Edward I. Altman, "Measuring Corporate Bond Mortality and Performance,"
Journal of Finance, 44, 1989, pp. 909–22.

OUTLINE

I. INTRODUCTION

A. Overview

1. Three risk components of fixed interest instruments
    a. Default risk
    b. Interest rate risk
    c. Liquidity risk
2. Measurement of default risk critical for
    a. Debt pricing
    b. Performance measurement
    c. Assessment of market efficiency
3. Deficiencies of the traditional average annual rate method
    a. Failure to consider bond mortality from causes other than default
    b. Failure to consider default probabilities for different time periods and bond ratings

B. Values to Calculate for Various Time Periods

1. Estimated probability of default
2. Estimated loss from default
3. Estimated cumulative annual mortality rates
4. Estimated marginal mortality rates
5. Net return spreads in comparison with risk-free securities

C. Previous Types of Studies

1. Compilation of statistics on default risks and returns
2. Identification of the default risk potential by examining risk premiums
3. Fons study – combined observed pricing and inherent default risk premium with estimates of default

D. Traditional Measures of Default Rates and Loans

1. Analysis of the entire range of corporate bonds (seven classes) or just noninvestment grade (three classes)
2. Calculation of annual rates of default and the long-term average
3. **Annual default rate** – ratio of the dollar amount of defaulting issues in a year to the outstanding amount as of a point in the year
4. Recent rates
   a. 1.86% – 1978–87
   b. 1.88% – 1978–87 if include distressed exchange issues
5. **Annual default loss** – sum of the difference between the par value and the value after default plus one coupon payment
   a. 1.2% – 1978–87
   b. Defaulting debt sells for about 40% of par value

II. ANALYSIS

A. Mortality Rate Concept

1. Note that the population in a specific group changes over time as bonds exit because of
   a. Defaults
   b. Calls
   c. Sinking funds
   d. Maturities
2. **Marginal mortality rate (MMR**) – individual mortality rate for a year

$$MMR_{(t)} = \frac{\text{Total Value of Defaulting Debt in Year (t)}}{\text{Total Value of Bond Population at Start of Year (t)}}$$

3. **Survival rate (SR)** – complement of the marginal mortality rate

$$SR_{(t)} = 1 - MMR_{(t)}$$

4. **Cumulative mortality rate (CMR)** – complement of the product of survival rates

$$CMR_{(T)} = 1 - \prod_{t=1}^{T} SR_{(t)}$$

5. Calculation of mortality rates
   a. Various specific mortality rates reflect the experience from all years of the experience period
   b. Weighted averages to eliminate bias

PAST CAS AND SoA EXAMINATION QUESTIONS

1. According to Altman, in "Measuring Corporate Bond Mortality and Performance," which of the following are true regarding bonds after default?

   1. The average price after default is dependent upon the initial bond rating.
   2. The price after default is dependent upon the number of years the bond is in existence before default.
   3. The average recovery rate is equal to the percentage of bonds in default that eventually recover and reimburse the full principal amount at maturity.

   A. 1 B. 2 C. 1,3 D. 1,2,3 E. None of these answers are correct. (95–10–9–1)

2. Referring to Altman's "Measuring Corporate Bond Mortality and Performance," explain the two deficiencies in the traditional technique of measuring default rates and losses based on the average annual rate method. (96–10–38–2)

3. You are given the following information:

	Time, T (in years)			
	0	1	2	3
No. of defaulting bonds	0	2	3	3
Value of defaulting debt	\$0	\$1,000	\$1,470	\$1,900
No. of nondefaulted bonds	100	98	95	92
Value of nondefaulted bonds	\$100,000	\$98,000	\$95,000	\$92,000

   Using Altman's "Measuring Corporate Bond Mortality and Performance," calculate the cumulative mortality rate at time T = 3 for this class of bonds. Show all work. (97–10–38–3)

4. According to Altman, in "Measuring Corporate Bond Mortality and Performance," which of the following are true?

   1. For the first three years after issuance, the lower the bond rating, the lower the net return spread.
   2. For all holding periods, all bond types have positive return spreads over Treasuries.
   3. There appears to be a positive correlation between the bond price after default and the number of years that the bond is in existence before default.

   A. 1 B. 2 C. 1,2 D. 1,3 E. 1,2,3 (98–10–13–1)

5. According to Altman, in "Measuring Corporate Bond Mortality and Performance":

   a. Investors have been more than fairly compensated for investing in high-risk bonds. Give three possible reasons to explain the positive return spreads.
   b. In addition to default risk, there are two other major risks associated with fixed interest instruments. Identify these two other risks. (98–10–37–1.5/.5)

6. According to Altman, in "Measuring Corporate Bond Mortality and Performance," the average bond price after default is correlated with the initial bond rating. (99–10–11–.5)

7. According to Altman, in "Measuring Corporate Bond Mortality and Performance," if expected default losses are fully discounted in the prices and yields of securities, the return spreads should be close to zero. (99–10–16–.5)

Altman

1. 1. F, p. 916 – Substitute "not dependent" for "dependent."

   2. F, p. 916 – Substitute "not dependent" for "dependent."

   3. F, p. 916 – It reflects "amounts for which investors were able to sell the defaulting issue."

   Answer: E

2. 1) "It fails to consider that there are other ways in a which a bond dies, namely redemptions from calls, sinking funds, and maturation. Therefore, it fails to consider the surviving population of bonds; . . . ."

   2) It fails to consider "the probability of default for various time periods in the future on the basis on an issue's specific attributes at issuance, summarized into its bond rating," p. 910.

3. 1) Calculate the annual marginal mortality rates. The value of the bond population at the start of the year is the value listed for the previous year.

$$MMR_{(t)} = \frac{\text{Total Value of Defaulting Debt in Year (t)}}{\text{Total Value of Bond Population at Start of Year (t)}}$$

$$MMR_{(1)} = 1{,}000/100{,}000 = .01$$
$$MMR_{(2)} = 1{,}470/98{,}000 = .015$$
$$MMR_{(3)} = 1{,}900/95{,}000 = .02$$

   2) Calculate the survival rates as the complements of the marginal mortality rates

$$SR_{(1)} = 1 - .01 = .99 \qquad SR_{(2)} = 1 - .015 = .985 \qquad SR_{(3)} = 1 - .02 = .98$$

   3) Calculate the cumulative mortality rate:

$$CMR_{(T)} = 1 - \prod_{t=1}^{T} SR_{(t)} = 1 - (.99)(.985)(.98) = .0444\text{, p. 912.}$$

4. 1. F, p. 920 – Substitute "the higher the net" for "the lower the net."

   2. T, p. 920

   3. F, p. 916 – Substitute "does not appear" for "appears."

   Answer: B

5. a. 1) Lack of information has led to the mispricing of such securities.
      2) Other risk elements (liquidity risk and reinvestment risk) that have not been isolated may be producing the effect.
      3) Retention values after default vary considerably, requiring a higher yield.
      4) Some institutions are not allowed to invest in low-grade bonds or have limits on such investments, reducing the demand and increasing the yield, pp. 920–21.

   b. 1) Liquidity risk
      2) Interest rate (reinvestment) risk, pp. 920–21.

6. F, p. 916 – Substitute "has virtually no correlation" for "is correlated."

7. T, p. 920.