Duration and Average Life

The term structure of a transaction refers to the length of time the investment is outstanding and can be measured by total term, average life and duration. These financial terms are commonly applied to loans, but they can be useful in evaluating any financial transaction.

The **total term** of a loan is the number of years from the loan draw down date to the last debt service.

The **average life** of a loan is the number of years that pass from the loan draw down until half the time-weighted principal is repaid. This figure is used as a measure to help lenders differentiate the risk factors between two loans with identical maturities. For instance, a lender may consider a 30-year level debt service (mortgage-style) loan less risky than a 30-year interest-only balloon loan. The average life of the first loan is significantly less than that of the second loan.

The calculation of the average life of a loan with a single initial draw down is:

Average Life = sum[principal payment * (days since loan draw)/360] / initial loan amount

If the loan has a single interest rate, the formula simplifies to:

Average Life = sum[interest payments] / (initial loan amount * interest rate)

To see average life using a graph, plot the principal payments against time and determine the balance point. This balance point is the average life of the loan.

The **Macaulay duration** of a loan is the number of years that pass from the loan draw down date until half of the time-weighted present value of the debt services has been paid. Duration is used by lenders to determine an instrument's sensitivity to interest rate changes. The risk of a change in market conditions will affect the value of a loan with a high duration more than the value of a similar loan with a low duration. The formula for this is Volatility (percent) = Duration / (1+yield).

The calculation of the Macaulay duration of a loan with a single initial draw down is:

Duration = sum[present value of each debt service * (days since loan draw)/360] / initial loan draw

The present value is calculated at the loan interest rate.

To see duration using a graph, plot the present value of the debt service payments against time and determine the balance point. This balance point is the duration of the loan.