BANCO DE MEXICO

Calculation of Total Annual Cost (TAC)

The TAC is calculated based on flows between the client and the lending institution.

TAC calculation formula

TAC is the numerical value i, expressed as a percentage, which satisfies the following equation:

$$\sum_{j=1}^{M} \frac{A_j}{(1+i)^{t_j}} = \sum_{k=1}^{N} \frac{B_k}{(1+i)^{s_k}}$$

Where:

i = TAC, expressed as a decimal
M = Total number of credit disposals
j = Consecutive number identifying each loan disposal
A_j = Amount of the j-th loan disposal
N = Number of total payments
k = Consecutive number identifying each payment
B_k = Amount of k-th payment
t_j = Time interval expressed in years and fractions of a year between the date the contract begins and the date of the j-th loan disposal
s_k = Time interval expressed in years and fractions of a year between the date on which the contract begins and the date of the k-th payment
$\sum$ = Symbol used to express the sum of the amounts indicated

Explaining the formula: left side

The left side of the equation represents the sum of the present value of loan disposals considering the time interval.
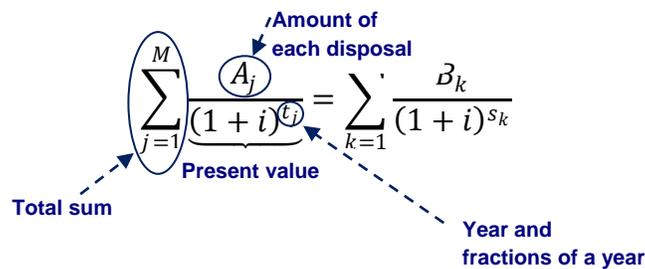
Example: A loan of \$15,000 (A) fully drawn when the contract is signed (period zero). Substituting in the formula:

$$Disposition = 15{,}000$$

Explaining the formula: right side

The right side of the equation represents the sum of the present value of the loan payments considering the time interval.

$$\sum_{j=1}^{M} \frac{A_j}{(1+i)^{t_j}} = \sum_{k=1}^{N} \frac{B_k}{(1+i)^{S_k}}$$

Example: The \$15,000 loan will be paid off in 24 monthly payments of \$962.33 each; a \$100 commission payable is also considered when the contract is signed. Substituting in the formula:

$$Payments = \frac{100}{(1+i)^{\frac{0}{12}}} + \frac{962.33}{(1+i)^{\frac{1}{12}}} + \frac{962.33}{(1+i)^{\frac{2}{12}}} + \cdots + \frac{962.33}{(1+i)^{\frac{23}{12}}} + \frac{962.33}{(1+i)^{\frac{24}{12}}}$$

In order to calculate the TAC, the numerical value of i, which is the same as the present value of disposals with the following payments, is as follows:

$$15{,}000 = 100 + \frac{962.33}{(1+i)^{\frac{1}{12}}} + \frac{962.33}{(1+i)^{\frac{2}{12}}} + \cdots + \frac{962.33}{(1+i)^{\frac{23}{12}}} + \frac{962.33}{(1+i)^{\frac{24}{12}}}$$

$$i = .5736$$

The TAC corresponding to this loan is the value of i expressed as a percentage:

$$TAC = 57.36\%$$

In order to verify that the TAC value is correct, such value is substituted in the formula and the equation is verified:

$$\frac{15{,}000}{(1+.5736)^0} = \frac{100}{(1+.5736)^{\frac{0}{12}}} + \frac{962.33}{(1+.5736)^{\frac{1}{12}}} + \frac{962.33}{(1+.5736)^{\frac{2}{12}}} + \cdots + \frac{962.33}{(1+.5736)^{\frac{26}{12}}} + \frac{962.33}{(1+.5736)^{\frac{24}{12}}}$$

$$15{,}000 = 100 + \frac{962.33}{1.0385} + \frac{962.33}{1.0785} + \cdots + \frac{962.33}{2.3844} + \frac{962.33}{2.4762}$$

$$15{,}000 = 100 + 926.65 + 892.29 + ... + 403.59 + 388.63$$

$$15{,}000 = 15{,}000$$

Exponent s_k represents the time interval, expressed in years and fractions of years, which elapses between the date on which the contract comes into effect and each of the loan payments are made (*k*-th payment). For example, in the case of loans with regular payments:

If payments are made:	Loan term:	S_k values:
Weekly	1.5 years	0/52, 1/52, 2/52, …, 77/52 and
Monthly	10 years	0/12, 1/12, 2/12, …, 119/12 and 120/12
Quarterly	3 years	0/3, 1/3, 2/3, 3/3, …, 8/3 y 9/3
Half yearly	2 years	0//2, 1/2, 2/2, 3/2 and 4/2

However, the payment of some loans does not always take place during regular periods. In this case, s_k is stated in days. For example, considering a loan settled in one payment, after four months and four days (a period of 127 days including 3 months of 31 days, a 365-day year), the s_k value will be:

$$s_k = s_1 = \frac{127}{365}$$

Obtaining the TAC using Excel sheets

The TAC can be obtained using calculus sheets. In this case, funds from each of the loans are assumed to occur at regular time intervals (weekly, half monthly, monthly, etc.).

Net fund flows received or paid by the borrower are entered in a column. Client payments are recorded with a positive sign and disposals with a negative sign.

The procedure is as follows:

(a) **IRR calculation:** the financial function *Internal Rate of Return* (IRR) is applied to the net fund flow range. An IRR outcome is obtained *per period* and is annualized by multiplying it by the total number of periods in the reference year (weeks: 52, two weeks: 24, months: 12, quarters: 4, etc.) to yield a simple annual IRR.

(b) **Obtaining the TAC:** the financial function *Effective Interest* (EFFECTIVE INT) is applied using the following arguments: i) the simple annual IRR, and ii) the number of reference periods in a year.

The following formula can also be used to obtain the CAT:

$$CAT = (1 + TIR_{period})^n - 1$$

where:

TIR_{period}: The result obtained at (a).

n: The number of periods in a year.

The following example illustrates how the TAC for the loan referred to in this document is obtained:

Period

Net fund flows

Loan disposal with a negative sign. The fee paid is deducted.

24 monthly payments with a positive sign

Monthly IRR

Simple annual IRR

EFFECTIVE INT

Total amount payable

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[1] If this function is not available it must be installed from the *Tools* menu. Choose the option *Complements* and from the list of *Available Complements* select the box *Tools for Analysis*, click on *accept.* You may have to follow additional instructions to install the program.

Banco de México TAC calculator

The TAC calculator is also available on Banco de México's website. This tool obtains the TAC using the flows between the client and the bank granting the loan.

The TAC calculator for diverse loans is available at:

http://www.banxico.org.mx/CAT/index.html