Determination of the Overnight Funding TIIE Index compounded on business days,[1] the Overnight Funding TIIE Index compounded on calendar days, and the Compounded in advance Overnight Funding TIIE.

To facilitate the transition to the new reference rates aligned to international standards and, in particular, to provide general market references in Mexico; Banco de México has decided to calculate and to provide the public with references based on the Overnight Funding Interbank Equilibrium Interest Rate (TIIE): a) the Overnight Funding TIIE (ON Funding TIIE) Index compounded on business days, b) the Overnight Funding TIIE Index compounded on calendar days, and c) the Compounded in advance Overnight Funding TIIE for tenors of 28, 91, and 182 days.

Below, the detail of the calculations carried out to obtain these references is described.

a. Overnight Funding TIIE Index compounded on business days

The Overnight Funding TIIE Index compounded on business days shows the composition of the Overnight Funding TIIE rate exclusively on business days from January 2nd, 2006, which is the first available record of the Overnight Funding TIIE rate, until the last day that such rate is available. For non-business days, a simple interest, based on the last available Overnight Funding TIIE rate, is applied. Banco de México will calculate the Overnight Funding TIIE Index compounded on business days to four decimal places, both for business and non-business days, as follows:

- **Formula for business days:**

The Overnight Funding TIIE Index compounded on business days, applicable on business day D, which incorporates as the last rate of the calculation period, the one from the immediately preceding business day to D, is given by the following formula: [2]

$$ON\ Funding\ TIIE\ Index_D = \begin{cases} 100,000 & if\ D = January\ 2, 2006 \\ 100,000 \times \left[\displaystyle\prod_{i=January\ 2,2006}^{D-1_h} \left(1 + \frac{TIIEF_i \times n_i}{36000}\right) \right] & if\ D \geq January\ 3, 2006 \end{cases}$$

Where:

- $D =$ The date corresponding to the business day for which the ON Funding TIIE Index is applicable.
- $D - 1_h =$ The date corresponding to the immediately preceding <u>business day</u> to D.
- $TIIEF_i =$ Overnight Funding TIIE rate published on business day i by Banco de México, through the internet page identified with the domain name www.banxico.org.mx, expressed in percentage points.

---

[1] This document is for informational purposes only. The official source for the Overnight Funding TIIE Indexes and Rates methodology is Circular 3/2012.

[2] The Overnight Funding TIIE Index applicable on business day D will be available on Banco de México's website from the immediately preceding business day to D, shortly after the publication of the last Overnight Funding TIIE rate considered for its calculation.

- n_i = Number of days for which the Overnight Funding TIIE rate published on business day i is applicable; that is, the result of adding the number of days between the publication day of $TIIEF_i$, including that day, and the immediately following business day, excluding the latter. For example, for the Overnight Funding TIIE rate published on a Friday, assuming that the next Monday after its publication is a business day, the number of applicable days would be equal to 3.

To perform the calculations of the Overnight Funding TIIE Index compounded on business days, 16 decimal places are used to round the result for each day, and the result for the final day of calculation will be published rounded to four decimal places. An example of values for certain business days is presented below:

Date on which Overnight Funding TIIE Index compounded on business days is applicable (D)	Date of the last Overnight Funding TIIE rate considered $(D-1)$	Last Overnight Funding TIIE rate considered	Number of days in which the Overnight Funding TIIE rate is applicable (n_i)	Overnight Funding TIIE Index compounded on business days
Monday 02/01/2006	NA	NA	NA	100,000
Tuesday 03/01/2006	Monday 02/01/2006	8.27%	1	$(100{,}000) * \left(1 + \frac{8.27 * 1}{36000}\right) = 100{,}022.9722$
Wednesday 04/01/2006	Tuesday 03/01/2006	8.28%	1	$(100{,}000) * \left[\left(1 + \frac{8.27 * 1}{36000}\right) * \left(1 + \frac{8.28 * 1}{36000}\right)\right]$ $= 100{,}045.9775$
Thursday 05/01/2006	Wednesday 04/01/2006	8.28%	1	$(100{,}000) * \left[\left(1 + \frac{8.27 * 1}{36000}\right) * \left(1 + \frac{8.28 * 1}{36000}\right) \right.$ $\left. * \left(1 + \frac{8.28 * 1}{36000}\right)\right]$ $= 100{,}068.9881$
Friday 06/01/2006	Thursday 05/01/2006	8.28%	1	$(100{,}000) * \left[\left(1 + \frac{8.27 * 1}{36000}\right) * \left(1 + \frac{8.28 * 1}{36000}\right) \right.$ $* \left(1 + \frac{8.28 * 1}{36000}\right)$ $\left. * \left(1 + \frac{8.28 * 1}{36000}\right)\right]$ $= 100{,}092.0039$
Monday 09/01/2006	Friday 06/01/2006	8.28%	3	$(100{,}000) * \left[\left(1 + \frac{8.27 * 1}{36000}\right) * \left(1 + \frac{8.28 * 1}{36000}\right) \right.$ $* \left(1 + \frac{8.28 * 1}{36000}\right)$ $* \left(1 + \frac{8.28 * 1}{36000}\right)$ $\left. * \left(1 + \frac{8.28 * 3}{36000}\right)\right]$ $= 100{,}161.0674$
Tuesday 10/01/2006	Monday 09/01/2006	8.28%	1	$(100{,}000) * \left[\left(1 + \frac{8.27 * 1}{36000}\right) * \left(1 + \frac{8.28 * 1}{36000}\right) \right.$ $* \left(1 + \frac{8.28 * 1}{36000}\right)$ $* \left(1 + \frac{8.28 * 1}{36000}\right)$ $* \left(1 + \frac{8.28 * 3}{36000}\right)$ $\left. * \left(1 + \frac{8.28 * 1}{36000}\right)\right]$ $= 100{,}184.1045$

- **Formula for non-business days:**

The Overnight Funding TIIE Index compounded on business days rounded to four decimal places applicable on a non-business day I will be calculated using the following formula: [3]

$$ON\ Funding\ TIIE\ Index_I = ON\ Funding\ TIIE\ Index_D \times \left(1 + \frac{TIIEF_D \times \Delta}{36000}\right).$$

Where:

- $I =$ The date of the non-business day for which the ON Funding TIIE Index compounded on business days is calculated.
- $D =$ The date corresponding to the immediately preceding business day to the non-business day I.
- $ON\ Funding\ TIIE\ Index_D =$ The ON Funding TIIE Index compounded on business days rounded to four decimal places applicable on business day D.
- $TIIEF_D =$ The Overnight Funding TIIE rate published by Banco de México through the internet page identified with the domain name www.banxico.org.mx, on business day D, expressed in percentage points.
- $\Delta =$ The difference in days between I and D.

For example, for Friday, April 7, 2023 (I), which corresponds to a non-business day, once you have the Overnight Funding TIIE Index compounded on business days (272,254.4115) and the Overnight Funding TIIE rate (11.25) for the business day D corresponding to Wednesday, April 5, 2023, the applicable Overnight Funding TIIE Index compounded on business days applicable on day I is calculated as follows:

$$ON\ Funding\ TIIE\ Index_I = ON\ Funding\ TIIE\ Index_D \times \left(1 + \frac{TIIEF_D \times \Delta}{36000}\right)$$

$$= 272{,}254.4115 \times \left(1 + \frac{11.25 \times 2}{36000}\right)$$

$$= 272{,}424.5705$$

Other examples of the Overnight Funding TIIE Index compounded on business days, for the Easter Week non-business days, are shown below:

Date	Published Overnight Funding TIIE rate	Δ	Overnight Funding TIIE Index compounded on business days
05/04/2023 (D)	11.25	NA	272,254.4115
06/04/2023 (I)	NA	1	272,339.4910

[3] The Overnight Funding TIIE Index compounded on business days, applicable on the non-business day I will be available on Banco de México's website from the immediately preceding business day to I, shortly after the publication of the last Overnight Funding TIIE rate considered for its calculation.

07/04/2023 (I)	NA	2	272,424.5705
08/04/2023 (I)	NA	3	272,509.6500
09/04/2023 (I)	NA	4	272,594.7295

The Overnight Funding TIIE Index compounded on business days allows to calculate the interest rate accruing for any period between two index publication dates using the following formula:

$$ON\ Funding\ TIIE\ \ compounded\ between\ D_1\ and\ D_2 = \left(\frac{ON\ Funding\ TIIE\ Index_{D_2}}{ON\ Funding\ TIIE\ Index_{D_1}} - 1\right) \times \frac{36000}{\delta}.$$

Where:

- D_1 = Starting date of the period to calculate.
- D_2 = The immediately following calendar day to the final date of the period to calculate the accrued interest.
- $ON\ Funding\ TIIE\ Index_{D_1}$ = ON Funding TIIE Index compounded on business days, applicable on D_1.
- $ON\ Funding\ TIIE\ Index_{D_2}$ = ON Funding TIIE Index compounded on business days, applicable on D_2.
- δ = The difference in days between D_2 and D_1.

In this context, the $ON\ Funding\ TIIE\ compounded\ between\ D_1\ and\ D_2$ represents an interest rate compounded only on business days for an investment that begins accruing interest on day D_1 and matures on day D_2. In other words, the last rate it considers to accrue interest is the last Overnight Funding TIIE rate corresponding to the immediately preceding banking business day to D_2.

It is recommended to market participants that, when using the Overnight Funding TIIE Index compounded on business days to calculate an interest rate for any financial transaction, the resulting rate be rounded to four decimal places.

b. Overnight Funding TIIE Index compounded on calendar days

The Overnight Funding TIIE Index compounded on calendar days shows the daily composition of the Overnight Funding TIIE rate from January 2, 2006, which is the first available record of the Overnight Funding TIIE rate, until the last day for which such rate is available. Banco de México will calculate the Overnight Funding TIIE Index compounded on calendar days to four decimal places, both for business days and non-business days, according to the following formula:

$$ON\ Funding\ TIIE\ Index_D = \begin{cases} 100{,}000 & if\ D = January\ 2, 2006 \\[2em] 100{,}000 \times \left[\prod_{i=January\ 2,2006}^{D-1_n} \left(1 + \frac{TIIEF_i}{36000}\right) \right] & if\ D \geq January\ 3, 2006 \end{cases}$$

Where:

- D = The date corresponding to the business day for which the ON Funding TIIE Index is applicable.[4]
- $D - 1_n$ = The date corresponding to the immediately preceding <u>calendar day</u> to D.
- $TIIEF_i$ = Overnight Funding TIIE rate published on day i by Banco de México through the internet page identified with the domain name www.banxico.org.mx, expressed in percentage points. If day i is a non-business day, the Overnight Funding TIIE rate published on the immediately preceding business day will be used.

For the calculations of the Overnight Funding TIIE Index compounded on calendar days, 16 decimal places will be used to round the result for each day, and the result for the final day of calculation will be published rounded to four decimal places. An example of values for certain days is presented below:

Date on which Overnight Funding TIIE Index compounded on calendar days is applicable (D)	Date of the last Overnight Funding TIIE rate considered	Last Overnight Funding TIIE rate considered	Overnight Funding TIIE Index compounded on calendar days on day D
Monday 02/01/2006	NA	NA	100,000.0000
Tuesday 03/01/2006	Monday 02/01/2006	8.27%	$(100{,}000) * \left(1 + \frac{8.27}{36000}\right) = 100{,}022.9722$
Wednesday 04/01/2006	Tuesday 03/01/2006	8.28%	$(100{,}000) * \left[\left(1 + \frac{8.27}{36000}\right) * \left(1 + \frac{8.28}{36000}\right)\right] = 100{,}045.9775$
Thursday 05/01/2006	Wednesday 04/01/2006	8.28%	$(100{,}000) * \left[\left(1 + \frac{8.27}{36000}\right) * \left(1 + \frac{8.28}{36000}\right) * \left(1 + \frac{8.28}{36000}\right)\right] = 100{,}068.9881$
Friday 06/01/2006	Thursday 05/01/2006	8.28%	$(100{,}000) * \left[\left(1 + \frac{8.27}{36000}\right) * \left(1 + \frac{8.28}{36000}\right) * \left(1 + \frac{8.28}{36000}\right) * \left(1 + \frac{8.28}{36000}\right)\right] = 100{,}092.0039$

---

[4] The Overnight Funding TIIE Index compounded on calendar days applicable on day D will be available on Banco de México's website from the immediately preceding business day to D, shortly after the publication of the last Overnight Funding TIIE rate considered for its calculation.

Saturday* 07/01/2006	Friday 06/01/2006	8.28%	$(100,000)*\left[\left(1+\frac{8.27}{36000}\right)*\left(1+\frac{8.28}{36000}\right)*\left(1+\frac{8.28}{36000}\right)\right.$ $\left.*\left(1+\frac{8.28}{36000}\right)*\left(1+\frac{8.28}{36000}\right)\right]=100,115.0251$
Sunday* 08/01/2006	Friday 06/01/2006	8.28%	$(100,000)*\left[\left(1+\frac{8.27}{36000}\right)*\left(1+\frac{8.28}{36000}\right)*\left(1+\frac{8.28}{36000}\right)\right.$ $\left.*\left(1+\frac{8.28}{36000}\right)*\left(1+\frac{8.28}{36000}\right)*\left(1+\frac{8.28}{36000}\right)\right]$ $=100,138.0516$
Monday* 09/01/2006	Friday 06/01/2006	8.28%	$(100,000)*\left[\left(1+\frac{8.27}{36000}\right)*\left(1+\frac{8.28}{36000}\right)*\left(1+\frac{8.28}{36000}\right)\right.$ $*\left(1+\frac{8.28}{36000}\right)*\left(1+\frac{8.28}{36000}\right)*\left(1+\frac{8.28}{36000}\right)$ $\left.*\left(1+\frac{8.28}{36000}\right)\right]=100,161.0833$

The Overnight Funding TIIE Index compounded on calendar days allows you to calculate the compounded interest rate for any period between two index publication dates using the following formula:

$$ON\ Funding\ TIIE\ \ compounded\ between\ D_1\ and\ D_2 = \left(\frac{ON\ Funding\ TIIE\ Index_{D_2}}{ON\ Funding\ TIIE\ Index_{D_1}} - 1\right) \times \frac{36000}{\delta}.$$

Where:

- D_1 = Starting date of the period to calculate.
- D_2 = The immediately following calendar day to the final date of the period to calculate the accrued interest.
- $ON\ Funding\ TIIE\ Index_{D_1}$ = ON Funding TIIE Index compounded on calendar days, applicable on D_1.
- $ON\ Funding\ TIIE\ Index_{D_2}$ = ON Funding TIIE Index compounded on calendar days, applicable on D$_2$.
- δ = The difference in days between D_2 and D_1.

In this context, the $ON\ Funding\ TIIE\ compounded\ between\ D_1\ and\ D_2$ represents a daily compounded interest rate for an investment that starts accruing interest on day D_1 and matures on day D_2. In other words, the last rate it considers to accrue interest is the last Overnight Funding TIIE rate corresponding to the immediately preceding calendar day to D_2, with the understanding that, for non-business days, the Overnight Funding TIIE rate published on the immediately preceding business day is the one applicable.

It is advised to market participants that, when using the Overnight Funding TIIE Index compounded on calendar days to calculate an interest rate for any financial transaction, the resulting rate should be rounded to four decimal places.

For example, with the Overnight Funding TIIE Index compounded on calendar days, it is possible to calculate the coupon rates paid by a bond with characteristics similar to a Bonde F,[5] which considers

---

[5] This exercise is not intended to replicate the rates of a Bonde F or G, as these have their own established methodology in their technical notes, and in some cases, the rates obtained through the Overnight Funding

interest calculation until the end of the period (in arrears). The coupon periods and rates for this example are shown in the table below:[6]

Coupon start date (D_1)	Maturity (and due) coupon date (D_2)	Interest rate (r)
11/08/2022	08/09/2022	8.5221%
14/07/2022	11/08/2022	7.7758%
16/06/2022	14/07/2022	7.5527%
19/05/2022	16/06/2022	6.9821%

In this hypothetical example, to determine the interest rate (r) for the 28-day coupon period (δ), through Overnight Funding TIIE Index, that starts on Thursday, August 11, 2022 (D_1), which uses the Overnight Funding TIIE rates published from that date and matures on September 8, 2022 (D_2), considering the last rate as that of Wednesday, September 7, the following equation applies:[7]

$$r = \left(\frac{ON\ Funding\ TIIE\ Index_{D_2}}{ON\ Funding\ TIIE\ Index_{D_1}} - 1\right) \times \frac{36000}{\delta}$$

$$= \left(\frac{256{,}774.7238}{255{,}083.9475} - 1\right) \times \frac{36000}{28}$$

$$= 8.5221\%$$

The rates for each of the coupon periods shown in this example can be calculated using the Overnight Funding TIIE Index compounded on calendar days based on the methodology mentioned earlier:

TIIE Index compounded on calendar days do not exactly replicate those obtained following the methodology of these instruments. This is due to the rounding performed on the Index. The objective of this exercise is to serve as a guide for new transactions linked to the Overnight Funding TIIE rate that consider interest calculation until the end of the period (*in arrears*) and may not necessarily be related to Bonde F or Bonde G. For more information, please refer to the technical descriptions of Bonde F and Bonde G.

[6] Bonde F and Bonde G consider the last rate for interest calculation to be the Overnight Funding TIIE rate of the business day prior to the coupon payment.

[7] It's worth mentioning that the Overnight Funding TIIE Index can be used for interest calculations regardless of the payment date. You simply need to use the Overnight Funding TIIE Index corresponding to the start date of the interest calculation period and the one corresponding to the maturity date of the interest calculation period. In this way, the coupon payment date could be the same as the maturity date of the interest calculation period or it could be one business day after, two business days after, three business days after, and so on.

Coupon start date (D_1)	Overnight Funding TIIE Index applicable on D_1	Maturity (and due) coupon date (D_2)	Overnight Funding TIIE Index applicable on D_2	Calendar days between D_2 and D_1 (δ)	Calculated interest rate using Overnight Funding TIIE Index
11/08/2022	255,083.9475	08/09/2022	256,774.7238	28	8.5221%
14/07/2022	253,550.5137	11/08/2022	255,083.9475	28	7.7758%
16/06/2022	252,069.7675	14/07/2022	253,550.5137	28	7.5527%
19/05/2022	250,708.2818	16/06/2022	252,069.7675	28	6.9821%

c. Compounded in advance Overnight Funding TIIE

Compounded in advance Overnight Funding TIIE are rates known from the beginning of the interest period, which are published on every business day. For each business day, Compounded in advance Overnight Funding TIIE take into account the composition of Overnight Funding TIIE rates published during the previous 28 calendar days to calculate the 28, 91, and 182 days tenors.[8]

In general, for each business day of determination, this rate, expressed in percentage points rounded to four decimal places, is calculated through the Overnight Funding TIIE Index compounded on business days according to the following formula:

$$Compounded\ in\ advance\ ON\ Funding\ TIIE\ for\ T\ days_D = \left[\left(\frac{ON\ Funding\ TIIE\ Index_D}{ON\ Funding\ TIIE\ Index_{D-28_n}} \right)^{\frac{T}{28}} - 1 \right] \times \frac{36000}{T}.$$

Where:

- $D =$ The date corresponding to the business day for which the Compounded in advance ON Funding TIIE is applicable.
- $D - 28_n =$ The date corresponding to the result of subtracting 28 days to D, it could be either a business or non-business day.
- $T =$ The tenor of the Compounded in advance ON Funding TIIE; in other words, 28, 91 or 182 days.
- $ON\ Funding\ TIIE\ Index_D$ = ON Funding TIIE Index compounded on business days to four decimal places, applicable on business day D, published by Banco de México through the internet page identified with the domain name www.banxico.org.mx.
- $ON\ Funding\ TIIE\ Index_{D-28_n}$ = ON Funding TIIE Index compounded on business days to four decimal places, applicable on day $D - 28_n$, as published by Banco de México through the internet page identified with the domain name www.banxico.org.mx.

---

[8] The Compounded in advance Overnight Funding TIIE applicable on the business day D will be available on Banco de México's website from the immediately preceding business day to D, shortly after the publication of the last Overnight Funding TIIE rate considered for their calculation.

Here is an example of the calculation of the 28-day Compounded in advance Overnight Funding TIIE (T), applicable on May 12, 2022 (D). The calculation period considers the Overnight Funding TIIE rates published from Thursday, April 14, to Wednesday, May 11, 2022 (28 calendar days). Thus, the data considered to calculate the 28-day Compounded in advance Overnight Funding TIIE are the following:

Date	Overnight Funding TIIE Index
Thursday, 14/04/2022 (D−28)	249,082.9854
Thursday, 12/05/2022 (D)	250,351.0660

With this data, the 28-day Compounded in advance Overnight Funding TIIE applicable on Thursday, May 12, 2022, and expressed as an annual percentage rounded to four decimal places is given by:

$$Compounded\ in\ advance\ ON\ Funding\ TIIE\ for\ 28\ days = \left[\left(\frac{ON\ Funding\ TIIE\ Index_D}{ON\ Funding\ TIIE\ Index_{D-28}}\right)^{\frac{T}{28}} - 1\right] \times \frac{36000}{T}$$

$$= \left[\left(\frac{250,351.0660}{249,082.9854}\right)^{\frac{28}{28}} - 1\right] \times \frac{36000}{28}$$

$$= 6.5456\%$$

Likewise, an example of the calculation of the 91-day Compounded in advance Overnight Funding TIIE (T), also applicable for May 12, 2022 (D), is shown below. The calculation period, similar to the 28-day term, considers the Overnight Funding TIIE rates published from Thursday, April 14, to Wednesday, May 11, 2022 (28 calendar days). Thus, the data considered to calculate the 91-day Compounded in advance Overnight Funding TIIE are the following:

Date	Overnight Funding TIIE Index
Thursday, 14/04/2022 (D−28)	249,082.9854
Thursday, 12/05/2022 (D)	250,351.0660

With this data, the 91-day Compounded in advance Overnight Funding TIIE applicable on Thursday, May 12, 2022, and expressed as an annual percentage rounded to four decimal places is given by:

$$Compounded\ in\ advance\ ON\ Funding\ TIIE\ for\ 91\ days = \left[\left(\frac{ON\ Funding\ TIIE\ Index_D}{ON\ Funding\ TIIE\ Index_{D-28}}\right)^{\frac{T}{28}} - 1\right] \times \frac{36000}{T}$$

$$= \left[\left(\frac{250,351.0660}{249,082.9854}\right)^{\frac{91}{28}} - 1\right] \times \frac{36000}{91}$$

$$= 6.5831\%$$