Depreciation Systems

FRANK K. WOLF

W. CHESTER FITCH

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ment, a sale, a transfer out, a life span retirement, or an outlier. Regular retirements are the most common transaction. They are included in an analysis to estimate the life of property whose investment is recovered through depreciation accruals.

Regular retirements are sometimes classified as either location (reusable) retirements or final retirements. The retirement of a unit of property that will be reused poses a special problem for the depreciation professional. If location life is used in the accrual rate, then the salvage ratio must also be based on location life. Thus, the unit that is retired and returned to stock to be used again must be assigned a gross salvage value. One rule is to assign salvage equal to 100% of the original cost. Consider a unit that was installed new and remained in service at the same location for 10 years. Then it was retired from that location and installed in a second location. After six years, it was retired from service at the second location. After retirement from the second location, the unit was scrapped rather than returned to stock for reuse. The net salvage at the time of its second and final retirement was zero. The "whole life" is 16 years and "whole life salvage ratio" is 0%. The average location life is (10 + 6)/2, or 8 years. If a salvage of 100% of the initial cost is assigned at the time the unit is retired from the first location, the average location life salvage ratio is (100% + 0%)/2, or 50%. Note that with either whole life or location life, the accrual rate is the same, 6.25%, i.e., 100%/16, or (100% − 50%)/8.

Multiple installations and the associated installation costs and methods of pricing reused units yielding current rather the original cost complicate capital recovery when location life is used. The use of "cradle to grave" accounting (i.e., use of whole life rather than location life) is an alternative when property is reused. Under this method, accounting location moves would not be recorded as retirements and salvage. If they are recorded, the cradle to grave effect can be achieved by considering the location salvage as a reverse retirement. Cradle to grave accounting is often favored because it is simpler than location life and avoids pricing and salvage problems created when location life is used. These advantages often result in better forecasts of life and salvage than if location life had been used.

Reimbursed retirement—code 1. A reimbursed retirement is one for which the company is fully compensated at the time of retirement, usually because the retirement occurred earlier than normal as the result of an unusual event. Compensation may be from insurance, from the party who damaged the utility by causing the retirement, or from an individual or public authority who desired or required the relocation or abandonment of the retired property. Usually reimbursed retirements should not be included in analysis to estimate the life and salvage of

property whose original investment is recovered through depreciation accruals.

Sale—code 2. A retirement caused by a sale is one in which the property is not retired from service, but continues in the same service under a new owner. Typically, the sold property has not reached its normal service life and is sold for at least the book value. The sale is made to a similar company and the property continues to be used in the same or similar manner as before the sale. Because the original cost is recovered primarily via the sale, these retirements are not normally included in an analysis to estimate the life and salvage of property whose original cost is recovered through depreciation accruals.

Transfer out—code 3. A transfer out is the retirement of property from one depreciable group and concurrent assignment (i.e., transfer in) to another depreciable group. This is an accounting transaction and the property is not physically altered or removed from service. Transfers out should not be included in an analysis to estimate the life of property whose original cost is recovered through depreciation.

Transfer in—code 4. A transfer in increases the plant balance and is the result of a transfer out from another account. This code can be eliminated by defining code 3 as *Transfers.* Then a transfer out would be a code 3 with a negative value assigned to the transaction and a transfer in would be a code 3 with a positive value assigned to the transaction.

Acquisition—code 5. An acquisition results in an increase in the plant in service caused by the purchase of property from a company providing similar service. A sale for one company results in an acquisition for another. The preferred treatment, when possible, is to merge the aged data from the acquired property with the aged data for the account to which the property is added. If the record of aged data is not available, the acquired balance is incorporated into the data. If the balance is not aged, it may be necessary to statistically age the data or keep it separate from the aged data.

Life span retirement—code 6. A life span retirement is the final retirement in a life span group (see Chapter 13). This coding allows interim retirements, which are coded as regular retirements, to be analyzed separately from the final retirements. The analyst is then better able to estimate a) the interim retirement survivor curve and b) the date of the final retirement. Life span retirements must be included in analysis to estimate the life of property whose original cost is recovered through depreciation accruals.

Outlier retirement—code 7. An outlier retirement is a retirement that results from an unusual occurrence and should be excluded from consideration when forecasting service life. If the occurrence, although unusual, is one that can be expected to reoccur from time to time, the

A characteristic of the placement band is that the more recent the placement, the less the experience and the shorter the survivor curve. Recent placement bands may be too short to give significant information about either the life or the general shape of the curve. In contrast, the most recent experience bands yield the longest life tables.

Recent experience bands yield the most recent retirement ratios, providing the forecaster with valuable information about the current retirement ratios for all ages. The analyst may examine the influence of a specific force of retirement by using the experience band method. For example, the effect of a recent change in a company's maintenance policy could be examined by comparing the survivor curve from an experience band that ends at the last year in which the old policy was in effect with the survivor curve from an experience band that starts with the first year during which the new policy was used.

Choosing the width of either the experience band or the placement band is an important decision that the analyst must make. A band of only one year will typically exhibit significant randomness, resulting in a survivor curve that may be difficult to analyze. Combining several years in a single band will result in an average curve that is smoother; that is, it shows less randomness than the curves from the one-year bands. This smoothing, or averaging, effect is a primary motivation for combining single years into multiple bands. Although widening a band has the advantage of smoothing the data, it has the disadvantage of obscuring or hiding differences between the individual bands.

The analyst must use good judgment when determining band widths. Many empirical procedures governing this choice have been developed. These include the selection bands of fixed width, often 3, 5, or 10 years; rolling bands, in which one band overlaps the next; and shrinking bands, in which the width of the band systematically decreases.

A preferred approach is to select the bands based on the history and the activities that occurred during the period defined by the bands. Because placement bands are often used to describe property of a particular technology, a band could be chosen that will be wide enough to include all property of a similar technology. Experience bands may be chosen to include the calendar years during which a single force of retirement was of particular interest.

Bands may be chosen to detect change in the survivor characteristics. Suppose, for example, that an experience band covering the past 12 years had been selected because it was believed that the economic forces had been somewhat constant during this period. To test for change during this period, the 12 years can be subdivided into nonoverlapping intervals. Division of these 12 years into the first five years and the last seven years would be an example. The life characteristics of the single 12-year period can be compared to the five-year and the seven-year periods. The mean service life indicated by the survivor curve constructed from the 12-year band is a weighted average of the curve from the five-year and seven-year bands, and a comparison of the shorter periods will show whether the service life has been constant during the 12-year period.

The ultimate combination of bands is the overall band, which combines all individual placement and experience bands into a single, overall band. The major attribute of the survivor curve obtained from this band is that it uses every available exposure and retirement. On the other hand, this grand average obscures the dynamic characteristics of the life characteristics of the property. In addition, it is difficult to define the meaning of the resulting survivor curve. Each individual retirement ratio is based on a different group of property. The first retirement ratio will include observations from all vintages and the second retirement ratio from all but the most recent. This pattern continues until the final point is based on observations from only one vintage. It is difficult to figure out the exact meaning of the overall band, and, in spite of the fact it does include all the data points, it should be given limited significance.

Incomplete Actuarial Data

Notice that the Account 897 data are incomplete. There are no data for the 1962 through 1967 placements before 1968, and this type of gap in data is not unusual. Legislation enacting the Uniform System of Accounts passed in the mid 1930s, and implementation in some industries started in the late 1930s. The start of implementation also depended on the size of the company, and some companies have started only recently. Companies were faced with the problem of initiating retirement records for property that had been in service for some time. The usual solution was to conduct a physical inventory so that, with the examination of records and information obtained from accounting and operating personnel, the age of the property currently in service could be estimated and recorded. From that point on, exposure and retirement data were kept. Figure 8.8 (see end of chapter) represents a data matrix that is missing data from the first two vintages.

Consider the construction of a survivor curve from the data in the experience band shown in Figure 8.8. Retirement ratios from early placement years are available even though the early history from those placements, indicated by the question marks, is unavailable. But construction of a survivor curve for an early placement band is not possible unless additional data, the fraction surviving from each vintage with missing data, are obtained or estimated. In Account 897, all years before 1968 are missing data. For example, the 1963 vintage is missing data for the age interval 0–

14 Salvage Analysis and Forecasting

THIS chapter discusses the analysis of aged salvage data and illustrates the use of a mathematical model to help estimate future salvage. Table 8.1 at the end of Chapter 8 shows the aged retirements for Account 897, Utility Devices. These data will be needed in this chapter. For convenience, Table 8.1 will be called the *retirement matrix.*

Net salvage is composed of gross salvage and cost of retiring.[1] Data reflecting these two categories often are kept separately. Different economic forces act on each, so that the pattern of gross salvage versus age differs from the pattern of cost of retiring versus age. If separate records are kept, each pattern can be analyzed. If the records are combined, the separate patterns may be obscured.

Though the patterns of gross salvage and cost of retiring versus age may be different, the general process for analyzing the patterns is the same. The gross salvage for Utility Devices will be assumed to be zero. This will simplify our illustration, and the cost of retiring will provide an example on which to base a discussion of analyzing and forecasting salvage.

Table 14.1 (see end of chapter) shows the cost of retiring by age for Account 897. Each row represents a vintage (or placement or installation) year, and each column represents an experience (or calendar) year. Each entry in the table is the total cost of retiring units from that vintage during that experience year. Vintage years run from 1962 through 1990 and experience years from 1968 through 1990.

Table 14.2 (see end of chapter) shows the salvage ratios (SR) for Account 897. The SR is the salvage divided by the original cost of the retirements and usually is expressed as a percentage. During 1974, $9.00 from the 1971 vintage was retired (see the retirement matrix). The cost of retiring these dollars, shown in Table 14.1, was $2.03, and the resulting SR is −2.03/9.00 or −22.6%.

SALVAGE ANALYSIS

Salvage analysis starts with an examination of the data reflecting the total annual costs. Often these are the only data available. The final row in Table 14.1 shows the sum of each column and equals the total cost of retiring during the calendar year. The original cost of all retirements during the calendar year is shown in the retirement matrix. Table 14.3 (see end of chapter) combines these annual retirement amounts. Column (a) shows the calendar year, column (b) shows the total dollars retired during the year, and column (c) shows the total cost of retiring during the year. Column (d) is the salvage ratio (SR) for the year (i.e., column (c)/column (b) times 100%). Statistics based on single years are often erratic, making any underlying pattern difficult to detect. The final four columns are used in the calculation of SRs for 3-year "rolling bands" or moving averages. This averaging process smooths the pattern of ratios. Column (e) defines the rolling bands. Each band has 2 years in common with the bands on either side of it. The retirements, column (f), during the 1968–1970 band equal 18.00 + 30.00 + 42.00 or $90.00, and the cost of retiring, column (g), is (−4.28) + (−7.65) + (−10.42) or −22.35. Column (h) is the average SR during the 3-year rolling band.

The average realized salvage is the total cost of retiring divided by the total retirements, or −1452.28/3833.00 or −37.9%. The SRs steadily become more negative, from about −24% during the early years to about −40% during the most recent years. One reason for this trend is that the average age of the annual retirements has increased. The first additions were made in 1962. The average life of the property in Account 897 is known to be about 10 years. During 1969 the account was "young," because a retired unit could not have been older than 7 years (i.e., a retirement from the 1962 vintage), and most retirements were younger than 7 years (i.e., retirements from more recent vintages). The average age of the units retired during 1969 was 4.8 years (the age and number of dollars retired during 1969 can be found in the retirement matrix). As time passed, the average age of the retirements increased. By 1989 the average age of retirements was 10.2 years.

In a stable account with zero growth (see Chapter 9), the average age of the retirements equal the average life. Though the annual additions to