 10 new firms to form a set of 41 companies for 1979. Interestingly enough, this set exhibited almost the same UVL and PBGC exposure as the set of 52 generated in 1978.

These upper bound forecasts are useful; however, a more refined measure would be desirable. Among the measures being explored is the firm's bond rating. This rating can be a good summary statistic of the firm's financial health. Firms with ratings of BB and below can, for example, be considered to be financially troubled. One preliminary study of firms with large (\$40 million or more) UVLs and such low bond ratings found 19 companies with a total UVL of \$4.6 billion in 1979. After subtracting 30 percent of the firm's net worth (at market value) the PBGC exposure implied by the \$4.6 billion UVL was only \$2.8 billion. Of course, as previously mentioned, bankruptcy may lower the firm's market value and thus increase the PBGC's exposure. A halving of market value, for example, was found to create an exposure of \$3.7 billion.

Another measure of economic health uses a weighted average of several financial ratios found to be significant in econometric studies of bankruptcy.^{3/} Applying it to 1979 data identified nine firms with an incentive to terminate their plans. The unfunded vested liability of the nine firms totalled \$697 million, while the PBGC's 30 percent exposure (i.e., UVL minus 30 percent of net worth) was \$536 million. If these firms' market net worth was halved by bankruptcy the PBGC exposure would be \$617 million.

The foregoing brief summary of various studies shows how estimates of the PBGC's exposure can differ widely, depending on the indicator of

financial health adopted and the cutoff point chosen on the indicator's scale of values. Regardless of the indicator and cutoff point chosen the net result of all these studies is to identify a set of troubled firms and, by implication, a set of untroubled firms. A difficulty with choosing preferable study methodologies to pursue is that all of the indicators and cutoff points in the studies considered so far are to some extent arbitrary. In addition, there may be some very good indicators (and cutoff points) not yet considered. Therefore, before holding a tournament of methods it would be useful to give some thought to a way of choosing candidates for entry. There may be some way to logically discriminate between good and bad methods, or at least between better and poorer methods.

VI. Stock Prices and Bankruptcy

In both financial theory and in common sense, the price of a firm's common stock reflects the dividends expected by investors. Lower dividends, for example, imply lower prices. In particular, financial theory views the price as the present value of the future stream of expected dividends. The theory also assumes, and this has been extensively tested, that the price incorporates all information available to investors about the company. That is, the price reflects all relevant financial ratios thought to be important by investors, such as the firm's cash flow, its profit rate, etc. Furthermore, if some new ratio, or combination of ratios, were discovered to be important then this too would quickly be reflected in the stock price according to the theory. In other words, new information is rapidly incorporated into the price.

Because the price reflects the future stream of expected dividends it must also mirror the probability, if any, that the firm may go bankrupt and thus cease to pay any dividends at all. Other things being equal, a greater probability of bankruptcy lowers the stock price of the company. Another way of putting this linkage is to say that companies with low stock prices (hence meager expected dividends) should have a greater chance of bankruptcy than firms with high prices. This is not to say that the linkage is simple, it may very well be quite complex. In any event, the stock price would be a measure of financial health and in theory it should be linked to the chance of bankruptcy. Discovery of this linkage should enable the analyst to predict the chance of a firm terminating its pension plan (due to bankruptcy) as a function of the price of the firm's common stock.

The Compustat division of Standard and Poor's has financial records on about 100 bankrupt firms that were listed on the New York, American and regional stock exchanges during the decade of the 1970s. The stock prices of these firms prior to bankruptcy are available so the bankruptcies can be arrayed by the magnitude of their closing prices, grouped into price intervals, and the number of bankrupts in each interval calculated. As expected, more bankrupts are found among the low-priced than among the high-priced stocks. In order to compute the annual probability of bankruptcy within each stock price interval, information on the annual number of non-bankrupts in each interval was also gathered from Compustat

records. Then the annual probability of bankruptcy for each stock price interval was computed as the ratio: the annual number of bankrupts in the interval divided by the total number of firms (i.e., bankrupts and non-bankrupts) in the interval that year. The computed bankruptcy probabilities fluctuated annually due to the small number of bankruptcies each year in each price interval. However, a consistent pattern appeared when a decade average of the annual probabilities was computed for each stock price interval. As a general rule, the probability of bankruptcy was higher the lower the stock price interval in question. Very low-priced firms had over 20 times the chance of bankruptcy as high-priced companies. These findings detailed in Table 1, were not unexpected. The only surprise in the table is the relatively small chance of bankruptcy experienced by even the lowest price firms (though this chance was the greatest among all the price intervals). For example, the table reveals that firms with common stock prices below \$1 per share had only a 2.3 percent chance of bankruptcy in the year. That is, only about two firms out of one hundred with stock prices this low could be expected to fail within the year.

The probabilities of bankruptcy in Table 1 were used to obtain estimates of the PBGC's expected liability from single employer pension plan terminations in 1979. The Compustat records were scanned to identify 575 firms with UVL. Fortunately, only 55 had a UVL exceeding 30 percent of their net worth in 1979. This excess for each firm, a measure of the PBGC exposure at termination, was multiplied by the probability of the firm's bankruptcy (given by its 1979 stock price). The product of this probability of termination and the PBGC exposure at termination computed and summed over the 55 firms, totalled \$19 million. However, this forecast of the exposure to the PBGC due to terminated single employ-

er plans in 1979 is much less than the \$67 million of claims actually incurred in 1979. ^{4/} The discrepancy may reflect various factors.

For example, the bulk of PBGC exposure is due to bankrupt firms. Bankruptcy tends to lower a firm's market value of net worth, thus increasing PBGC exposure. Assuming halving of net worth at termination, a total expected exposure of \$30 million is obtained. This number is considerably greater than the \$19 million found by the 30 percent rule but still appreciably short of the \$67 million exposure actually experienced by the PBGC in 1979.

The shortfall in the estimate of exposure could be explained if the PBGC recovered nothing at all from the typical firm at bankruptcy. In this case the forecasting method can generate a projection of expected PBGC exposure much closer to the \$67 million actually experienced. The total UVL of the 575 firms with UVL in 1979 was \$31 billion. Supposing no net worth correction is made to this amount (i.e., the PBGC is assumed to recover nothing from a terminating firm) then a crude calculation of the order of magnitude of the PBGC's expected exposure can be obtained by multiplying the \$31 billion UVL total by the typical firm's probability of bankruptcy. About 85 percent of the \$31 billion UVL is due to firms with stock prices above \$20 a share (suggesting a .001 chance of bankruptcy) while the remainder of the UVL total is accounted for by lower-priced firms with roughly a .004 chance of termination. On this reckoning the PBGC's total expected exposure would be \$45 million. This amount is still short of the \$67 million experienced in 1979 (a figure already reduced by an estimated recovery of \$9 million from terminating firms). However, another correction might be considered. It is also possible that the effect of low stock prices is also reflected in the following year.

The probabilities in use so far have been the chance that a firm goes bankrupt in the same year that its stock price reaches a given range. Another predictor would be the chance that a company terminates in the year after its price reaches the range. This probability, for firms with stock prices above \$20 a share, was found to be .002 (rather than the .001 relevant for same-year bankruptcy). Table 2 summarizes the probabilities for firms with various stock prices. Applying these year-after probabilities to the 50 firms with largest UVL (which had about 75 percent of the \$31 billion UVL total for all 575 firms) plus a five percent sample of the remaining 525 firms with some UVL gave an estimated expected exposure to the PBGC of \$66 million. ^{5/} Because this amount is derived by applying the year-after probabilities of bankruptcy to 1979 data it is really a prediction of the PBGC's new exposure for 1980. Data on actual exposure for 1980 are not yet available for comparison with the forecast but it is close to the actual exposures of \$79 million and \$67 million realized in 1978 and 1979.

The studies that have been summarized in sections V and VI employ different definitions of financial difficulty and accordingly derive different sets of troubled firms and estimates of PBGC exposure in one year (either 1978, 1979 or 1980). It would be useful to test the comparative forecasting accuracy of the methods employed

Table 1:

Bankruptcy Probabilities for Firms on the New York, American and Regional Stock Exchanges (Decade Average of 1970-79 Annual Probabilities)

Stock Price	Bankruptcy Probability
\$ 0 - .99	.023
1 - 1.49	.022
1.5 - 1.99	.013
2 - 2.99	.007
3 - 3.99	.005
4 - 4.99	.005
5 - 5.99	.003
6 - 7.99	.005
8 - 9.99	.002
10 - 11.99	.001
12 - 14.99	.003
15 - 19.99	.001
20 and up	.001
All Firms	.004

in these studies for several years. This might involve the generation of a series of annual forecasts of PBGC exposure using each method, and a comparison of these forecasts with the PBGC's actual experience during the same years. To date such a study has not been performed for even one method, so the most consistently accurate methods for forecasting PBGC exposure have not yet been identified.

Table 2:

Probability that Firms Go Bankrupt
The Year After Their Stock Price
Reaches a Certain Interval

Stock Price	Bankruptcy Probability
\$ 0 - .99	.011
1 - 1.49	.015
1.5 - 1.99	.008
2 - 2.99	.010
3 - 3.99	.005
4 - 4.99	.007
5 - 5.99	.006
6 - 7.99	.003
8 - 9.99	.004
10 - 11.99	.002
12 - 14.99	.001
15 - 19.99	.002
20 and up	.002
All Firms	.004

VII. Forecasting Multiemployer Exposure

The technique of claims forecasting for the multiemployer program can be substantially different than that discussed above for the single employer program. Because the multiemployer program is new, any relationship between the incidence of claims and economic variables will not become clearly evident for several years. Also, an approach which focuses on financial characteristics of employers/contributors will not generally be feasible due to the number of such employers (500,000) and the unavailability of data on those employers. While an analysis of data available from pension plan forms helps to reveal potential problems, these data indicate neither the contributing employers ability to support the plan nor when support might cease. While the importance of the survival of individual employers contributing to multiemployer plans cannot be ignored, the threat of claims against the program is more a function of the ability of an industry or sector of an industry to support the plan.

The claims forecasting problem for the multiemployer program comes down to identifying those plans which can be expected to qualify for financial assistance and projecting the size and timing of those claims. This is largely a problem of identifying plans in declining or depressed industries where the contribution base and/or employer participation is not being maintained at a level sufficient to fund the unfunded accrued liability. Estimating the timing and size of claims then becomes a problem of predicting the

cash inflows and outflows of the plans which are likely candidates for financial assistance.

Much work was done on this type of claims forecasting methodology during the development of recommendations to Congress on the design of multiemployer program legislation. At that time the PBGC developed a model that simulates the operation of a pension plan over time providing a profile of contributions, investment income, benefit liabilities, benefit payouts and expenses under the program as designed. A conceptual view of part of the output from that model and how it might be used is presented in Figure 1. The chart in Figure 1 simply illustrates the evolution of some measure of the financial health of a plan (in this case the ratio of the plan assets to liabilities) over time and the measure's relationship to significant financial thresholds. Several measures could be chosen because the model provides a variety of variables reflecting plan liabilities and cash flows. The reorganization threshold is the critical level of the declining measure at which the plan should be reorganized to increase its chance of remaining solvent. If decline continues, the lower threshold is eventually reached at which PBGC assistance is needed. Plan assets and liabilities in Figure 1 are affected by contributions and benefit levels, themselves determined by plan characteristics and by historical trends in output, employment and labor costs. The important result is that this model provides a projection of when the reorganization and assistance thresholds may be reached and thus the basis for developing a profile of the claims for financial assistance which might be expected over time. This model has been used to analyze a sample of 413 plans during the legislation development process. The threat of claims appears to be coming from less than 10 percent of the number of plans in the sample. Plans considered most likely to terminate could create net claims of \$560 million on the PBGC over the coming decade, an amount well in excess of past experience.

Several extensions or modifications of the model could be made in order to test the sensitivity of its forecasts to alternative assumptions. For example, the fraction of new employers choosing to join a multiemployer plan in an industry could be changed, employer contributions could be based more on output than employment, and actuarial assumptions could be altered to generate best-case and worst-case scenarios. The goal of this exercise would be to identify the versions of the model which are best at forecasting the claims on the PBGC from multiemployer plans.

1/ Liabilities associated with benefits to which participants are entitled regardless of their continued employment with the sponsoring firm.

2/ Although the Compustat tapes do not contain data on many smaller firms which sponsor pension plans, this may not be a problem because a large portion of the claims exposure is presented by relatively large firms which have listed securities.

3/ See Edward Altman, "Financial Ratios, Discriminate Analysis and the Prediction of Corporate Bankruptcy," *The Journal of Finance*, September 1968. The weights are actually regres-

sion coefficients found in updated studies by Altman. The measure of financial health is dubbed the Zeta score of the firm.

4/ Annual Report, FY 79, PBGC, p. 25.

5/ Using a logit function to transform the probabilities of Table 2 into a smoothly decreasing function of stock prices led to somewhat lower estimates of expected liability.

Figure 1.--CLAIMS FORECASTING FOR MULTIEMPLOYER PLANS

INDUSTRY DRIVEN PRIMARY VARIABLES

- CONTRIBUTIONS: FUNCTION OF (1) OUTPUT, EMPLOYMENT
(2) PLAN CHARACTERISTICS
- AGE/SERVICE CHARACTERISTICS: FUNCTION OF EMPLOYMENT HISTORY
- BENEFIT LEVELS: FUNCTION OF (1) HISTORICAL TRENDS
(2) LABOR COSTS

