AIMMS Function Reference - Financial Functions - General Conversions

Part III

Financial functions

Introduction to Financial Functions

Financial functions can be of great use in modeling financial optimization models. They perform common business calculations, such as determining

- the depreciation of an asset,
- the payments for a loan,
- the future value or net present value of an investment, and
- the values of bonds, coupons or other securities.

Having these functions available in AIMMS prevents you from having to implement such functionality into your models yourself. Common arguments for the financial functions include:

- **Values:** the value of an investment, security or cash flow at a specific time. For example, the amount paid periodically to an investment or loan.
- **Rates:** the interest rate or discount rate for an investment or security. For example, the desired internal return on investment could be 8 percent.
- **Dates:** the date of measurements, payments or other events. For example, the date of settlement of a security. AIMMS' financial functions always expects dates to be provided in the format "`ccyy-mm-dd`".
- **Interval lengths (in time periods):** the number of periods that has to be analyzed. For example, the useful life of an asset or the number of payments or periods of an investment
- **Type:** the time when payments are made during the period. For example, at the beginning of a month or the end of the month.

The financial functions supported by AIMMS can be divided into separate categories. Each of these categories will be shortly introduced (including the mathematical equations underlying the functions in a category) and each of the available functions will be described in full detail. The following categories can be distinguished:

- General conversion functions
- Day count bases and dates
- Depreciation of assets
- Investments and loans
- Securities

Financial Functions - General Conversions

Prices (such as security prices) are often provided as a fractional price, whereas the financial functions in AIMMS always expect decimal prices. AIMMS supports the following conversion functions between fractional and decimal prices:

- PriceDecimal
- PriceFractional

Annual interest rates can be given as a nominal rate (just the sum of interest rates over the number of compounding periods) or in the form of an effective rate (including the effects of interest over interest for all compounding periods). AIMMS supports the following interest rate conversion functions:

- RateEffective
- RateNominal

PriceDecimal

The function `PriceDecimal` converts a price expressed as a fractional number to a price expressed as a decimal number depending on the input parameter *FractionBase*.

```
PriceDecimal(
    FractionalPrice,            ! (input) numerical expression
    FractionBase                ! (input) numerical expression
    )
```

Arguments:

FractionalPrice
: The price expressed as a fractional number. *FractionalPrice* can be any real number.

FractionBase
: The base used as the denominator of the fraction. *FractionBase* must be a positive integer.

Return value:

The function `PriceDecimal` returns the *FractionalPrice* expressed as a decimal number.

Equation:

The conversion between decimal and fractional prices is based on the system of equations

$$\begin{cases} \lfloor p_f \rfloor = \lfloor p_d \rfloor & \text{(integer parts)} \\ p_f - \lfloor p_f \rfloor = \frac{b}{10^{\lfloor \log b \rfloor}} \left(p_d - \lfloor p_d \rfloor \right) & \text{(fractional parts)} \end{cases}$$

where p_d is the decimal price, p_f the fractional price and b the base.

Remarks:

- For bases which are a power of 10, the decimal and fractional prices coincide. In all other cases, the fractional price is smaller than the decimal price.
- The function `PriceDecimal` is similar to the Excel function `DOLLARDE`.

See also:

The function `PriceFractional`.

PriceFractional

The function PriceFractional converts a price expressed as a decimal number to a price expressed as a fractional number depending on the input parameter *FractionBase*.

```
PriceFractional(
    DecimalPrice,            ! (input) numerical expression
    FractionBase             ! (input) numerical expression
    )
```

Arguments:

DecimalPrice
: The price expressed as a decimal number. *DecimalPrice* can be any real number.

FractionBase
: The base to be used as the denominator of the fraction. *FractionBase* must be a positive integer.

Return value:

The function PriceFractional returns the *DecimalPrice* expressed as a fractional number.

Remarks:

- The system of equations on which the conversion between decimal and fractional prices is based, is explained for the function PriceDecimal (the inverse of PriceFractional).
- The function FractionalDecimal is similar to the Excel function DOLLARFR.

See also:

The function PriceDecimal.

RateEffective

The function `RateEffective` returns the effective annual interest rate, expressed as a fraction, on the basis of a nominal interest rate plus the number of compounding periods per year.

```
RateEffective(
    NominalRate,            ! (input) numerical expression
    NumberPeriods           ! (input) numerical expression
    )
```

Arguments:

NominalRate
: The nominal annual interest rate expressed as a fraction. *NominalRate* must be a nonnegative decimal number.

NumberPeriods
: The number of compounding periods per year. *NumberPeriods* must be a positive integer.

Return value:

The function `RateEffective` returns the effective annual interest rate expressed as a fraction.

Equation:

The conversion between nominal and effective rates is based on the equation

$$r_{eff} = \left(1 + \frac{r_{nom}}{n}\right)^n - 1$$

where r_{eff} is the effective annual rate, r_{nom} the nominal annual rate and n the number of compounding periods.

Remarks:

- This function can be used in an objective function or constraint, and the input parameter *NominalRate* can be used as a variable.
- The function `RateEffective` is similar to the Excel function `EFFECT`.

See also:

The function `RateNominal`.

RateNominal

The function `RateNominal` returns the nominal annual interest rate, expressed as a fraction, on the basis of an effective annual interest rate plus the number of compounding periods per year.

```
RateNominal(
    EffectiveRate,            ! (input) numerical expression
    NumberPeriods             ! (input) numerical expression
    )
```

Arguments:

EffectiveRate
: The effective annual interest rate expressed as a fraction. *EffectiveRate* must be a nonnegative decimal number.

NumberPeriods
: The number of compounding periods per year. *NumberPeriods* must be a positive integer.

Return value:

The function `RateNominal` returns the nominal annual interest rate expressed as a fraction.

Remarks:

- The equation on which the conversion between nominal and effective rates is based, is explained for the function `RateEffective` (the inverse of `RateNominal`).
- This function can be used in an objective function or constraint, and the input parameter *EffectiveRate* can be used as a variable.
- The function `RateNominal` is similar to the Excel function `NOMINAL`.

See also:

The function `RateEffective`.