STATEMENT

ON THE FINANCIAL CALCULATIONS OF THE GOVERNMENT SECURITIES MARKET USED AND PROPOSED BY THE GOVERNMENT DEBT MANAGEMENT AGENCY PRIVATE COMPANY LIMITED BY SHARES

Date of entry into force: 18 October 2022

Preamble

Government Debt Management Agency Private Company Limited by Shares (hereinafter as: ÁKK Zrt.) considers the following financial calculations and formulas to be applicable to government securities placed publicly by the Hungarian State via auction in Hungary (hereinafter as: Hungarian Government Securities), including Hungarian Government Securities with an original term-to-maturity of more than 365 days (hereinafter as: Hungarian Government Bonds) and Hungarian Government Securities with an original term-to-maturity of less than 365 days (hereinafter as: Discount Treasury Bills).

1. Fixed-rate Hungarian Government Bonds

1.1. Yield-price calculation, regardless of the length of the term-to-maturity

$$Gross\ rate\ (\%) = \sum_{i=1}^{n} \frac{Fi}{(1+T_p)^{p_i+\frac{nbc}{w}}}$$

where:

T_a: annualized yield to maturity
T_p: yield to maturity corresponding to the length of the interest payment period
f: the number of interest payments in a year

$$T_p = \sqrt[f]{1+T_a} - 1, and\ T_a = (1+T_p)^f - 1$$

n: the number of remaining cash-flow items on the settlement date
d_i: the payment date (interest payment and redemption) of the i-th cash flow item
d_s: the settlement date
d_0: the issue date
d_{t0}: technical interest payment date, which is to be defined by deducting two interest periods from the next interest payment date
d_{t1}: technical interest payment date, which is to be defined by deducting one interest period from the next interest payment date
p_i: integer $(0,1,2,\dots,n)$, the number of interest payments between the settlement date (d_s) and the date of F_i (that is d_i). If the settlement date is before the first interest payment, furthermore if there is a technical interest payment date (d_{t1}) between the settlement date and the next (first) interest payment date, all p_i values increase by 1. (So $p_1 = 1, p_2 = 2, etc.$)
nbc: the number of days between the settlement date and the next interest payment date $(nbc = d_1 - d_s)$. If the settlement date is prior to the first interest payment, furthermore if there is a technical interest payment date (d_{t1}) between the settlement date and the next interest payment date, then

$$nbc = d_{t1} - d_s$$

w: the number of days in the actual interest payment period, by default the number of days between the next interest payment and the previous interest payment ($w = d_i - d_{i-1}$)

If the settlement date is before the first interest payment, furthermore if there is a technical interest payment date (d_{t1}) between the settlement date and the next interest payment date, the value of w is:

$$w = d_{t1} - d_{t0}$$

If the settlement date is before the first interest payment, furthermore if there is no technical interest payment date between the settlement date and the next interest payment date, the value of w is:

$$w = d_1 - d_{t1}$$

F_i: the i-th cash-flow item of the bond ($i = 1,2,3,\ldots,n-1$: i-th interest payment, $i = n$: the last interest payment and redemption)

g: annual coupon

f: the number of interest payments in a year

calculation of the value of F_i , if $i > 1$

$$F_i = \frac{g}{f}, \qquad F_n = \frac{g}{f} + 100$$

calculation of the value of F_i, if $i = 1$

- if $d_{t1} = d_0$, that is if the first interest payment period is exactly as long as the interest payment frequency, then

$$F_1 = \frac{g}{f}$$

- if $d_{t1} < d_0$, that is if the first interest payment period is shorter than the interest payment frequency, then

$$F_1 = \frac{g}{f} * \frac{d_1 - d_0}{d_1 - d_{t1}}$$

- if $d_{t1} > d_0$, that is if the first interest payment period is longer than the interest payment frequency, then

$$F_1 = \frac{g}{f} + \frac{g}{f} * \frac{d_{t1} - d_0}{d_{t1} - d_{t0}}$$

The calculated value of F_i shall in all cases be determined – unless otherwise provided by the Public Offering – **by rounding to two decimal places**. (An exception to this may be, for example, semi-annual interest rate bonds, where the annual coupon divided by two gives a value of three decimal places instead of two. In this case, all F_i values, and F_1 also shall be rounded to three decimal places. For example: if the annual coupon is 9.25%, the half-yearly payment is 4.625%.)

The gross price must be calculated by rounding to 4 (four) decimal places.

1.2. Calculation of accrued interest

1.2.1. Calculation of accrued interest in case of series paying interest annually:

If the settlement date (d_s) is before the first interest payment date (d_1),

a) and $d_0 \geq d_{t1}$, then

$$Accrued\ interest = \frac{g}{f} * \frac{d_s - d_0}{d_1 - d_{t1}}$$

b) and $d_0 \leq d_{t1}$, but $d_s \leq d_{t1}$, then

$$Accrued\ interest = \frac{g}{f} * \frac{d_s - d_0}{d_{t1} - d_{t0}}$$

c) and $d_0 \leq d_{t1}$, but $d_s \geq d_{t1}$, then

$$Accrued\ interest = \frac{g}{f} * \frac{d_{t1} - d_0}{d_{t1} - d_{t0}} + \frac{g}{f} * \frac{d_s - d_{t1}}{d_1 - d_{t1}}$$

In all other cases:

$$Accrued\ interest = \frac{g}{f} * \frac{d_s - d_{i-1}}{d_i - d_{i-1}}$$

1.2.2. Calculation of accrued interest in case of series paying interest semi-annually:

$$Accrued\ interest = g' * \frac{d_s - d_{i-1}}{d_i - d_{i-1}}$$

where:

g': the interest rate payable for the given interest period specified in the Public Offering of the given series

The accrued interest must be calculated by rounding to 4 (four) decimal places.

1.3. Net price = Gross price – Accrued interest

2. Floating-rate Hungarian Government Bonds

2.1. Calculation of accrued interest

2.1.1. In case of the given floating-rate Hungarian Government Bond, if the product serving as the interest rate base is a Discount Treasury Bill, or any index linked to a Discount Treasury Bill, other derivative, or any money market product (e.g.: central bank base rate, repo rate, BUBOR, etc.):

$$Accrued\ interest = g_v * \frac{d_s - d_{i-1}}{360}$$

where:

g_v: the actual interest rate of the given floating-rate Hungarian Government Bond

2.1.2. From the first interest payment of the given floating-rate Hungarian Government Bond after 1 January 2003, if the product serving as the interest rate base is a fixed-rate Hungarian Government Bond, or any derivative linked to it, or the consumer price index:

$$Accrued\ interest = \frac{g_v}{f} * \frac{d_s - d_{i-1}}{d_i - d_{i-1}}$$

where:

f: the number of interest payments or interest fixings in a year

If the fixed interest changes within an interest payment period, the value accrued up to the day of the change must be rounded down to two decimal places.

In case of Section 2.1.1. and 2.1.2. above, if the interest payable for the given interest period of the given Hungarian Government Bond, that is the value of F_i is zero, then the accrued interest rate is also zero for the days within the given interest period.

3. Discount Treasury Bills

$$Price\ (\%) = \frac{100\%}{(1 + T_a * \frac{d_n - d_s}{360})}$$

$$Yield\ (\%) = \frac{100\% - P}{P} * \frac{360}{d_n - d_s} * 100$$

where:

d_n: the maturity date of the given Discount Treasury Bill
P: price expressed in percentage

4. Determining the number of days

When determining the number of days between two dates, the first day must be excluded from the calculation, while the last day is included in the period. (The starting day must be deducted from the closing day.)

5. Payments due on public holidays

The interest payment dates specified in the Public Offering published at the time of the issuance of the individual Hungarian Government Bonds series are so-called theoretical interest payment dates. If any of these dates falls on a public holiday, then the actual payment shall be due on the next working day, however, the theoretical interest payment date as per the Public Offering shall be taken into account in the yield-price calculation, the accrued interest calculation and the determination of the ex coupon days.

6. Ex-coupon days

In the course of the calculation, in case of all Hungarian Government Bonds, the last time when a due payment may be taken into account is the second working day before the actual interest payment. The interest shall be payable to that investor who owns the security at the close of the second working day prior to the payment. On the one working day directly preceding the payment, the actual interest payment must be disregarded in the course of the calculation. Calculation of the accrued interest of the subsequent new interest payment starts from the interest payment date.

In case of all Hungarian Government Bonds and Discount Treasury Bills, the last day for which the given series can still be traded is the second working day before maturity. The investor who owns the security at the close of the second working day before maturity shall be entitled to the interest and principal payments at maturity.

Ex coupon days are determined in accordance with the currently effective General Business Rules of the KELER Central Depository Ltd.

Calculation example for the yield-price calculation of fixed-rate Hungarian Government Bonds according to the Acutal/Actual method

Example

Starting parameters:

Name:	2026/F
Issue date (d_0):	24/02/2021
Coupon (g):	1.50%
Maturity (d_n):	26/08/2026
Value date (d_s):	30/06/2021
Number of interest payment (f):	1
YTM ($T_a = T_p$):	8.43%

Parameters to be calculated for the calculation:

$d_{t0} = 26/08/2019$
$d_{t1} = 26/08/2020$
$w = d_1 - d_{t1} = 365\ days$
$nbc = d_1 - d_s = 57\ days$
$T_p = T_a = 8.43\%$

d_i	p_i	F_i	nbc	w	$p_i + \frac{nbc}{w}$	$\frac{1}{(1+T_p)^{p_i+\frac{nbc}{w}}}$	$\frac{F_i}{(1+T_p)^{p_i+\frac{nbc}{w}}}$
26/08/2021	0	0.75	57	365	0.1561644	0.9874404	0.7406
26/08/2022	1	1.50	57	365	1.1561644	0.9106709	1.3660
26/08/2023	2	1.50	57	365	2.1561644	0.8398698	1.2598
26/08/2024	3	1.50	57	365	3.1561644	0.7745733	1.1619
26/08/2025	4	1.50	57	365	4.1561644	0.7143533	1.0715
26/08/2026	5	101.50	57	365	5.1561644	0.6588152	66.8697

$$Gross\ price\ (\%) = \sum_{i=1}^{n} \frac{F_i}{(1+T_p)^{p_i+\frac{nbc}{w}}} = 72.4695\%$$

$$Accrued\ interest^{1}\!: Actual/Actual\ (\%) = \frac{g}{f} * \frac{d_s - d_0}{d_1 - d_{t1}} = 0.5178\%$$

$$Net\ price\ (\%) = Gross\ price\ (\%) - Accr.interest\ (\%) = 71.9517\%$$

[1] Definition according to Section 1.2.1. a), as being a fixed-rate bond with annual interest payments, where the issuance occured after the technical interest payment, that is $d_0 \geq d_{t1}$.

Calculation examples for the price and yield calculation of Discount Treasury Bills

Example 1

The price of **D230222** Discount Treasury Bill on **26 June 2022** with a yield of **6.72%**:

Name: D230222
Maturity (d_n): 22/02/2023
Value date (d_s): 26/06/2022
YTM (T_a): 6.72%

Parameters to be calculated for the calculation:

$$d_n - d_s = 238\ days$$

$$Price\ (\%) = \frac{1}{1 + T_a * \frac{d_n - d_s}{360}} = \frac{1}{1 + 0.0672 * \frac{238}{360}} = 95.7463\%$$

Example 2

The price of **D220824** Discount Treasury Bill on **16 May 2022** with a price of **98.36%**:

Name: D220824
Maturity (d_n): 24/08/2022
Value date (d_s): 16/05/2022
Price (P): 98.36%

Parameters to be calculated for the calculation:

$$d_n - d_s = 100\ days$$

$$Yield\ (\%) = \frac{100\% - P}{P} * \frac{360}{d_n - d_s} = \frac{1 - 0.9836}{0.9836} * \frac{360}{100} = 6\%$$

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Calculation examples for the calculation of accrued interest on floating-rate Hungarian Government Bonds

Example 1

The accrued interest of the **2026/C** Hungarian Government Bond on 29 June 2013, assuming that the annual interest rate (g) for the period between 24 October 2012 and 24 April 2013 is 6.97%.

Number of days from the interest period:

$$d_s - d_i = 67\ days$$

The basis for the interest fixing of the 2026/C bond is the 3-month and 6-month Discount Treasury Bill, therefore the accrued interest is calculated as set out in Section 2.1.1.:

$$Accrued\ interest\ (\%) = g * \frac{d_s - d_{i-1}}{360} = 6.97\% * \frac{67}{360} = 1.2972\%$$

Example 2

The accrued interest of the **2019/D** Hungarian Government Bond on 24 April 2018, assuming that the annual interest rate (g) for the period between 28 February 2018 and 28 May 2018 is 0.04%.

Calculation of the interest rate payable:

$$\frac{0.04\% * 89}{360} = 0.0099\%,$$

which must be rounded to 2 decimal places, so 0.01%, that is $10{,}000 * 0.01\% = HUF\ 1$, therefore the interest rate payable at the end of the interest period is 0.01%.

Number of days from the interest period:

$$d_s - d_{i-1} = 55\ days$$

The basis for the interest fixing of the 2019/D bond is the 3-month BUBOR, therefore the accrued interest is calculated as set out in Section 2.1.1.:

$$Accrued\ interest\ (\%) = g * \frac{d_s - d_{i-1}}{360} = 0.04\% * \frac{55}{360} = 0.0061\%$$

Example 3

The accrued interest of the **2019/D** Hungarian Government Bond on 24 April 2018, assuming that the annual interest rate (g) for the period between 28 February 2018 and 28 May 2018 is 0.02%.

Calculation of the interest rate payable:

$$\frac{0.02\% * 89}{360} = 0.0049\%,$$

which must be rounded to 2 decimal places, so 0.00%, that is $10{,}000 * 0.00\% = HUF\ 0$, therefore the interest rate payable at the end of the interest period is zero.

Since the interest payable is HUF 0 Ft, the accrued interest is 0% on any day of the interest period.

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