STATEMENT

Official methodology of calculations applied and recommended for use for the pricing of government securities by ÁKK Zrt., valid from 01 March 2018

Entry into force: 01 March 2018

Government Debt Management Agency Pte. Ltd.

Regarding the Hungarian Government Bonds issued by the Hungarian State, ÁKK Zrt. considers the following financial calculations and formulas to be applicable.

1) Fixed-rate Hungarian Government Bonds

1.1.) Yield-price calculation, regardless of the length of the residual maturity

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

where:

T_a= annual yield to maturity
T_p= yield to maturity corresponding to the length of the interest payment period
f= the number of interest payments in one year

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

n= the number of the remaining cash flow items on the settlement date
d_i= the payment date (interest payment and redemption) of the cash flow item i
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 date of 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= integers (0,1,2...n), the number of the interest payments between the settlement date (d_s) and the date of F_i (that is d_i). If the settlement date is prior to the first interest payment, furthermore if there is a technical interest payment date between the settlement date and the next (first) interest payment date (d_{t1}), then all p_i value increases by 1. (For example 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 between the settlement date and the next interest payment date (d_{t1}), then

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

w = the number of days in the current interest payment period. In the base case 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 prior to the first interest payment, furthermore if there is a technical interest payment date between the settlement date and the next interest payment date (d_{t1}), then the value of w is:

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

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

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

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

g = annual coupon rate

f= the number of interest payments in one 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 length of the first interest payment period corresponds with the interest payment frequency, then

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

- if $d_{t1} < d_0$, that is if the length of 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 length of 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 is to be defined - unless otherwise provided in the Public Offering - by **rounding it off to two decimal places** in all cases. (Those bonds with half-year interest payment periods may represent an exception to the above in case of which by dividing the annual coupon rate with two the result has three decimal places instead of two decimal places. In such cases all F_i values, thus even the F_1 shall be rounded off to three decimal places. Example: if the annual coupon rate is 9.25%, then the half-year payment will be 4.625%.)

1.2.) Calculation of accrued interest

1.2.1.) Calculation of accrued interest in case of the bonds with annual interest payment frequency being already in circulation:

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

a) and $d_0 >= d_{t1}$, then

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

b) and $d_0 <= d_{t1}$, but $d_s <= d_{t1}$

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

c) and $d_0 <= d_{t1}$, but $d_s >= d_{t1}$

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

In all other cases:

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

1.2.2.) Calculation of accrued interest in case of the series with half-year interest payment frequency:

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

where:

g' = the interest rate paid, as determined for the given interest period in the Public Offering of the given series.

1.3.) Net price = Gross price - Accrued interest

2.) Calculation of the accrued interest of floating rate Hungarian Government Bonds

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

$$Felhalmozott\_kamat = g_v \times \frac{d_s - d_{i-1}}{360}$$

2.2.) From the first interest payment of the given floating rate Hungarian Government Bond after 01 January 2003, if the product serving as the interest base is a fixed-rate Hungarian Government Bond, or any other derived product connected to the Hungarian Government Bond, or consumer price index:

$$Accrued\_\text{int}\ erest = \frac{g_v}{f} \times \frac{d_s - d_{i-1}}{d_i - d_{i-1}}$$

where:

f= the number of interest payments or interest rate publications during one year.

In the event the published interest is changed within the interest payment period, then the value accumulated until the day of the change must be rounded off to two decimal places.

In case of 2.1.) and 2.2.) sections above, if the payable interest rate for the relevant interest rate period of the given Hungarian Government Bond, that is the value of **Fi** is zero, then the value of the accrued interest 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 date of maturity of the given Discount Treasury Bill

P = the price expressed in percentage

4) Determining the number of days

When the number of days between two dates is to be determined, then the first day must be disregarded for the calculation whereas the last day must be included in the period. (The starting day must be deducted from the closing day.)

5) Payments due on bank holidays

The interest payment dates determined in the Public Offering published at the time of issuance of the different Hungarian Government Bond series are so-called theoretical interest payment dates. In the event any of these days is a bank holiday, then actual payment shall be due on the next working day, nevertheless the theoretical interest payment dates as per the Public Offering shall be used for purposes of the yield-price calculations, the accrued interest calculation and determination of the ex coupon days.

6) Determination of ex coupon days (from 03 September 2007)

For purposes of the calculations, in case of all Hungarian Government Bonds, the last time when due payments may be taken into account is the second working day prior to the actual interest payment. The interest shall be due to that investor who owns the given security at the closing time of the second working day prior to payment. The actual interest payment must be disregarded when making the calculations on the working day directly preceding the payment. Calculation of the accrued interest of the subsequent, new interest payment will start from the interest payment date.

In case of all Hungarian Government Bonds and Discount Treasury Bills, the last day when the given series can be traded will be the second working day prior to the maturity. Those investors will be entitled to receive interest and capital payments who own the given security at the closing time of the second working day prior to the maturity.

Ex coupon days are determined according to the rules of Keler Zrt. as effective from time to time.

Examples for calculating the yield-price of fixed-rate Hungarian Government Bonds with the Actual/Actual method

Example 1

Code: 2004/J
Coupon: 8.50%
Maturity (d_n): 12-10-2004

Value date (d_s): 27-09-2001

Yield as per the calculation (T_a): 9.41%

Parameters to be counted for the calculation:

d_0 = 05-07-2001
d_{t1} = 12-10-2001
d_{t0} = 12-04-2001

w = $d_{t1} - d_{t0}$ = 183 days
nbc = $d_{t1} - d_s$ = 15 days

T_p = $\sqrt[2]{1+0{,}0941} - 1$ = 4.60%

d_i	F_i	p_i	nbc	w	p_i+nbc/w	dt	PV
2002-04-12	6.54	1	15	183	1.0819672	0.95251274	6.229433325
12-10-2002	4.26	2	15	183	2.0819672	0.91063069	3.879286755
12-04-2003	4.24	3	15	183	3.0819672	0.8705902	3.69130246
12-10-2003	4.26	4	15	183	4.0819672	0.83231029	3.545641856
12-04-2004	4.24	5	15	183	5.0819672	0.79571356	3.373825482
12-10-2004	104.26	6	15	183	6.0819672	0.76072598	79.31329069
(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)=(3)+(4)/(5)*	*(7)=1/((1+T_p)^(6))*	*(8)=(2)*(7)*

Based on the formula specified in Section 1.1:

Gross price $= \sum_{i=1}^{i=n} \frac{F_i}{(1+T_p)^{p_i+\frac{nbc}{w}}}$, that is the sum of the values displayed in column (8), rounded off to four decimal places.

Thus the gross price is = **100.0328%**

Accrued interest:

According to the old method: 8.5% * 84days/365days = 1.9562%

Based on Actual/Actual: 6.54% * 84days/ 281days = **1.9550%**

Net price:

According to the old accrued interest calculation: 100.0328% - 1.9562% = 98.0766%

According to the new accrued interest calculation: 100.0328% - 1.9550% = **98.0778%**

Example 2

Name: 2007/D
Coupon: 6.25%
Maturity (d_n): 12-06-2007

Value date (d_s): 03-20-2002

Yield as per the calculation (T_a=T_p): 7.00%

Parameters to be counted for the calculation:

d_0 = 31-01-2002
d_{t1} = 12-06-2001

w = $d_1 - d_{t1}$ = 365 days
nbc = $d_1 - d_s$ = 84 days

d_i	F_i	p_i	nbc	w	p_i+nbc/w	dt	PV
12-06-2002	2.26	0	84	365	0.230137	0.98454984	2.225082638
12-06-2003	6.25	1	84	365	1.230137	0.92014004	5.750875234
12-06-2004	6.25	2	84	365	2.230137	0.85994396	5.374649751
12-06-2005	6.25	3	84	365	3.230137	0.80368594	5.023037151
12-06-2006	6.25	4	84	365	4.230137	0.75110836	4.694427244
12-06-2007	106.25	5	84	365	5.230137	0.70197043	74.58435808
(1)	***(2)***	***(3)***	***(4)***	***(5)***	***(6)=(3)+(4)/(5)***	***(7)=1/((1+T_a)^(6))***	***(8)=(2)*(7)***

Based on the formula specified in Section 1.1:

Gross price $= \sum_{i=1}^{i=n} \frac{F_i}{(1+T_p)^{p_i+\frac{nbc}{w}}}$, that is the sum of the values displayed in column (8), rounded off to four decimal places.

Thus the gross price is = **97.6524%**

Accrued interest:

Based on Actual/Actual: 6.25% * 48days / 365days = **0.8219%**

Net price: 97.6524% - 0.8219% = **96.8305%**

Example for calculation of the Discount Treasury Bills

The price of the Discount Treasury Bill no. **D031001** as of **12 February 2003** with a yield of **7.45%**:

d_n-d_s = 231 days

$$\text{Price} = \frac{100\%}{1+0{,}0745\times\frac{231}{360}} = 95.4377\%$$

The price of the Discount Treasury Bill no. **D030806** as of **06 May 2003** with a price of **97.85%**:

d_n-d_s = 92 days

$$\text{Yield} = \frac{100\%-97{,}85\%}{97{,}85\%}\times\frac{360}{92}\times 100 = 8.60\%$$

Example for calculation of the accrued interest of floating rate Hungarian Government Bonds

1)

The accrued interest of the Hungarian Government Bond no. **2005/F** as of 24 April 2003, presuming that the annual interest for the period between 24 February 2003 and 24 August 2003 is 7.93%.

d_s-d_{i-1} = 59 days

The base for calculating the bond no. 2005/F shall be the 6-month Discount Treasury Bill, therefore the accrued interest is calculated in the following way:

$$\text{Accrued interest} = \frac{7{,}93\%\times 59}{360} = 1.2996\%$$

2)

The accrued interest of the Hungarian Government Bond no. 2004/F as of 16 October 2003, presuming that the annual interest for the period between 12 March 2003 and 12 September 2003 is 7.30%, whereas the annual interest for the period between 12 September 2003 and 12 March 2004 is 6.80%.

Since the day of calculation is beyond the first half-year period, the calculation of the accrued interest must be divided into two parts. The value of the first half-year must be rounded off to two decimal places.

$$\frac{g}{f} = \frac{7{,}30\%}{2} = 3{,}65\%$$

The interest applicable for the second period is 6.80%, therefore the payment for this period:

$$\frac{g}{f} = \frac{6{,}80\%}{2} = 3{,}40\%$$

The number of days lapsed from the second period:

$d_s - d_{i-1}$ = 34 days

The length of the second period:

$d_i - d_{i-1}$ = 182 days

The interest for bond no. 2004/F will be determined on the basis of the consumer price index (CPI) therefore the amount of accrued interest based on the above presumptions:

Accrued interest = $3{,}65\% + 3{,}40\% \times \frac{34}{182}$ = 4.2852%

3)

The accrued interest of the Hungarian Government Bond **2019/D** as of 24 April 2018, presuming that the annual interest rate for the period between 28 February 2018 and 28 May 2018 is 0,04%,

Calculation of the amount of interest to be paid:

Interest payable = $\frac{0{,}04\% \times 89}{360}$ = 0,0099%, rounded to two decimals, then it will be 0,01%, i.e. 10,000*0.01% = HUF 1, so the interest payable at the end of the interest period will be 0,01%.

The numbers of days elapsed from the interest period:

$d_s - d_{i-1}$ = 55 nap

The base for deteremining the interest rate of the bond 2019/D shall be the 3-month BUBOR, therefore the accrued interest is calculated as follows:

Accrued interest = $\frac{0{,}04\% \times 55}{360}$ = 0,0061%

4)

The accrued interest of the Hungarian Government Bond **2019/D** as of 24 April 2018, presuming that the annual interest rate for the period between 28 February 2018 and 28 May 2018 is 0,02%, Calculation of the amount of interest to be paid:

Interest payable = $\frac{0,02\% \times 89}{360}$ = 0,0049%, rounded to two decimals, then it will be 0,00%, i.e. 10,000*0.00% = HUF 0, so the interest payable at the end of the interest period will be zero.

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