

APPROVED
Resolution of the Board of the
of the National Bank of Ukraine
No. 732 dated 26 October 2015

Procedure for Measuring at Fair Value
of Residents' Securities
Owned by the National Bank of Ukraine
or Accepted by it as Collateral

*(as amended by
NBU Board Decisions
No. 338 dated 2 June 2017
No. 627 dated 20 September 2018
No. 935 dated 16 December 2019
No. 327 dated 14 May 2020
No. 539 dated 21 August 2020 –
effective since 1 September 2020
No. 641 dated 29 December 2021
No. 395 dated 4 August 2022)*

(in the text of the Procedure, the words “KievPrime index” in all cases shall be replaced with the words “index of interest rates of Ukrainian interbank market in hryvnias” in all cases, respectively, according to NBU Board decision No.338 dated 2 June 2017)

(in the text of the Procedure, the words “Risk Management Department” in all cases shall be replaced with the words “Financial and Operational Risk Office” in all cases, respectively, according to NBU Board decision No. 935 dated 16 December 2019)

(in the text of the Procedure, the words "Financial and Operational Risk Office" in all cases shall be replaced with the words “risk management unit” in all cases, respectively, according to NBU Board decision No. 641 dated 29 December 2021)

I. General Provisions

1. This procedure was developed with the aim of ensuring fulfillment of requirements of Instruction on accounting of the National Bank of Ukraine's transactions with financial investments, certificates of deposit, and securities of own

issue, which is approved by NBU Board Decision No. 875-D dated 29 December 2017 (as amended), and designing a single approach to determining a fair value of domestic government bonds and other residents' securities owned by the National Bank of Ukraine and recognized in accounting and financial reporting at their fair value, which are accepted by or offered to the National Bank of Ukraine as a collateral as a collateral.

(Section I paragraph 1 as amended according to NBU Board decisions No. 627 dated 20 September 2018, No. 327 dated 14 May 2020)

2. This Procedure regulates the measurement at fair value of debt securities issued by the State represented by the Ministry of Finance of Ukraine and securities issued by resident legal entities (hereinafter - securities). Procedure for assessment at fair value of nonresidents' securities and derivative financial instruments are governed by other regulations and regulatory documents of the National Bank of Ukraine.

3. For the purposes hereof, the following definitions apply:

1) active market shall denote a market, in which securities transactions take place with sufficient frequency and volumes to provide pricing information on an ongoing basis

2) observable inputs shall denote inputs developed using market data, such as publicly available information about actual events or transactions, and that reflect the assumptions that market participants would use when pricing a security

3) inputs shall denote the assumptions that market participants would use when pricing a security including assumptions about risk, including risk inherent in a particular valuation technique used to measure fair value (such as a pricing model), and risk inherent in the inputs to the valuation technique. Inputs may be observable or unobservable

4) Level 1 inputs shall denote quoted prices (unadjusted) in active markets for identical securities that the economic entity can access at the measurement date

5) level 2 inputs shall denote inputs other than quoted prices included within Level 1 that are observable for the security, either directly or indirectly

6) level 3 inputs shall denote unobservable inputs for the security

7) principal market shall denote the market with the greatest volume and level of activity (number of deals executed) for the security

8) income approach shall denote valuation technique that converts future amounts (for example, cash flows or income and expenses) to a single current (i.e. discounted) amount. The fair value measurement is determined on the basis of the value indicated by current market expectations about those future amounts

9) yield to maturity shall denote the yield expressed as an annual rate, which will be received by debt security owner if the owner holds it until maturity

10) closed inputs shall denote inputs, for which market data are not available and which are developed using of best information available about assumptions that market participants would use when pricing the security

11) identical securities shall denote securities issued by a single issuer under similar conditions of issue, payment of income, repurchase or repayment

12) Section I paragraph 3 subparagraph 12 excluded.

(according to NBU Board Decision No. 338 dated 5 December 2017)

13) zero coupon yield curve is a graphic interpretation of yield of zero coupon debt securities with different maturities. Basic zero coupon yield curve shall be constructed under government bonds. The aim of zero coupon yield curve construction is getting an easy tool for debt securities valuation

14) security rate shall denote a security fair value expressed as percentage from its nominal value

15) the most advantageous market shall denote the market that maximizes the amount, which would be received to sell the security after taking into account all transaction and transportation costs

16) DG bonds shall denote domestic government debt securities

16¹) DM bonds or domestic municipal bonds shall denote domestic local debt securities

(Section I paragraph 3 supplemented with subparagraph 161 according to NBU Board Decision No. 539 dated 21 August 2020)

17) Eurobonds shall denote external government debt securities

18) identical securities shall denote securities issued by a single issuer or the issuer with similar (comparable) parameters and having similar (comparable) conditions of issue, payment of income, repurchase or repayment

19) risk premium shall denote a compensation sought by risk-averse market participants for bearing uncertainty inherent in the cash flows of an asset or a liability

20) market approach shall denote the valuation methodology that uses prices and other relevant information generated by market transactions involving identical or similar securities

21) spot rate is a theoretical yield of homogeneous zero coupon bonds as of the current date presented as an interest rate

22) fair value shall denote the price that would be received to sell an asset or paid to transfer a liability in an orderly transaction between market participants at the measurement date

23) forward rate shall denote theoretical yield that reflects spot rate on a fixed future date

24) BID price shall denote the price a market participant is willing to pay to purchase a security, i.e. the price for public securities bid for purchase, or bid price

25) ASK price shall denote a price a market participant is willing to accept for a security, i.e. a price of sell order or offer price.

4. Other terminology herein shall be used in the meaning defined in the laws of Ukraine, regulations and internal orders of the National Bank of Ukraine, and International Financial Reporting Standards.

II. Methodology for Measuring Fair Value of Securities and the Inputs Sources

5. Securities fair value shall be measured according to the principles of IFRS 13. Fair Value Measurement. The objective of securities fair value measurement is to determine the price of the ordinary purchase and sale transaction between market participants on the measurement date under current market conditions (hereinafter - the market price).

6. Fair value measurement assumes that the securities purchase and sale transaction takes place in the main securities market or, if there is no principal market, in the most advantageous market for securities. Unless evidenced otherwise, the market, where, as a rule, the National Bank of Ukraine effects the securities purchase

and sale transactions, shall be assumed the principal market, or in case there is no principal market, it shall be assumed the most advantageous market.

7. To measure the securities fair value, the National Bank of Ukraine applies the market approach (where possible). If Level 1 inputs are not sufficient for applying the market approach, the yield-based approach and Level 2 and 3 inputs shall be used.

8. Inputs sources for measurement of securities fair value are the following:

1) information on bond deals received directly from the National Bank of Ukraine Depository's automation system

2) information from the financial information agencies (Cbonds <http://ua.cbonds.info/>, Bloomberg, Refinitiv etc.)

(Section II paragraph 8 subparagraph 2 as amended according to NBU Board Decision No. 327 dated 14 May 2020)

3) information from stock exchanges, National Depository of Ukraine PJSC, SETTLEMENT CENTER FOR SERVICING FINANCIAL MARKET AGREEMENTS PJSC

4) information from official website of the Ukrainian Stock Market Infrastructure Development Agency (SMIDA) and other sources.

9. For the purposes of this Procedure, securities issued by the State represented by the Ministry of Finance of Ukraine and debt securities issued by resident legal entities shall be deemed as those having an active market, if the following criteria are met simultaneously:

1) availability of daily bilateral quotations (i.e. both BID and ASK prices) in the principal market for these securities or, if there is no principal market, in the most advantageous market for these securities during the last 30 calendar days or starting from the date following the primary placement, if the primary placement took place 30 calendar days before the measurement date;

2) minimum BID price for daily bilateral prices is lower than maximum ASK price, and the relative spread between minimum BID price and maximum ASK price is lower than 0.5%. The relative spread is calculated according to the following formula:

$$Spread_{BID-ASK} = \frac{P_{ASK} - P_{BID}}{(P_{ASK} + P_{BID})/2} \times 100, \quad (1)$$

where $Spread_{BID-ASK}$ - is a relative spread between minimum BID price and maximum ASK price, percent

P_{ASK} - maximum ASK price

P_{BID} - minimum BID price

3) information about execution of the deals on purchase/sale of the securities issued by the state shall be available at least during 15 calendar days within last 30 calendar days or starting from the date following the securities primary placement if the primary placement was effected less than 30 calendar days before the measurement date. Within this timeframe at least 30 securities purchase/sale deals shall be executed, the daily trade amounts under the deals executed shall be at least UAH 5 million at face value, provided the price under each such deal is not lower than minimum BID price and not higher than maximum ASK price in the principal market for these securities or if there is no principal market, then in the most advantageous market for these securities on the deal execution day

4) information about execution of the deals on purchase/sale of the securities other than issued by the state shall be available at least during 5 days within last 30 calendar days or from the date following the securities primary placement, if the primary placement took place less than 30 calendar days before the measurement. Within this timeframe, at least 10 securities purchase/sale deals shall be executed, the daily trade amount under deals executed shall be at least UAH 1 million at the nominal value, provided the price under each such deal is not lower than minimum BID price and not higher than maximum ASK price in the principal market for these securities or, if there is no principal market, then in the most advantageous market for these securities on the deal execution day.

10. For the purposes of this Procedure, shares owned by public joint stock companies shall be deemed having an active market, if the following criteria are met simultaneously:

1) the shares are listed in the stock exchange register, i.e. they are listed securities according to rules of the stock exchange and under regulations or regulatory documents of the National Securities and Stock Market Commission

2) stock-exchange rate was calculated for the shares at least during 10 calendar days within last 30 calendar days

3) the free float is at least 10% of the total issue of shares. The free float shall be calculated according to regulations or regulatory documents of the National Securities and Stock Market Commission.

11. To take into account main characteristics of the securities for their fair value measurement, the National Bank of Ukraine divides securities into the following types:

1) domestic government bonds denominated in hryvnia (hereinafter - UAH DG bonds) comprising domestic government bonds issued according to Main Requirements for Issue and Placement of Short-Term Government Bonds, Main Requirements for Issue and placement of mid-term government bonds, and Main requirements for issue and Placement of Long-Term Government Bonds approved by Resolution of the Cabinet of Ministers No. 80 *On Domestic Government Bonds Issuances* dated 31 January 2001 (as amended) (hereinafter - CMU Resolution No. 80)

2) domestic government bonds denominated in foreign currency (hereinafter - FX DG bonds) comprising domestic government bonds issued according to the Main Terms of Issue and Placement of Short-Term Domestic Government Bonds Denominated in Foreign Currency, the Main Terms of Issue and Placement of Short-Term or Mid-Term Domestic Government Bonds Denominated in Foreign Currency approved by CMU Resolution No. 80

3) domestic government bonds to refund the VAT amounts (hereinafter – VAT DG bonds), comprising domestic government bonds issued according to Main requirements for issuance of domestic government bonds to refund the VAT amounts and Procedure for issue, circulation and repayment of domestic government bonds with a maturity of 5 years approved by Resolution of the Cabinet of Ministers of Ukraine No. 368 *On Issuance of DG Bonds to Refund the VAT Amounts* dated 12 May 2010, domestic government bonds issued according to the Main Requirements for Issue of Domestic Government Bonds to Refund the VAT Amounts and the Procedure for Issue, Circulation and Repayment of Domestic Government Bonds with a Maturity of 5 Years approved by Resolution of the Cabinet of Ministers No. 139 *On Issue of Domestic Government Bonds to Refund the VAT Amounts* dated 21 May 2014, and other domestic government bonds to refund the VAT amounts

4) indexed domestic government bonds, comprising domestic government bonds issued according to Main Requirements for Issue and Placement of Mid-Term and Long-Term Indexed Government Bonds approved by CMU Resolution No. 80

5) domestic government bonds with early repayment denominated in foreign currency (hereinafter - FX DG bonds with early repayment) comprising domestic government bonds issued according to the Main Terms of Issue and Placement of Short-Term Domestic Government Bonds With Early Repayment Denominated in Foreign Currency approved by CMU Resolution No. 80

6) inflation-indexed domestic government bonds comprising domestic government bonds issued in accordance with the Terms of Issue and Placement of Domestic Government Bonds of Ukraine in 2017 as approved by Resolution No. 748

of the Cabinet of Ministers of Ukraine *On Execution of Transactions with Sovereign Debt in 2017* dated 4 October 2017

7) other domestic government bonds comprising domestic government bonds of issues other than listed in subparagraphs 1–6 of this paragraph

8) Eurobonds comprising Eurobonds of all issues

“8¹) hryvnia-denominated corporate bonds that have been placed with the guarantee of the Cabinet of Ministers of Ukraine”

(Section II paragraph 11 supplemented with subparagraph 8¹ according to NBU Board Decision No. 327 dated 14 May 2020)

8²) Domestic municipal bonds that cover domestic municipal bonds issued inline with the Budget Code of Ukraine and the Procedure of Municipal Borrowings approved by Resolution of the Cabinet of Ministers of Ukraine No. 110 dated 16 February 2011 (as amended)”

(Section II paragraph 11 supplemented with subparagraph 8² according to NBU Board Decision No. 539 dated 21 August 2020)

9) other debt securities denominated in hryvnia not traded outside Ukraine

10) other debt securities denominated in foreign currency not traded outside Ukraine

11) other debt securities traded outside Ukraine

12) shares and other equity securities

13) certificates of deposits of the National Bank of Ukraine

(Section II paragraph 11 in the wording of NBU Board Decision No. 627 dated 20 September 2018)

12. Base for measurement of debt securities fair value shall be basic zero coupon yield curves, which are built separately for the following groups of government bonds:

1) UAH DG bonds

2) FX DG bonds and FX DG bonds with early repayment denominated in U.S. dollars.

*(Section II paragraph 12 in the wording of
NBU Board Decision
No 627 dated 20 September 2018)*

13. Basic zero coupon yield curves shall be calculated based on data of actually made and executed domestic government bonds deals of a respective group using the following parametric models:

1) the Nelson-Siegel model, as follows:

$$s_p = \beta_0 + \beta_1 \left(\frac{1 - e^{-p/\tau}}{(p/\tau)} \right) + \beta_2 \left(\frac{1 - e^{-p/\tau}}{(p/\tau)} - e^{-p/\tau} \right) \quad (2)$$

or

2) the Nelson-Siegel-Svensson (hereinafter - Svensson) model, as follows:

$$s_p = \beta_0 + \beta_1 \left(\frac{1 - e^{-p/\tau}}{(p/\tau)} \right) + \beta_2 \left(\frac{1 - e^{-p/\tau}}{(p/\tau)} - e^{-p/\tau} \right) + \beta_3 \left(\frac{1 - e^{-p/\tau_1}}{(p/\tau_1)} - e^{-p/\tau_1} \right), \quad (2^1)$$

where s_p is a spot rate for the term P resulting from the calculations according to the model

P is a term, for which the spot rate is calculated, years

β_0 – long-term factor of zero coupon yield curve that determines the general level of curve (i.e. interest rates), the increase of which results in total interest rates increase (moving the curve up on the chart), and vice versa;

β_1 – short-term factor of zero coupon yield curve that determines the curve slope, the increase of which results in more rapid growth of short-term interest rates against long-term interest rates, and vice versa;

β_2, β_3 – medium-term factors of zero-coupon yield curve determine a curve's shape (or the curvature)

τ, τ_1 – parameters that may impact a zero-coupon yield curve shape and level by showing dynamics and direction of short-term interest rates and account for curves' position

e – a mathematical constant, which is the base of natural logarithms, $e \approx 2.718281828459045$

Assets and Liabilities Management Committee of the NBU makes decisions on a parametric model to estimate basic yield curve (Nelson-Siegel or Svensson models) in addition to each group of domestic government bonds as determined in Section II Paragraph 12 of the Regulation. The model for each group of domestic government bonds shall be selected based on a relevant market segment situation so as to insure as accurate as possible concordance between the model profitability and profitability

determined based on domestic government bond agreements. The selected parameters of the model shall be approved by a separate regulation of the NBU.

*(Section II paragraph 13 in the wording of
NBU Board Decision
No 627 dated 20 September 2018)*

14. Spot rates forming the basic zero coupon yield curves are the rates with continuing interest accrual. To move from the spot rate with continuing interest accrual to effective spot rate with annual interest accrual, the following formula shall be used:

$$s_p^{ef} = e^{s_p} - 1 \quad (3)$$

where s_p^{ef} is effective spot rate with annual interest accrual for the term P
 e – a mathematical constant, which is the base of natural logarithms,
 $e \approx 2.718281828459045$

s_p is a spot rate for term P , which is the calculation result according to the Nelson-Siegel (2) or Svensson models (2¹).

*(Section II paragraph 14 indent four
in the wording of NBU Board Decision
No. 627 dated 20 September 2018)*

15. Zero coupon yield curve shall be constructed as of the end of the reference day - the last business day preceding the day of construction of this curve for each domestic sovereign bonds' group set out in paragraph 12 of this Section - according to the following procedure:

1) information on all deals regarding domestic sovereign bonds of the respective group executed during sampling period of 15 business days preceding the date of zero coupon yield curve construction, is retrieved from the National Bank of Ukraine Depository automation system

*(Section II paragraph 15 subparagraph 1
as amended according to NBU Board decision
No. 627 dated 20 September 2018)*

2) all deals that fail to meet the sampling criteria and market deals' characteristics shall be excluded from the retrieved sample, in particular:

deals made in the primary market if DG bonds were placed by less than two participants

*(Section II paragraph 15 subparagraph 2 indent two
as amended according to NBU Board decision
No. 627 dated 20 September 2018)*

deals on DG bonds with residual maturity of not more than 30 calendar days as of the reference day

deals under which the National Bank of Ukraine is the buyer, made in result of bilateral listing, as well as their related deals

deals made under specified conditions for fulfilling the obligations, which are set in laws

deals having attributes of repurchase obligations (repo) deals, i.e. two deals concluded in the same stock exchange, or in the over-the-counter market on different dates during last 15 business days, for the same amount of domestic government bonds of single issue, for which the amount of the earlier deal is smaller than the amount of the later deal

*(Section II paragraph 15 subparagraph 2
as amended according to NBU Board decision
No. 627 dated 20 September 2018)*

3) based on domestic government bonds deals left in the sample after excluding the deals pursuant to Section II paragraph 15 subparagraph 2 of this Procedure, the charts shall be built to show relationship between DG bonds' yield to maturity and their remaining maturity for the last five and ten business days. Based on the data from charts, information on the latest minimal and maximum levels of DG bonds' yield established in the primary market, data of financial information agencies (Cbonds <http://ua.cbonds.info/>, Bloomberg) on domestic government bonds quotes on the date of building the curve of non-coupon yield, and applying the expert judgment method, a typical market yield-to-maturity interval shall be calculated within the sample (i.e. the interval of market yield values that are mostly found within the sample). The data used to derive typical market yield-to-maturity interval in the last calendar year shall be stored in electronic format by the risk management unit. Yield to maturity for domestic government bonds shall be calculated using successive iterations method, taking into account the following formula:

*(Section II paragraph 15 subparagraph 3 indent one
in the wording of NBU Board decision
No. 627 dated 20 September 2018)*

$$P_{ijg} = \sum_{t=1}^n \left(\frac{CF_{it}}{(1 + YTM_{ijg})^{d_t}} \right) \quad (4)$$

where YTM_{ijg} is yield to maturity calculated in form of effective interest rate with annual interest accrual based on the price of the deal j on the issue i of domestic government bonds for the business day g within the sample

P_{ijg} – the price of the DG bond issue i according to conditions of the deal j for the business day g , UAH

CF_{it} – value of the cash flow t under the issue i of domestic government bonds, UAH. At the same time, for FX DG bonds, cash flows are converted to UAH

equivalent using the official UAH exchange rate against respective foreign currency for the business day g

t – the running number of the cash flow under the issue i of domestic government bonds

n – number of cash flows under the issue i of domestic government bonds

d_t – residual maturity of the cash flow t under the issue i of domestic government bonds, years

4) to avoid impact of random factors on zero coupon yield curve, deals with nonmarket price parameters shall be excluded from the group of deals under each domestic government bonds issue, in particular, deals with yield to maturity that is either lower than the lower bound of a typical market yield to maturity range, or higher than the upper bound of a typical market yield to maturity range

5) for each domestic government bonds issue, provided the deals were left in the sample after procedures performed as set out by subparagraphs 2–4 of this paragraph, the weighted average yield to maturity for each business day shall be calculated according to the following algorithm:

if for the business day g the sample has deals on the issue i of DG bonds, then the weighted average yield of the issue i of DG bonds for the business day g shall be calculated according to the following formula:

$$\overline{YTM}_{ig} = \frac{\sum_{j=1}^n YTM_{ijg} \times Q_{ijg}}{\sum_{j=1}^n Q_{ijg}}, \quad (5)$$

where \overline{YTM}_{ig} is weighted average yield of the issue i of DG bonds for the business day g within the sample

YTM_{ijg} – yield to maturity calculated based on price of the deal j on the issue i of domestic government bonds for the business day g within the sample

Q_{ijg} – number of securities purchased and sold according to the deal j on the issue i of domestic government bonds for the business day g within the sample

n – number of deals on the issue i of domestic government bonds for the business day g within the sample

if for the business day g the sample has no deals on the issue i of DG bonds, and the business day g is not the first day of the sample, then the weighted average yield of the issue i of DG bonds for the business day g shall be calculated according to the following formula:

$$\overline{YTM}_{ig} = \overline{YTM}_{i(g-1)}, \quad (6)$$

where $\overline{YTM}_{i(g-1)}$ is weighted average yield of the issue i of domestic government bonds for the preceding business day ($g - 1$)

if for the business day g the sample has no deals on the issue i of DG bonds, and the business day g is the first day of the sample, then the weighted average yield of the issue i of DG bonds for the business day g is unknown

6) for each domestic government bonds issue, provided the deals were left in the sample after performing procedures set out by subparagraphs 2–4 of this paragraph, the weighted average yield to maturity shall be calculated as of the end of last business day preceding the date of zero coupon yield curve construction using method of linearly weighted moving average with the smoothing period not exceeding five, using the following formula:

$$\overline{YTM}_i = \frac{\sum_{g=1}^T \overline{YTM}_{ig} \times g}{\sum_{g=1}^T g} \quad (7)$$

where \overline{YTM}_i is weighted average yield to maturity of the i -issue of domestic government bonds

g – the running number of a business day within the smoothing period

T – number of business days within the smoothing period, which shall be determined as the smallest value of the following figures: five or the number of business days, for which the weighted average yield of the issue i of DG bonds for the business day g is known

\overline{YTM}_{ig} – weighted average yield of the issue i of DG bonds for the business day g within the smoothing period

7) the value of each domestic government bonds issue shall be calculated as of the date of zero coupon yield curve construction based on weighted average yield to maturity for the respective period according to the following formula:

$$\overline{P}_i = \sum_{t=1}^n \left(\frac{CF_{it}}{(1 + \overline{YTM}_i)^{d_t}} \right) \quad (8)$$

where \overline{P}_i is the value of the i -issue of domestic government bonds as of the date of zero coupon yield curve construction, UAH

CF_{it} – value of the cash flow t under the issue i of domestic government bonds, UAH. For FX domestic government bonds, cash flows are converted to UAH equivalent using official UAH exchange rate against respective foreign currency as of the date of the zero coupon yield curve construction

\overline{YTM}_i – weighted average yield to maturity of the i -issue of domestic government bonds calculated according to formula (7)

t – the running number of the cash flow under the issue i of domestic government bonds

n – number of cash flows under the issue i of domestic government bonds

d_t – residual maturity of the cash flow t under the issue i of domestic government bonds, years

8) domestic government bonds market is divided into conditionally liquid and conditionally illiquid segments according to remaining maturity of domestic government bonds. The conditionally liquid segment of the domestic government bonds market is a segment, within which deals with market price parameters were made during last 15 business days. Conditionally liquid segment of domestic government bonds market begins with the overnight term and ends with the longest maturity among domestic government bonds issues, deals on which were left within the sample after performing procedures set out in subparagraphs 2–4 of this paragraph. Domestic government bonds issues with maturities longer than the longest maturity of the conditionally liquid segment of domestic government bonds market shall form conditionally illiquid segment of domestic government bonds market

*(Section II paragraph 15 subparagraph 8
as amended according to NBU Board Decision
No. 539 dated 21 August 2020)*

9) adjustment of Nelson-Siegel or Svensson models described in Paragraph 13 of this Section shall be performed for practical use in current calculations through selection of initial values of model parameters β_0 , β_1 , β_2 , β_3 , τ and τ_1 with the following values:

$$\beta_0 = 0.01$$

$$\beta_1 = 0.01$$

$$\beta_2 = 0.01$$

$$\beta_3 = 0.01$$

$$\tau = 1$$

$$\tau_1 = 1$$

*(Section II paragraph 15 subparagraph 9 indent one
as amended according to NBU Board Decision
No. 539 dated 21 August 2020)*

Expert limitation of minimum and maximum value of s_t is possible. For example, s_0 for the hryvnia (UAH) may be set at the level of overnight Index of

interest rates of Ukrainian interbank market in hryvnias as of the end of the selection period.

Benchmarks for conditionally illiquid segment of domestic government bonds market are determined by the Assets and Liabilities Management Committee of the National Bank of Ukraine taking into account macroeconomic situation forecast and monetary policy of the National Bank of Ukraine

*(Section II paragraph 15 subparagraph 9
as amended according to NBU Board Decision
No. 338 dated 2 June 2017)*

10) for each issue of domestic government bonds, s_t spot rate shall be calculated for each cash flow CF_{it} driven at time t through application of the parameter t to formula (2) or (2¹)

*(Section II paragraph 15 subparagraph 10 as
amended according to NBU Board decision No.
627 dated 20 September 2018)*

11) for each domestic government bonds issue, the model value shall be calculated through discounting future cash flows using spot rates s_t according to the following formula:

$$\hat{P}_i = \sum_{t=1}^n (CF_{it} \times e^{-s_t \times d_t}) \quad (9)$$

where \hat{P}_i is model value of the issue i of domestic government bonds as of the date of zero coupon yield curve, UAH

CF_{it} – value of the cash flow t under the issue i of domestic government bonds, UAH. At the same time for FX domestic government bonds, cash flows are converted into UAH equivalent using official UAH exchange rate against respective foreign currency as of the date of zero coupon yield curve construction

s_t is a spot rate the term of which corresponds to the cash flow t and which is calculated based on a respective zero coupon yield curve calculated according to the formulas (2) or (2¹)

t – the running number of the cash flow under the issue i of domestic government bonds

n – number of cash flows under the issue i of domestic government bonds

d_t – residual maturity of the cash flow t under the issue i of domestic government bonds, years

e – a mathematical constant, which is the base of natural logarithms,
 $e \approx 2.718281828459045$

(Section II paragraph 15 subparagraph 11 as amended according to NBU Board Decision No. 627 dated 20 September 2018)

12) based on the model value of each domestic government bonds issue, its model yield to maturity shall be calculated using successive iterations method taking into account the following formula:

$$\hat{P}_i = \sum_{t=1}^n \left(\frac{CF_{it}}{(1 + Y\hat{T}M_i)^{d_t}} \right) \quad (10)$$

where $Y\hat{T}M_i$ is the model yield to maturity for the issue i of domestic government bonds

\hat{P}_i – value of the issue i of domestic government bonds as of the date of zero coupon yield curve construction, which is calculated according to formula (9)

CF_{it} – value of the cash flow t under the issue i of domestic government bonds, UAH. At the same time, for FX domestic government bonds, cash flows are converted to UAH equivalent using official UAH exchange rate against respective foreign currency as of the date of zero coupon yield curve construction

t – the running number of the cash flow under the issue i of domestic government bonds

n – number of cash flows under the issue i of domestic government bonds

d_t – residual maturity of the cash flow t under the issue i of domestic government bonds, years

13) squared difference between weighted average yield to maturity and obtained model yield to maturity for each domestic government bonds issue and the total sum of these values for the entire sample shall be calculated according to the following formula:

$$\sum_{i=1}^k e_i^2 = \sum_{i=1}^k (\overline{YTM}_i - Y\hat{T}M_i)^2 \quad (11)$$

where $\sum_{i=1}^k e_i^2$ – the sum of squared differences between actual weighted average yield and model yield by all domestic government bonds included in the sample

\overline{YTM}_i – weighted average yield to maturity of the issue i of domestic government bonds, calculated according to formula (7)

$Y\hat{T}M_i$ – model average yield to maturity of the issue i of domestic government bonds calculated according to formula (10)

k – total number of the issues of domestic government bonds in the sample

14) through using the optimum solution finding tool (for example, MS EXCEL Solver), model parameters β_0 , β_1 , β_2 , β_3 , τ and τ_1 shall be adjusted for achieving

the minimum sum of squared deviations $\sum_{i=1}^k e_i^2$. Resulting values of the model parameters β_0 , β_1 , β_2 , β_3 , τ and τ_1 shall meet the following conditions:

$$\beta_0 > 0; \beta_0 + \beta_1 > 0;$$

$$\tau > 0;$$

$$\tau_1 > 0;$$

forward rates > 0 .

*(Section II paragraph 15 subparagraph 14
in the wording of NBU Board decision
No. 627 dated 20 September 2018)*

16. Measurement of a fair value of domestic government bonds issued to compensate the VAT is based on yield to maturity indices, which shall be constructed separately for each group of VAT DG bonds with common basic terms of issuance.

17. Construction of a yield to maturity index shall be performed as of the end of last business day preceding the day of construction of this index for each VAT-DG bond group defined in paragraph 16 of this Section according to the following procedure:

1) information about all the deals in domestic government bonds of the respective group, which were made during the sampling period of 45 business days preceding the date of the yield to maturity index construction, is retrieved from the National Bank of Ukraine Depository automation system

2) from the sample retrieved, all the deals that don't meet the sampling criteria and characteristics of the deals made in the market shall be excluded, in particular:

deals made in the primary market

deals resulting from bilateral listing, under which the National Bank of Ukraine is the buyer, as well as related deals

deals made under specified obligation fulfillment conditions set out by the legal framework

deals having attributes of repurchase obligations (repo) agreements, i.e. two deals made in the same stock exchange, or in the over-the-counter market on different dates during last 45 business days, for the same amount of domestic government bonds of single issue, for which the amount of the earlier deal is smaller than the amount of the later deal

3) based on domestic government bonds deals left in the sample after excluding deals pursuant to subparagraph 2 of this paragraph, the charts shall be built to show relationship between the yield before repayment and the remaining maturity before domestic government bonds repayment for the last five and ten business days. Based on the data of these charts and applying the expert judgment, a typical market yield-to-maturity range shall be defined within the sample (i.e. the range of the market yield values that are mostly found within the sample). Yield to maturity for domestic government bonds shall be calculated using successive iterations method taking into account formula (4)

4) to avoid an impact of random factors on the yield to maturity indices, the deals having non-market price parameters shall be excluded from the group of deals in each domestic government bonds group, in particular, deals having the yield to maturity that is lower than the lower bound of the typical market yield to maturity range, or higher than the upper bound of the typical market yield to maturity range

5) based on the deals left in the sample after performing procedures set out by subparagraphs 2-4 of this paragraph, the weighted average yield to maturity of the respective domestic government bonds group for each business day shall be calculated according to the following algorithm:

if for the business day g there are deals within the sample, then the weighted average yield of the domestic government bonds group for the business day g shall be calculated according to the following formula:

$$\overline{YTM}_g = \frac{\sum_{i=1}^k \sum_{j=1}^n YTM_{ijg} \times Q_{ijg}}{\sum_{i=1}^k \sum_{j=1}^n Q_{ijg}} \quad (12)$$

where \overline{YTM}_g – weighted average yield of a group of domestic government bonds for the business day g within the sample

YTM_{ijg} – yield to maturity calculated based on price of the deal j on the issue i of domestic government bonds for the business day g within the sample

Q_{ijg} – number of securities purchased and sold according to the deal j on the issue i of domestic government bonds for the business day g within the sample

n – number of deals on the issue i of domestic government bonds within the sample

k – number of issues of domestic government bonds in the sample

if for the business day g the sample has no deals, and the business day g is not the first day of the sample, then the weighted average yield of a group of the domestic government bonds for the business day g shall be calculated according to the following formula:

$$\overline{YTM}_g = \overline{YTM}_{(g-1)}, \quad (13)$$

where $\overline{YTM}_{i(g-1)}$ is weighted average yield of a group of domestic government bonds for the preceding business day ($g - 1$)

if for the business day g the sample has no deals, and the business day g is the first day of the sample, then the weighted average yield of a group of the domestic government bonds for the business day g is unknown

6) the yield to maturity index for the corresponding domestic government bonds group shall be calculated using the linear weighted moving average method with a smoothing period not exceeding five, according to the following formula:

$$I_{YTM} = \frac{\sum_{g=1}^T \overline{YTM}_g \times g}{\sum_{g=1}^T g}, \quad (14)$$

where I_{YTM} – yield to maturity index

g – the running number of a business day within the smoothing period

T – number of business days within the smoothing period, which shall be defined as the smallest value from the following figures: five or the number of business days, for which the weighted average yield to maturity of the domestic government bonds group for the business day g is known

\overline{YTM}_g – weighted average yield of the domestic government bonds group for the business day g within the sample.

18. The fair value of a security is defined using the following approaches in descending order of their priority:

1) if a security has the active market pursuant to the criteria set forth in paragraph 9 of this Chapter, then the fair value of this security shall be defined using the market approach and level 1 inputs, and shall be equal to the minimum BID price in the principal market for these securities, or, in case of lack of a principal market, in the most advantageous market for these securities at the date preceding the date of assessing the security

2) if a security has an active market pursuant to the criteria set forth in paragraph 10 of this Chapter, then the fair value of this security shall be defined using the market approach and level 1 inputs, and shall be equal to the minimum BID price in the principal market for these securities, or, in case of lack of the principal market, in the most advantageous market for these securities at the date preceding the date of assessing the security, if the total amount of BIDs calculated as progressive total in descending order of the price makes not less than a minimum tolerance amount defined

in relevant regulations and directive documents of the National Securities and Stock Market Commission

3) if a security does not have an active market pursuant to the criteria set forth in paragraphs 9 and 10 of this Chapter, then the fair value of this security is defined using a yield approach and taking into account the group of this security pursuant to paragraph 11 of this Chapter.

19. To calculate the fair value of a security using a yield approach the following inputs and formulas are used:

1) the fair value of a UAH DG bond is calculated using level 2 inputs according to the following formula:

$$P = \sum_{t=1}^n (CF_t \times e^{-s_t \times d_t}) \quad (15)$$

where P is fair value of a security as at the measurement date

CF_t – the amount of cash flow t on the security

s_t – a spot rate with the term corresponding to cash flow t determined based on a zero coupon yield curve for UAH domestic government bonds calculated according to the formulas (2) or (2¹) using ratios defined in accordance with paragraph 15 subparagraph 14 of this Section

t – the running number of the cash flow generated by domestic government debt securities

n – number of DG bonds cash flows

d_t – residual maturity of the cash flow t under the domestic government bonds, years

e – a mathematical constant, which is the base of natural logarithms, $e \approx 2.718281828459045$

2) the fair value of a FX DG bond is calculated using level 2 inputs according to the following formula:

$$P = \sum_{t=1}^n (CF_t \times e^{-s_t \times d_t}) \quad (16)$$

where P is fair value of a security as at the measurement date, UAH

CF_t – the amount of cash flow t on the security, UAH. At the same time, cash flows are converted to the UAH equivalent using the official UAH exchange rate against respective foreign currency as of the date of fair value measurement;

s_t a spot rate with the term corresponding to cash flow t determined based on a zero coupon yield curve for FX domestic government bonds calculated according to formulas (2) or (2¹) using ratios defined in accordance with paragraph 15 subparagraph

14 of this Section and converted in the currency of the security using the function XCF (XCCY - analysis of spreads of the cross currency basis swaps) in the Bloomberg information terminal

t – the running number of the cash flow generated by domestic government debt securities

n – number of DG bonds cash flows

d_t – residual maturity of the cash flow t under the domestic government bonds, years

e – a mathematical constant, which is the base of natural logarithms, $e \approx 2.718281828459045$

3) the fair value of VAT DG bonds is calculated using level 2 inputs according to the following formula:

$$P = \sum_{t=1}^n \left(\frac{CF_t}{(1 + I_{YTM})^{d_t}} \right) \quad (17)$$

where P is fair value of domestic government bonds as at the measurement date

CF_t – value of the cash flow t generated by domestic government bonds.

I_{YTM} – yield to maturity index for the respective VAT DG bonds group

t – the running number of the cash flow generated by domestic government debt securities

n – number of DG bonds cash flows

d_t – residual maturity of the cash flow t under the domestic government bonds, years

4) exchange-rate-linked domestic government debt securities are essentially a combination of a hryvnia bond and an embedded Asian FX option that has the U.S. dollar-hryvnia currency pair as an underlying asset. The fair value of exchange-rate-linked domestic government debt securities is calculated based on level 2 inputs using the following formula:

$$P = \sum_{t=1}^n (CF_t \times e^{-s_t \times d_t}) + P_{FX_opt} \quad (18)$$

where P is fair value of a security as at the measurement date

CF_t – the amount of cash flow t on the security

a spot rate with the term corresponding to cash flow t determined based on a zero coupon yield curve for UAH domestic government bonds calculated according to the formulas (2) or (2¹) using ratios defined in accordance with paragraph 15 subparagraph 14 of Section II hereof

t – the running number of the cash flow generated by domestic government debt securities

n – number of DG bonds cash flows

d_t – residual maturity of the cash flow t under the domestic government bonds, years

e – a mathematical constant, which is the base of natural logarithms, $e \approx 2.718281828459045$

P_{FX_opt} – the fair value of the FX call option as of the valuation date, which is calculated using an adjusted model for the valuation of European FX options based on the standard Garman-Kohlhagen form of the Black-Scholes formula.

If the calendar month in which domestic government debt securities are to be repaid has not yet begun, the following formula is used to calculate the fair value of the FX call option:

$$P_{FX_opt} = \frac{1000}{K} \times \left(S \times e^{-s_T^B \times T} \times \Phi(d_1) - K \times e^{-s_T^B \times T} \times \Phi(d_2) \right) \quad (19)$$

and to calculate the delta equivalent of the FX call option embedded into exchange-rate-linked domestic government debt securities, as measured in hryvnias, the following formula is used:

$$E\Delta_{FX_opt} = \frac{1000}{K} \times S_0 \times e^{-s_T^B \times T} \times \Phi(d_1). \quad (20)$$

If the calendar month in which domestic government debt securities are to be redeemed has already begun, the delta of the FX call option equals zero, and the following formula is used to calculate the fair value of the FX call option:

$$P_{FX_opt} = \text{Max} \left[0, \frac{(S - K) \times 1000}{K} \right], \quad (21)$$

where K is the exercise price of the FX call option, which is equal to the weighted average UAH/USD exchange rate (measured in hryvnias per USD 1 and rounded to four decimal places) in the interbank market of Ukraine for the calendar month preceding the month in which the initial placement of domestic government debt securities was made

S – the current value of the underlying asset, which equals to the arithmetic average of the official UAH/USD exchange rate (measured in hryvnias per USD 1 and rounded to four decimal places) for the following period:

from the beginning of the current calendar month through the business day when domestic government debt securities are evaluated, if the calendar month in which domestic government debt securities are to be redeemed has not yet begun

the calendar month preceding the month in which domestic government debt securities are to be redeemed, if this month has already ended

T – the time, in years, that is left till the end of the calendar month preceding the month in which domestic government debt securities are to be redeemed

s_T^B – is a spot rate with continuing interest accrual that corresponds to the time period T and is defined based on a zero coupon yield curve for UAH-denominated domestic government bonds calculated according to the formulas (2) or (2¹) using ratios calculated in accordance with Section II paragraph 15 subparagraph 14 of this Procedure

s_T^B – is the continuously compounded rate for the U.S. dollar, which corresponds to the period T , is determined on the basis of the yield curve for the U.S. dollar, is calculated by the U.S. Treasury, and is published on its official website at <https://www.treasury.gov/resource-center/data-chart-center/interest-rates/Pages/TextView.aspx?data=yield> or on the Federal Reserve’s website at <https://www.federalreserve.gov/releases/h15/>. If the period T does not coincide with the standard periods for which the U.S. Treasury publishes rates, the rate for the period T is determined by applying a linear interpolation between two adjacent values. The U.S. Treasury publishes semiannually compounded rates, which are translated into continuously compounded rates through the following formula:

$$s_T^B = \ln \left(\left(1 + \frac{i_T^B}{2} \right)^2 \right), \quad (22)$$

where i_T^B is the semiannually compounded rate for the U.S. dollar, which corresponds to the period T , is determined on the basis of the yield curve for the U.S. dollar, is calculated by the U.S. Treasury, and is published on its official website at <https://www.treasury.gov/resource-center/data-chart-center/interest-rates/Pages/TextView.aspx?data=yield> or on the Federal Reserve’s website at <https://www.federalreserve.gov/releases/h15/>

d_1, d_2 – model parameters that shall be calculated according to the following formulas:

$$d_1 = \frac{\ln(S/K) + (s_T^Q - s_T^B + \sigma^2/2) \times T}{\sigma \times \sqrt{T}}, \quad (23)$$

$$d_2 = \frac{\ln(S/K) + (s_T^Q - s_T^B - \sigma^2/2) \times T}{\sigma \times \sqrt{T}} = d_1 - \sigma \times \sqrt{T}, \quad (24)$$

\ln is a natural logarithm

Φ is the cumulative standard normal distribution function

e is a mathematical constant, which is the base of natural logarithms,
 $e \approx 2.718281828459045$

σ is the historical volatility of the weighted average UAH/USD exchange rate (measured in hryvnias per USD 1 and rounded to four decimal places) in the interbank market of Ukraine, or a monthly arithmetic average of official exchange rates (measured in hryvnias per USD 1 and rounded to four decimal places) that is calculated for the past 10 years and annualized

$e^{-s_T^B \times T} \times \Phi(d_1)$ – is the delta of the FX call option embedded into exchange-rate-linked domestic government debt securities

$\frac{1000}{K}$ is the amount of U.S. dollars in line with the terms of the FX call option embedded into exchange-rate-linked domestic government debt securities

S_0 is the official UAH/USD exchange rate as of the measurement day

(Section II paragraph 19 subparagraph 4 in the wording of NBU Board decisions)

No. 338 dated 2 June 2017,
 No. 627 dated 20 September 2018,
 No. 327 dated 14 May 2020)

4¹) FX DS bonds with early repayment may be put forward early by the owner at any moment and repaid unconditionally by the issuer under the Procedure On Early Repayment of Mid-Term Domestic Government Bonds Denominated in Foreign Currency as approved by Order No. 408 of the Ministry of Finance of Ukraine dated 27 March 2012 which means it comprises embedded option for the owner. Early repayment of FX DS bonds with early repayment shall be conducted by the issuer upon request of the owners at face value including accumulated coupon yield calculated at the rate of 0.5 of the annual coupon rate. Fair value of a FX DG bond with early payment is calculated using the level 2 inputs under the formula (16) or the following formula:

$$P = \text{Max} \left[\sum_{t=1}^n (CF_t \times e^{-s_t \times d_t}), \sum_{t=1}^m (CF_t^{opt} \times e^{-s_t \times d_t}) \right], \quad (24^1)$$

where P is fair value of a security as at the measurement date, UAH

CF_t – the amount of cash flow t on the security under the issue conditions, UAH. At the same time, cash flows are converted to the UAH equivalent using the official UAH exchange rate against respective foreign currency as of the date of fair value measurement

CF_t^{opt} – the amount of cash flow t on the security in case of early repayment, UAH. At the same time, cash flows are converted to the UAH equivalent using the official UAH exchange rate against respective foreign currency as of the date of fair value measurement

s_t – a spot rate with the term corresponding to cash flow t determined based on a zero coupon yield curve for FX domestic government bonds, calculated according to the formulas (2) or (2¹) using ratios defined in accordance with paragraph 15 subparagraph 14 of this Section and converted in the currency of the security using the function XCF (XCCY - analysis of spreads of the cross currency basis swaps) in the Bloomberg information terminal

t – the running number of the cash flow generated by domestic government debt securities

n – number of DG bonds cash flows in accordance with the issue conditions

m – number of money flows generated by domestic government bonds in the case of early repayment

d_t – residual maturity of the cash flow t under the domestic government bonds, years The date of the cash flow received to repay FX DS bonds in the case of early repayment shall be determined 21 calendar days upon the date of evaluation as to exercise the right of early repayment the owner shall submit a written application to the Ministry of Finance of Ukraine no later than 20 calendar days before the early repayment date determined by the owner

e – a mathematical constant, which is the base of natural logarithms,
 $e \approx 2.71828182\ 8459045$

(Section II paragraph 19 supplemented with
 subparagraph 4¹ according to NBU Board decision
 No. 627 dated 20 September 2018)

4²) inflation-indexed domestic government bond shall have a floating coupon rate. Calculation of the amount of an annual coupon rate for inflation-indexed domestic government bonds shall include CPI (index of inflation) set no later than two months before the date of coupon rate payment. The fair value of inflation-indexed domestic government bond is calculated using the level 2 inputs under the following formula:

$$P = \sum_{t=1}^m (CF_t^{\text{exp}} \times e^{-s_t \times d_t}) \quad (24^2)$$

where P is fair value of a security as at the measurement date, UAH

CF_t^{exp} – the amount of the expected cash flow t on the security, which is calculated considering the following:

the consensus-based forecast of CPI for five years published in the most recent FOCUSECONOMICS CIS Countries publication

monetary targets of the NBU starting from the sixth year upon the measurement date

s_t – a spot rate with the term corresponding to cash flow t determined based on a zero coupon yield curve for UAH domestic government bonds calculated according to the formulas (2) or (2¹) using ratios defined in accordance with paragraph 15 subparagraph 14 of this Section

t – the running number of the cash flow generated by domestic government debt securities

n – number of DG bonds cash flows

d_t – residual maturity of the cash flow t under the domestic government bonds, years

e – a mathematical constant, which is the base of natural logarithms,
 $e \approx 2.71828182\ 8459045$

(Section II paragraph 19 supplemented with subparagraph
 4² according to NBU Board decision No. 627 dated 20
 September 2018)

5) the fair value of other domestic government bonds is calculated using level 2 inputs according to the following:

formula (15), if other domestic government bonds are UAH-denominated

formula (16), if other domestic sovereign bonds are FX-denominated.

At the same time, the possibility of early redemption of long-term domestic government bonds shall be ignored, because the possibility to exercise this right by the National Bank of Ukraine is close to zero

6) The fair value of Eurobonds is calculated using level 2 inputs and the following sources, in the decreasing order of their importance:

CBBT (Composite Bloomberg Bond Trader) – a market price that is compiled using data from hundreds of different dealers – from the Bloomberg terminal.

BGN (Bloomberg Generic Price) – a consensus market price of a bond that is determined on the basis of quotations received by Bloomberg from several sources, and other data that Bloomberg deems appropriate – from the Bloomberg terminal. BGN is a market indicator of bond valuation that uses both hard and indicative quotations, depending on which of them are available at the time of valuation.

BVAL (Bloomberg Valuation Service) – a Bloomberg terminal feature that provides reasonable market prices available at the end of the day for various instruments.

EXCH (Exchange Traded) – a market price that is compiled using quotations from different stock exchanges – from the Bloomberg terminal.

BFV (Bloomberg Fair Value) – a measure that identifies the market price of a bond on the basis of trading data on other bonds that are similar in type of issuer and credit quality – from the Bloomberg terminal.

other Bloomberg terminal data deemed appropriate by the NBU's risk management unit

data on yields for similar securities, and analytical functions in the Bloomberg terminal, including: YAS (Yield & Spread Analysis) function, YASN (Yield and Spread Analysis for Structured Notes) function, and other analytical functions that the NBU's risk management unit sees fit to use

Thomson Reuters Pricing Services (RIC=RRPS) at Refinitiv Eikon financial analysis platform (RIC being the individual's financial instrument code on said platform)

Thomson Reuters Fixed Income Trading composite (TRFIT COMPOSITE, RIC=R) from Refinitiv Eikon financial analysis platform

Thomson Reuters Composite EMEA (RIC=), from Refinitiv Eikon financial analysis platform

other data from Refinitiv Eikon financial analysis platform that is deemed relevant by the NBU's risk management unit

data on yields for similar securities, and calculators from Refinitiv Eikon financial analysis platform, specifically: Fixed Rate Bond Calculator, Floating Rate Note Calculator, and other calculators deemed relevant by the NBU's risk management unit.

(Section II paragraph 19 subparagraph 6 in the wording of NBU Board Decision No. 327 dated 14 May 2020)

61) the fair value of hryvnia-denominated corporate bonds that have been placed with the guarantee of the Cabinet of Ministers of Ukraine is determined using level 2 and level 3 inputs in a binomial method that builds a binomial cash flow tree for each bond. The binomial bond cash flow tree assumes that there are two possible scenarios for each date of receipt of the bond cash flow:

timely receipt of cash flow from the issuer of the security with probability $(1 - PD_t)$

default of the issuer of the security and receipt of cash flow from the guarantor for the amount, within the time, and in the manner prescribed by the terms of the guarantee of the Cabinet of Ministers of Ukraine, with Probability PD_t .

Based on the constructed binomial cash flow tree for a bond, the fair value of hryvnia-denominated corporate bonds that are placed with the guarantee of the Cabinet of Ministers of Ukraine is determined by the following formula:

$$P = \sum_{t=1}^n [CF_t \times (1 - cPD_t) \times e^{-s_t \times d_t} + CF_t \times R_t \times cPD_t \times e^{-s_{t+m} \times d_{t+m}}] \quad (24^1)$$

where P is fair value of a security as at the measurement date

CF_t – the amount of cash flow t on the security

s_t – a spot rate with the term corresponding to cash flow t determined based on a zero coupon yield curve for UAH domestic government bonds calculated according to the formulas (2) or (2¹) using ratios defined in accordance with paragraph 15 subparagraph 14 of Section II hereof

s_{t+m} – a spot rate with the term corresponding to cash flow t increased by m , determined based on a zero coupon yield curve for UAH domestic government bonds calculated according to the formulas (2) or (2¹) using ratios defined in accordance with paragraph 15 subparagraph 14 of Section II hereof

t – the running number of the cash flow generated by the security

n – number of the security's cash flows

d_t – residual maturity of the cash flow t under the security, years

d_{t+m} is the residual maturity of the cash flow t under the security, which is measured in years and increased by m

m – is the expected term of receipt of cash flow t from the guarantor, measured in years, that is expected in case of default of the issuer of the security and determined taking into account all the conditions of the guarantee of the Cabinet of Ministers of Ukraine. If under the terms of the guarantee of the Cabinet of Ministers of Ukraine, the owner of the security has the right to file a claim against the guarantor only after the court makes a final decision that is not subject to appeal in the case related to the security, then m takes on the value of 10

e – a mathematical constant, which is the base of natural logarithms, $e \approx 2.718281828459045$

R_t – a ratio that, if multiplied by the size of cash flow t for the security, equals the amount that will be compensated by the guarantor for cash flow t in case of default by the issuer of the security. This ratio is determined taking into account all the conditions of the guarantee of the Cabinet of Ministers of Ukraine. If under the terms of the guarantee of the Cabinet of Ministers of Ukraine the owner of the security cannot demand satisfaction of his/her claim from the guarantor due to the fact that this claim can be satisfied by crediting to the issuer of the security a counterclaim that is related to the reciprocal financial commitments of the issuer of the security to the owner of the security (including when the owner of the security is in liquidation) and in the event that these reciprocal financial commitments exist, then R_t takes on the value of zero

*(Section II paragraph 19 paragraph 61 indent sixteen
in the wording of NBU Board Decision
No. 539 dated 21 August 2020)*

cPD_t is the sum of the probabilities of scenarios in which the issuer of the security defaults on the payment of cash flow t for the security, which is set at:

$cPD_t = 1$ if as at the time of valuation, the issuer of the security has defaulted

$cPD_t = [1 - \prod_{t=1}^n (1 - PD_t)]$ in other cases,

where PD_t is the probability of default by the issuer of the security, which is determined in accordance with Annex 9 “Values of the PD and LGD Ratios for Active Banking Transactions” to the Regulation On Determining Credit Risk for Active Banking Operations, approved by NBU Board Resolution No. 351 (as amended) dated 30 June 2016

*(Section II paragraph 19
supplemented with paragraph 6¹
according to NBU Board Decision
No. 327 dated 14 May 2020)*

“6²) the fair value of domestic municipal bonds is determined using level 2 and level 3 inputs in a binomial method that builds a binomial cash flow tree for each bond. The binomial bond cash flow tree assumes that there are two possible scenarios for each date of receipt of the bond cash flow:

timely receipt of cash flow from the issuer of the security with cumulative probability $(1 - (1 - cPD_t))$

a default (including a technical default, namely payment delay) of the issuer of the security and receipt of a past-due cash flow from the issues of the expected amount and in the expected timeframe with cumulative probability cPD_t .

Based on the constructed binomial cash flow tree for a bond, the fair value of domestic municipal bonds is determined by the following formula:

$$P = \sum_{t=1}^n [CF_t \times (1 - cPD_t) \times e^{-s_t \times d_t} + CF_t \times R \times cPD_t \times e^{-s_{t+m} \times d_{t+m}}], \quad (24^2)$$

where P is fair value of a security as at the measurement date

CF_t – the amount of cash flow t on the security

s_t – a spot rate with the term corresponding to cash flow t determined based on a zero coupon yield curve for:

UAH domestic government bonds calculated according to the formulas (2) or (2¹) using ratios defined in accordance with paragraph 15 subparagraph 14 of Section II hereof, if domestic municipal bonds are denominated in hryvnia

foreign currency domestic government debt securities, which is calculated according to the formulas (2) or (2¹) using the ratios defined pursuant to Section II paragraph 15 subparagraph 14 of this Procedure and converted into the currency of the security using the function XCF (XCCY - analysis of spreads of the cross currency basis swaps) in the Bloomberg information terminal, if domestic municipal bonds are denominated in foreign currency

s_{t+m} – a spot rate with the term corresponding to cash flow t increased by m determined based on a zero coupon yield curve for:

UAH domestic government bonds calculated according to the formulas (2) or (2¹) using ratios defined in accordance with paragraph 15 subparagraph 14 of Section II hereof, if domestic municipal bonds are denominated in hryvnia

foreign currency domestic government debt securities, which is calculated according to the formulas (2) or (2¹) using the ratios defined pursuant to Section II paragraph 15 subparagraph 14 of this Procedure and converted into the currency of the security using the function XCF (XCCY - analysis of spreads of the cross currency basis swaps) in the Bloomberg information terminal, if domestic municipal bonds are denominated in foreign currency

t – the running number of the cash flow generated by the security

n – number of the security's cash flows

d_t – residual maturity of the cash flow t under the security, years

d_{t+m} is the residual maturity of the cash flow t under the security, which is measured in years and increased by m

m – is the expected term of receipt of cash flow t from the issuer of the security, measured in years, in case of default (as well as technical default) of the issuer of the security estimated taking into account the overall accumulated statistics of repayment of domestic municipal bonds with delayed payments

e – a mathematical constant, which is the base of natural logarithms, $e \approx 2.718281828459045$;

R – a ratio that, if multiplied by the size of the cash flow t for the security, equals the amount that will be compensated by the issuer for the cash flow t in case of default (as well as technical default) estimated taking into account the overall accumulated statistics of repayment of domestic municipal bonds with delayed payments

cPD_t – the sum of the probabilities of scenarios in which the issuer of the security defaults on the payment of cash flow t on the security, which is set at:

$cPD_t = 1$ if as at the time of valuation, the issuer of the security has defaulted (technically defaulted)

estimated for all other cases based on statistics of international rating agencies for cumulative average rates of default on publicly guaranteed debt for a group of credit ratings that cover the best of two the worst ratings in Ukraine set but such international rating agencies Standard&Poor's, Fitch Ratings, and Moody's Investors Service:

in hryvnia, if domestic municipal bonds are denominated in hryvnia

in foreign currency, if domestic municipal bonds are denominated in foreign currency

The value of indicators m , R , and cPD_t is determined by the Assets and Liabilities Management Committee of the NBU based on the recommendations of the risk management unit

(Section II paragraph 19 supplemented with subparagraph 6² according to NBU Board Decision No. 539 dated 21 August 2020)

7) the fair value of other debt securities that are denominated in hryvnia and do not circulate outside Ukraine is defined using level 2 and 3 inputs according to the following formula:

$$P = \sum_{t=1}^n (CF_t \times e^{-(s_t+r) \times d_t}) \quad (25)$$

where P is fair value of a security as at the measurement date

CF_t – the amount of cash flow t on the security

s_t – a spot rate with the term corresponding to cash flow t determined based on a zero coupon yield curve for UAH domestic government bonds calculated according to the formulas (2) or (2¹) using ratios defined in accordance with paragraph 15 subparagraph 14 of this Section

r – premium for a security risk as compared to a risk of domestic government bonds, which is defined by the Risk management unit using available market data, information about financial position of the issuer, and expert judgment of Risk management unit experts, and which is among level 3 inputs. A premium for risk of government-guaranteed domestic government bonds is lesser than a premium for risk of debt securities issued by state-owned enterprises and government agencies and which is lesser than a premium for risk of debt securities of other issuers

t – the running number of the cash flow generated by domestic government debt securities

n – number of DG bonds cash flows

d_t – residual maturity of the cash flow t under the domestic government bonds, years

e – a mathematical constant, which is the base of natural logarithms, $e \approx 2.718281828459045$;

8) the fair value of other debt securities that are denominated in FX and do not circulate outside Ukraine is defined using level 2 and 3 inputs according to the following formula:

$$P = \sum_{t=1}^n (CF_t \times e^{-(s_t+r) \times d_t}) \quad (26)$$

where P is fair value of a security as at the measurement date

CF_t – the amount of cash flow t on the security

s_t – a spot rate with the term corresponding to cash flow t determined based on a zero coupon yield curve for UAH domestic government bonds calculated according to the formulas (2) or (2¹) using ratios defined in accordance with paragraph 15 subparagraph 14 of this Section and converted in the currency of the security using the function XCF (XCCY - analysis of spreads of the cross currency basis swaps) in the Bloomberg information terminal

r – premium for a security risk as compared to a risk of domestic government bonds, which is defined by the Risk management unit using available market data, information about financial position of the issuer, and expert judgment of Risk management unit experts, and which is among level 3 inputs. A premium for risk of government-guaranteed domestic government bonds is lesser than a premium for risk of debt securities issued by state-owned enterprises and government agencies and which is lesser than a premium for risk of debt securities of other issuers

t – the running number of the cash flow generated by domestic government debt securities

n – number of DG bonds cash flows

d_t – residual maturity of the cash flow t under the domestic government bonds, years

e – a mathematical constant, which is the base of natural logarithms, $e \approx 2.718281828459045$;

9) the fair value of other debt securities that do not circulate outside Ukraine is defined using the resources specified by subparagraph 6 of paragraph 14 of this Section in descending order of their priority

10) the fair value of shares and other equity securities as well as the fair value of investments in the authorized capital of both residents and nonresidents are defined by the unit that performs the functions of collateral assessment and monitoring pursuant to other NBU regulations and directive documents

*(Section II paragraph 19 subparagraph 10
as amended according to NBU Board Decision*

11) the fair value of NBU certificates of deposit, which are accepted by it or offered to it as collateral securing fulfillment of obligations, is calculated using level 2 inputs according to the following formula:

$$P = \sum_{t=1}^n (CF_t \times e^{-s_t \times d_t}) \quad (26^1)$$

where P – the fair value of the certificate of deposit as of the measurement date

CF_t – the amount of cash flow t on the certificate of deposit

s_t – a spot rate with the term corresponding to cash flow t determined using the linear interpolation method based on the latest weighted average CD yields available on the measurement date and calculated via the software and hardware complex of the automation system for the monetary policy instruments as rate with continuous interest compounding at the NBU's placing CDs and changing the NBU key policy rate

t – the running number of a cash flow on a CD

n – the number of cash flows on the CD

d_t – residual maturity of the cash flow t on the CD, years

e – a mathematical constant, which is the base of natural logarithms,
 $e \approx 2.718281828459045$.

*(Section II paragraph 19 subparagraph 11
in the wording of NBU Board Decision
No. 935 dated 16 December 2019)*

*(Section II paragraph 19 as amended
according to NBU Board Decisions
No. 627 dated 20 September 2018,
No. 935 dated 16 December 2019)*

20. To determine similar securities, the risk management unit employees shall use their own expert judgments. Moreover, all the following criteria for securities' similarity must be taken into account:

- 1) identical (the same) sector of the economy
- 2) identical issue credit rating
- 3) identical home country of the issuer
- 4) identical securities currency

5) identical interest rate type (fixed interest rate or floating interest rate)

6) for securities with a floating interest rate - similar (comparable) parameters of the floating interest rate (its base index and reset frequency)

7) similar residual maturity. Allowed deviations: 30 calendar days or less between residual maturities for the securities with a residual maturity of up to one year, 60 calendar days or less for the securities with residual maturity over one year and up to three years, and 90 calendar days or less for the securities with residual maturity of three years and more

8) similar additional terms and conditions regarding the type of collateral (for example, guarantee, securing with certain type of assets etc.)

9) similar terms and conditions regarding issuance (for example, available indexation, early repayment option etc.).

(Section II paragraph 20 as amended according to NBU Board Decision No. 935 dated 16 December 2019)

21. The fair value of securities at the time of their initial recognition equals to:

1) the price of a securities trade deal, if the deal was made at arm's length

2) most recent stock market securities sales price in the currency of the securities nominal published by the National Bank of Ukraine net of accumulated coupon yield and fair value of embedded options as of the date of the price publication and increased by accumulated coupon yield and fair value of embedded options as of the date of the price publication as of the date of initial recognition, if the NBU requirements are met under the loans including requirements of direct repo transactions or agreements on storing the cash reserves by means of fair value of acquired securities that remain unrealized on the results of the sale

(Section II paragraph 21 in the wording of NBU Board Decision No 627 dated 20 September 2018)

“2¹) value of securities determined based on the income approach using level 2 and level 3 inputs in the case NBU's claims are satisfied under loans, direct repos or agreements on storing the cash reserves by taking ownership of securities under martial law. The value of the security shall be calculated by the following formula:

$$\bar{P}_i = \sum_{t=1}^n \left(\frac{CF_{it}}{(1 + \overline{YTM}_i)^{d_t}} \right), \quad (26^2)$$

where \bar{P}_i is the value of securities issue i
 CF_{it} – the amount of the cash flow t
 t – the running number of the cash flow generated by the securities' issue i
 n – number of cash flows under the issue i of securities
 d_t – residual maturity of the cash flow t under the issue i of securities, years
 \overline{YTM}_i is the weighted average yield to maturity of the securities issue i calculated by the following formula:

$$\overline{YTM}_i = KR + SP, \quad (26^3)$$

where KR is the key policy rate of the National Bank of Ukraine

SP is a premium/discount for the risks that is set out in the NBU Board decision on taking ownership of securities taking into account the status of Ukraine's securities market, financial position of the securities issuer, and the characteristics of the securities issue

*(Section II paragraph 21 supplemented with
subparagraph 2¹
according to NBU Board Decision
No. 395 dated 4 August 2022)*

3) the fair value of securities, which is defined according to paragraphs 18 and 19 of this Section in all other cases.

22. A securities trade deal is deemed made at arm's length, if:

1) yield to maturity of debt securities pertaining to conditionally illiquid segment of the stock market, which is defined based on the price of a securities trade deal, deviates from the yield to maturity defined on the ground of the estimated fair value (paragraphs 18 and 19 of this Section) by 10 basis points or less

2) the price of a securities trade deal for other debt securities equals to the estimated fair value (paragraphs 18 and 19 of this Section).

III. Methodology for Calculating the Adjusting Factors for Securities

23. Adjusting factors shall be calculated for those securities accepted by the National Bank of Ukraine as collateral, or that is trade object under repo transactions. Adjusting factors are meant for loss minimization of the National Bank of Ukraine in the event of interest rate risk, exchange risk and liquidity risk occurrence.

24. Adjusting factors shall be calculated using the following approaches:

1) individual approach that provides determining an adjusting factor separately for each securities issue

2) standard approach that provides determining single adjusting factors for securities grouped by certain characteristics (for example, by maturity, coupon rate amount, FX denomination etc.).

25. If the individual approach is applied, the adjusting factor for the i -issue of securities shall be calculated according to the following algorithm:

1) interest rate factor for the issue i of securities is determined according to paragraph 26 of this Section

2) exchange risk factor for the issue i of securities is determined according to paragraph 27 of this Section

3) liquidity risk factor for the issue i of securities is determined according to paragraph 28 of this Section

4) adjusting factor for the issue i of securities is calculated according to the following formula:

$$CR_i = 1 - HC_i = 1 - (\Delta IR_i + \Delta FX_i + \Delta L_i), \quad (27)$$

where CR_i is the adjusting factor for the issue i of securities

HC_i – haircut for the risks inherent in the issue i of securities

ΔIR_i – the interest rate risk factor for the issue i of securities

ΔFX_i – the exchange risk factor for the issue i of securities

ΔL_i – is the liquidity risk factor for the issue i of securities.

26. Interest rate risk factor shall be determined based on assumption of possible unfavourable change of zero coupon yield curve in the respective foreign currency according to the following algorithm:

1) security fair value is calculated according to the technique set out in Section II hereof

2) possible unfavorable change of a zero coupon yield curve shall be simulated and the adjusted zero coupon yield curves shall be calculated by increasing the parameter β_0 of the Nelson-Siegel model in formula (2) or of the Svensson model in formula (2¹):

(Section III paragraph 26 subparagraph 2 indent one as amended according to NBU Board Decision No. 627 dated 20 September 2018)

for zero coupon yield curve constructed on the basis of UAH DG bonds, by the value calculated using expert judgment but at least by 0.05 (500 basis points)

for zero coupon yield curve constructed on basis of FX DG bonds denominated in USD, by the value calculated using expert judgment, but at least by 0.02 (200 basis points)

3) adjusted security fair value is calculated using adjusted zero coupon yield curve according to the methodology set out in Section II hereof

4) interest rate risk factor is calculated as relative change of security fair value using the following formula:

$$\Delta IR_i = \left| \frac{P_i^{shift} - P_i}{P_i} \right|, \quad (28)$$

where ΔIR_i is the interest rate risk factor for the issue i of securities

P_i – fair value of a security of the issue i

P_i^{shift} – adjusted fair value of a security of the issue i

Output shall be rounded to the nearest figure in multiples of 0.005 [for example, MS Excel function “ROUND(ΔIR_i ;0.005) ”].

27. Interest rate risk factor shall be calculated based on assumption on respective FX rate in unfavourable direction according to the following algorithm:

1) for all securities issues denominated in UAH except for indexed domestic government bonds, there is no exchange risk factor, i.e. $\Delta FX_i = 0$

2) for all securities issues denominated in FX, currency risk factor is calculated based on assumption on FX devaluation against UAH by two percent, i.e. $\Delta FX_i = 0,02$;

3) for issues of indexed domestic government bonds, for which the month of the bonds repayment has not started yet, the currency risk factor is calculated based on assumption regarding foreign currency depreciation against hryvnia and a decrease in

a time value of the embedded call option according to zero according the following formula:

$$\Delta FX_i = \frac{P_{FX_opti}^{Time}}{P_i} + \left(1 - \frac{\text{Max}\left[1, \frac{0,98 \times S_i}{K_i}\right]}{\text{Max}\left[1, \frac{S_i}{K_i}\right]} \right) \quad (29)$$

where ΔFX_i is the exchange risk factor for the issue i of securities

P_i – fair value of a security of the issue i , which is calculated according to formula (18)

$P_{FX_opti}^{Time}$ – a time value of the currency call option, which is the difference between the values of the currency call option, calculated according to the formulas (19) and (21)

K_i – currency call option exercise price for the i -issue of indexed domestic government bonds, value of which equals to weighted average UAH/USD exchange rate (UAH per USD 1, rounded to four decimal places) in the interbank market during the calendar month preceding the month when initial placement of domestic government bonds took place

S_i – present value of the underlying asset of currency call option for the i -issue of indexed domestic government bonds, which equals to weighted average UAH/USD exchange rate (UAH per USD 1, rounded to four decimal places) from the beginning of the current calendar month inclusive through the business day preceding the day of measurement of the i -issue of indexed domestic government bonds

(Section III paragraph 27 subparagraph 3 in the wording of NBU Board Decision No. 338 dated 2 June 2017)

4) for the issues of indexed domestic government bonds, for which the month of domestic government bonds redemption has already started, there is no currency risk factor, i.e. $\Delta FX_i = 0$.

28. The liquidity risk factor includes expenses related to a sale of a low-liquid security. Such securities comprise all the securities issued by resident legal entities who do not have an active market pursuant to Section II paragraphs 9 and 10 hereof. All the low-liquid securities have the liquidity risk factor equaling to three per cent of their fair value, i.e. $\Delta L_i = 0,03$. For all the other securities there is no liquidity risk factor, i.e. $\Delta L_i = 0$.

29. If the standard approach is applied, the single adjusting factor for the group j of securities having certain characteristics shall be defined according to the following algorithm:

1) all the securities shall be grouped according to certain features (maturity, coupon rate, FX denomination, issuer, etc.). j The number and characteristics of the groups are defined depending on the securities accepted by the National Bank of Ukraine as collateral, or which are a trade object under repo transactions

2) for each group j of securities a few theoretical issues i of securities are determined, including the issue i of the securities with the minimum possible coupon rate and maximum maturity

3) the interest rate factor for each theoretical issue i of securities within a securities group j is determined according to paragraph 26 of this Section

*(Section III paragraph 29 subparagraph 3
as amended according to NBU Board Decision
No. 338 dated 16 December 2019)*

4) the exchange risk factor for each theoretical issue i of securities within a securities group j is determined according to paragraph 27 of this Section

*(Section III paragraph 29 subparagraph 4
as amended according to NBU Board Decision
No. 338 dated 16 December 2019)*

5) the liquidity risk factor for each theoretical issue i of securities within a securities group j is determined according to paragraph 28 of this Section

*(Section III paragraph 29 subparagraph 5
as amended according to NBU Board Decision
No. 338 dated 16 December 2019)*

6) the adjusting factor for each group j of securities is calculated according to the following formula:

$$CR_j = 1 - HC_j = 1 - (\max(\Delta IR_i) + \max(\Delta FX_i) + \max(\Delta L_i)), \quad (30)$$

where CR_j is the adjusting factor for the group j of securities

HC_j – haircut for the risks inherent in the securities group j

$\max(\Delta IR_i)$ – maximum interest rate risk factor among the interest rate risk factors calculated for theoretical issues i of securities within the securities group j

$\max(\Delta FX_i)$ – maximum exchange risk factor among the exchange risk factors calculated for theoretical issues i of securities within the securities group j

$\max(\Delta L_i)$ – maximum liquidity risk factor among the liquidity risk factors for theoretical issues i of securities within the securities group j .

30. Adjusting factors calculated using the standard approach for the securities grouped by certain characteristics are approved by a separate directive document of the National Bank of Ukraine and revised in case of material changes in trends in the stock market of Ukraine. Material changes in trends in the stock market of Ukraine are the changes that lead to an increase/decrease of the possible unfavorable change in the zero coupon yield curve by more than 50 percent as compared to the change used for calculation of adjusting factors with the use of conventional approach.

31. The adjusting factor for a security is calculated with the use of the individual approach if such security cannot be attributed to any group of securities for which single adjusting factors are calculated using the standard approach.

IV. Security Rating and Yield to Maturity Calculation

32. Taking into account different face values of securities, the securities fair value is determined as securities rates to a precision of six decimal places. For debt securities the securities rate is calculated net of the accumulated coupon yield.

33. The rate of shares and other equity securities is calculated according to the following formula:

$$p = \frac{P}{N} \times 100 \quad (31)$$

where P is security rate as at the measurement date

P – fair value of a security as at the measurement date

N – security face value.

34. The debt securities rate net of the accumulated coupon yield is calculated according to the following formula:

$$p = \frac{P - AI}{N} \times 100 \quad (32)$$

where P is security rate as at the measurement date

P – fair value of a security as at the measurement date

N – current fair value of a security as at the measurement date

AI – accumulated coupon yield on a security at the measurement date, which is calculated according to the following formula:

$$AI = \frac{C_t \times (d_0 - d_{(t-1)})}{d_t - d_{(t-1)}}, \quad (33)$$

where C_t is amount of the next coupon on a security at the measurement date
 d_0 – measurement date
 d_t – date of the next coupon payment on a security
 $d_{(t-1)}$ – date of the preceding coupon payment on a security, if the coupon payment on a security has been already performed, or the date of security issuance, if the coupon payment on a security has not been performed yet (i.e. if the first coupon period is not over yet).

35. The debt securities rate net of the indexed value and accumulated coupon yield at the date of their redemption equals to 100.000000.

(Section IV paragraph 35 in the wording of NBU Board Decision No. 338 dated 2 June 2017)

36. The yield to maturity of debt securities net of indexed domestic sovereign bonds shall be calculated using the successive iterations method, taking into account the following formula:

$$P = \sum_{t=1}^n \left(\frac{CF_t}{(1 + YTM)^{d_t}} \right), \quad (34)$$

where YTM is yield to maturity of the security at the measurement date

P – fair value of the security at the measurement date, UAH

CF_t – the amount of cash flow t on the security, UAH. Cash flows are converted to the UAH equivalent using the official UAH exchange rate against respective foreign currency as of the date of measurement

t – the running number of the cash flow generated by domestic government debt securities

n – number of DG bonds cash flows

d_t – residual maturity of the cash flow t under the domestic government bonds, years

37. The yield to maturity of indexed domestic government bonds shall be calculated using the successive iterations method taking into account the formula (34), net of the fair value of the FX call option (P_{FX_opt}), which is calculated according to the formulas (19) or (21).

*(Section IV paragraph 37 in the wording of NBU
Board Decision
No. 338 dated 2 June 2017)*

V. Allocation of Responsibility Areas

38. When measuring the fair value of securities, responsibility areas shall be allocated between subdivisions of the National Bank of Ukraine (hereinafter – subdivisions) pursuant to their powers and within their competence and depending on the purpose of this measurement.

39. Measurement of securities' fair value shall be performed for:

1) initial recognition of securities at the end of the business day that is the day of their initial recognition

2) daily revaluation of securities owned by the National Bank of Ukraine, which are reflected in accounting and financial reports at a fair value as of the end of the business day prior to the day of revaluation

3) measuring the fair value of securities proposed to the National Bank of Ukraine as collateral at the date of initial recognition of a credit transaction, which is determined by NBU regulations and directive documents on accounting

4) measuring the value adequacy of securities accepted by the National Bank of Ukraine as collateral to cover liabilities to the National Bank of Ukraine, as of the end of the business day prior to the day of revaluation of collateral or transaction.

40. Risk management unit shall:

1) calculate zero coupon yield curves using the Nelson-Siegel and/or Svensson parametric models under Section II Paragraphs 12 - 15 herein and yield to maturity indices under Section II Paragraph 16 herein no less than once a week as of the end of the business day with the use of automation systems of the NBU depository. Moreover, new zero coupon yield curves and yield to maturity indices are used to calculate the securities fair value beginning with the day following the date of construction of these curves and indices

*(Section V paragraph 40 subparagraph 1 as
amended
according to NBU Board Decision
No. 627 dated 16 December 2019)*

2) calculate adjusting ratios of securities with the use of the automation system of the NBU depository

3) calculate the fair value of securities owned by the National Bank of Ukraine, which are reflected in accounting and financial reports at fair value, at the end of every business day with the use of the automation system of the NBU depository and control uploading of this information in the form of securities rates to ABS BARS *Millennium* system to reflect the securities revaluation in accounting, having control over downloaded information compliance with calculations made. The list of securities reflected in accounting and financial reports at fair value shall be obtained from ABS BARS *Millennium* system.

4) determine whether the price of a deal on purchase/sale of securities that belong to a conditionally illiquid stock market pursuant to paragraph 22 of Section II herein is in conformity to the market conditions;

5) ensures disclosure of information about zero coupon yield curves, adjusting ratios for the securities accepted as collateral by the National Bank of Ukraine and their fair value on the official web-site of the National Bank of Ukraine and in other information resources;

6) submit proposals to the responsible collegial body regarding benchmarks for the conditionally illiquid segment of the domestic sovereign bonds market, which were coordinated with proposals of the Open Market Operations Department.

(Section V paragraph 40 as amended according to NBU Board Decision

No. 627 dated 20 September 2018)

41. Operational Department:

1) shall reflect in accounting the fair value of securities at their initial recognition using ABS BARS *Millennium* system based on information received from the Open Market Operations Department;

2) shall reflect revaluation of securities to the fair value in the accounting using ABS BARS *Millennium* system based on information in the form of securities rates, which was downloaded to the system.

42. Open Market Operations Department:

1) shall use information about the securities fair value, which was obtained from the automation system of the NBU depository, when performing transactions on securities purchase/sale or direct repo transactions;

2) shall give the Operational Department information about the securities fair value to reflect securities at their fair value at the time of their initial recognition in the accounting;

3) shall develop and submit to the risk management unit proposals concerning yield to maturity targets of hryvnia domestic government bonds belonging to the conditionally illiquid segment of the domestic government bonds market, followed by relevant substantiation for their further submission to the Assets and Liabilities Management Committee of the National Bank of Ukraine.

(Section V paragraph 42 as amended according to NBU Board Decision

No. 935 dated 16 December 2019)

43. Information technologies Department:

1) shall provide automated calculation of zero coupon yield curves, adjusting ratios for securities, securities fair value, securities rates and yield to maturity in the automation system of the NBU depository pursuant to this Procedure;

2) shall provide automated publication of information about zero coupon yield curves and adjusting ratios for securities on the Official web-site of the National Bank of Ukraine and in other information resources.

44. The Monetary Policy and Economic Analysis Department submits information about macroeconomic situation forecast and NBU monetary policy in case of their material changes to the Open Market Department and the risk management unit to develop and agree the proposals concerning the benchmarks for the conditionally illiquid segment of the domestic government bonds market.

(Section V paragraph 44 as amended according to NBU Board Decision

No. 935 dated 16 December 2019)

Director
Risk Management Department Ihor Budnyk

APPROVED
Resolution of the Board of the
of the National Bank of Ukraine
No. 732 dated 26 October 2015

Procedure for Measuring at Fair Value Nonresidents' Debt Securities Owned by the
National Bank of Ukraine or Accepted by it as Collateral

*(as amended by
NBU Board Decisions
No. 627 dated 20 September 2018
No. 935 dated 16 December 2019
No. 539 dated 21 August 2020 –
effective since 1 September 2020
No. 641 dated 29 December 2021)*

(in the text of the Procedure, the words "Risk Management Department" in all cases shall be replaced with the words "Financial and Operational Risk Office" in all cases, respectively, according to NBU Board decision No. 935 dated 16 December 2019)

(in the text of the Procedure, the words "Financial and Operational Risk Office" in all cases shall be replaced with the words "risk management unit" in all cases, respectively, according to NBU Board decision No. 641 dated 29 December 2021)

I. General Provisions

1. This procedure was developed with the aim to ensure fulfillment of requirements of *Instruction on Accounting of the National Bank of Ukraine's Transactions With Financial Instruments and Securities of Own Issue* approved by NBU Board Decision No. 875 dated 29 December 2017 (as amended), and design a single approach to determination of fair value of nonresidents' debt securities in which foreign exchange reserves of Ukraine are placed and which are recognized in accounting and financial reporting at a fair value as well as nonresidents' debt securities received by or offered to the National Bank of Ukraine as a collateral.

*(Section II paragraph 1 as amended according to
NBU Board Decisions
No. 627 dated 20 September 2018,
No. 539 dated 16 December 2019)*

2. This Procedure regulates the measurement of fair value and nonresident revaluation to fair value of nonresidents' debt securities, in which the gold and foreign exchange reserves of Ukraine are placed, including both the Open Market Operations Department securities portfolio and the World Bank Treasury securities portfolio. Herein, the portfolio is a set of securities grouped by certain characters, with the right to own, use and dispose them belonging to the National Bank of Ukraine, and which are accepted by the National Bank of Ukraine as collateral (hereinafter - securities).

3. Terminology herein is used in the meaning defined in the legislation of Ukraine, regulations and internal orders of the National Bank of Ukraine, and International Financial Reporting Standards.

II. The Methodology for Measuring Securities' Fair Value and Inputs Sources

4. The fair value of securities shall be measured according to the principles of International Financial Reporting Standard 13. Fair Value Measurement. The objective of securities fair value measurement is to determine the price of the ordinary purchase and sale transaction between market participants on the measurement date under current market conditions (hereinafter - the market price).

5. Fair value measurement assumes that securities purchase and sale transaction takes place in the main securities market or, if there is no main market, in the most favourable for securities market. If there is no evidence of a contrary statement, the market, in which the National Bank of Ukraine, as a rule, effects securities purchase and sale transaction, shall be accepted as the main market, in case there is no main market, it shall be accepted as the most favourable market. Such market in most cases the securities transactions of the National Bank of Ukraine is an over-the-counter market, which it can access through Bloomberg trade terminal.

6. To measure the securities fair value, the National Bank of Ukraine applies the market-based approach and open Level 1 and 2 inputs. The market-based approach uses prices and other relevant information that is generated by market transactions with identical or similar securities.

7. As sources of level 1 and 2 inputs for measuring securities fair value, the following resources are used in priority order:

1) data from Bloomberg terminal, in particular:

CBBT (Composite Bloomberg Bond Trader) is a market price that is compiled using data from hundreds of different dealers

BGN (Bloomberg Generic Price) is a consensus market price of a bond that is determined on the basis of quotations received by Bloomberg from several sources, and other data that Bloomberg deems appropriate. BGN is a market indicator of bond valuation that uses both hard and indicative quotations, depending on which of them are available at the moment of valuation

BVAL (Bloomberg Valuation Service) is a Bloomberg terminal feature that provides reasonable market prices available as of the end of day for various instruments.

For securities with a single source of prices, the additional analysis of hierarchy levels is conducted by BVAL regularly but not less than once a year, using the field BRAM_STANDARD_FV_HIERARCHY_LEVEL.

BRAM_STANDARD_FV_HIERARCHY_LEVEL which classifies prices as level 1, 2, or 3 based on significance of unobserved inputs, is defined according to IFRS 13 and accounting standards that require the disclosure of these levels in financial reporting. The values are calculated using the standard rules established and supported by Bloomberg and the pricing transparency data included into the BVAL price.

To determine the fair value of securities of the 3rd level of hierarchy, DCF (discount cash flow) model is used

(Section II paragraph 7 subparagraph 1 second indent in the wording of NBU Board Decision No. 641 of 29 December 2021)

2) data on the yield of similar securities and analytical functions from Bloomberg information terminal, in particular:

YAS (Yield & Spread Analysis) function allows to measure fixed income instrument on a basis of parameters set by user

YASN (Yield & Spread Analysis for structured Notes) function allows to measure floating interest rate instrument on a basis of parameters set by user
other analytical functions in Bloomberg information terminal

3) data from Refinitiv Eikon information and analytical terminal, in particular:
RIC=RRPS (the Thomson Reuters Pricing Service),
where RIC is an individual code of instrument in Refinitiv Eikon information and analytical terminal

Thomson Reuters Fixed Income Trading composite (TRFIT COMPOSITE, RIC=R)

Thomson Reuters Composite EMEA (RIC=)

International Capital Market Association (ICMA) (RIC=ICMA)

other data from Refinitiv Eikon information and analytical terminal

4) data on yields for similar securities, and calculators from Refinitiv Eikon financial analysis platform, specifically:

Fixed Rate Bond Calculator allows to measure fixed interest rate bond on a basis of parameters set by user

Fixed Rate Note Calculator allows to measure floating interest rate note on a basis of parameters set by user

other calculators in Refinitiv Eikon information and analytical terminal.

(Section II paragraph 7 in the wording of NBU Board Decision No. 539 dated 21 August 2020)

8. Within this Procedure, nonresidents' debt securities are those having an active market, if the following criteria are met simultaneously:

availability of daily bilateral quotations during the last 30 calendar days or beginning from the date following the primary placement, if the primary placement took place 30 calendar days before the measurement date

availability of bilateral quotations from at least three independent sources on the measurement date

on the measurement date the BID price is lower than the ASK price, and the relative spread between BID and ASK prices is lower than 0.5%.

To calculate the relative spread between BID and ASK prices the following formula is used:

$$Spread_{BID-ASK} = \frac{P_{ASK} - P_{BID}}{(P_{ASK} + P_{BID})/2} \times 100, \quad (1)$$

where $Spread_{BID-ASK}$ - is a relative spread between BID and ASK prices, percent

P_{ASK} - ASK price

P_{BID} - BID price.

Taking into account the active market definition, market prices obtained from Bloomberg Generic Price (BGN) are inputs of level 1, and market prices obtained from other sources are inputs of level 2.

(Section II paragraph 8 indent eight as amended according to NBU Board Decision No. 539 dated 21 August 2020)

9. To observe the principle of prudence for measuring the securities' fair value, the BID prices shall be used: "PX_BID" field of the Bloomberg informational terminal or "BID.Close" field of Refinitiv's Eikon information and analytical terminal.

(Section II paragraph 9 as amended according to NBU Board Decision No. 539 dated 21 August 2020)

10. For discounted securities and treasury bills, value of which cannot be measured using the data sources in a priority order set out in paragraph 7 of this Section, the fair value is calculated using the following formula:

$$P = 100 - D, \quad (2)$$

where P is a security fair value

D – the discount amount according to the identifier of the respective security in Bloomberg information terminal.

11. For certificates of deposit, value of which cannot be measured using the data sources in a priority order set out in paragraph 7 of this Section, the fair value is determined as constant 100.000000 for the whole time they are kept in portfolio, or until the maturity date.

12. To determine similar securities, the risk management unit employees shall use their own expert judgments. All following criteria for securities similarity must be taken into account:

- 1) identical (the same) industry of economy
- 2) identical credit rating of the issuances
- 3) identical home country of issuer
- 4) identical currency of securities
- 5) identical interest rate type (fixed interest rate or floating interest rate)
- 6) for securities with an interest rate: similar (comparable) parameters of floating interest rate (underlying index and interest rate change frequency)
- 7) similar remaining maturity. Allowed slippages: 30 calendar days or less between remaining maturities for the securities with a remaining maturity of less than one year; 60 calendar days or less for the securities with remaining maturity from one to three years; and 90 calendar days or less for the securities with remaining maturity of three and more years
- 8) similar additional terms and conditions regarding the type of collateral (for example, guarantee, securing with certain type of assets etc.)
- 9) similar terms and conditions regarding issuance (for example, available indexation, early repayment option etc.).

(Section II paragraph 12 as amended)

according to NBU Board Decision

No. 935 dated 16 December 2019)

13. To perform securities reassessment on a daily basis, inputs shall be used as of the end of the last business day in the main or the most favorable market for the securities, even if this day is a national holiday or weekend in Ukraine. If a business day in Ukraine is a banking holiday in the securities issuer country and, provided the securities are not traded on that day, then, in order to perform securities reassessment on a daily basis, the market prices as of the end of the last business day in the issuer country shall be used.

14. Securities fair value shall be defined as securities prices exclusive of aggregated coupon yield with precision to six decimal places.

III. Procedure for Measurement of Securities Fair Value and Calculation of Adjusting Factors

15. Measurement of securities fair value shall be performed for:

1) initial recognition of securities at fair value at the time of initial recognition

2) daily revaluation of securities, which are in portfolio of the National Bank of Ukraine and which are reflected in accounting and financial reports at a fair value as of the end of the business day prior to the day of revaluation

3) monthly revaluation of securities, which are in portfolio of the National Bank of Ukraine and which are reflected in accounting and financial reports at a fair value as of the end of the last business day of the month

4) measuring the value adequacy of securities accepted by the National Bank of Ukraine as collateral to cover liabilities before the National Bank of Ukraine as of the end of the business day prior to the day of revaluation of collateral or transaction

5) measuring the fair value of securities proposed to the National Bank of Ukraine as collateral as of the end of the business day that is the day of receipt of proposal from the bank regarding providing securities as collateral.

16. To revalue the debt securities owned by the National Bank of Ukraine and reflected in accounting and financial reports at a fair value, the measurement of fair value shall be performed on a daily basis (each business day) both for securities in portfolio of the Open Market Operations Department and securities managed by the World Bank Treasury.

If securities transactions of the World Bank Treasury took place on the day that was a holiday or weekend in Ukraine, the fair value shall be additionally measured at the end of the day of transaction to properly reflect such transactions in accounting.

To record the result of securities purchase and sale in the balance, the securities fair value shall be calculated as of the time of their primary recognition irrespective of whether these securities remain owned by the National Bank of Ukraine at the end of the business day that is a day when securities were purchased, or were sold at the same day.

Upon the request of the Operational Department, the securities fair value shall be measured as of the end of the days mentioned in the request.

17. At the beginning of each business day, the risk management unit receives information on securities transactions from the following sources:

ABS BARS Millennium system - provides information on securities transactions that are already reflected in the balance sheet;

Bloomberg information terminal – provides information on securities transactions in the World Bank Treasury portfolio that are not yet reflected in the balance sheet. Also, the following functions are used: Change Trading System Databases (CTSD) that enable the user to change current trade system for some other trade system he/she has access to and Trade Blotter (TBLT) that enables the user to review deals executed on a certain account or in a certain portfolio.

To measure the fair value of securities with temporary international securities identification ISIN code (hereinafter - ISIN), securities market prices with respective temporary ISIN shall be used. After replacement of a temporary ISIN with a permanent one, securities market prices with respective permanent ISIN shall be used.

*(Section III paragraph 17 as amended
according to NBU Board Decision*

No. 935 dated 16 December 2019)

18. Taking into account changes in portfolios of Open Market Operations Department and the World Bank Treasury, the Financial and Operational Risk Office shall measure the fair value for each security in the portfolios based on Bloomberg information terminal and Thomson Reuters Eikon information and analytical terminal using data resources in a priority order set out in Section II paragraph 7 hereof.

*(Section III paragraph 18 as amended
according to NBU Board Decision*

No. 935 dated 16 December 2019, No. 539 dated 21 August 2020)

19. Risk management unit each day shall calculate fair value of securities accepted by the National Bank of Ukraine as collateral, and ensure entering mentioned information into respective software.

(Section III paragraph 19 as amended according to NBU Board Decision

No. 935 dated 16 December 2019)

20. Risk management unit shall calculate fair value of securities, which are offered to National Bank of Ukraine as collateral as of the end of the business day that is a day of application (request) from bank regarding providing securities as collateral, and as of the end of the business day that is a day of lending to a bank, and shall ensure entering the mentioned information into respective software.

(Section III paragraph 20 as amended according to NBU Board Decision

No. 935 dated 16 December 2019)

21. The risk management unit shall calculate adjusting ratios for securities offered to the National Bank of Ukraine as collateral (the ratios shall be calculated as of the end of the business day when the bank offers securities as collateral) and ensure entering mentioned information into respective software. An adjusting ratio shall be calculated according to the following formula: An adjusting ratio shall be calculated according to the following formula:

$$CR_i = 1 - HC_i = 1 - (\Delta IR_i + \Delta FX_i), \quad (3)$$

where CR_i is the adjusting factor for the issue i of securities

HC_i – haircut for the risks inherent in the issue i of securities

ΔFX_i – FX risk factor for the i -issue of securities that is calculated based on the assumption regarding respective foreign currency devaluation against hryvnia by two percent, i.e. $\Delta FX_i = 0,02$

ΔIR_i – interest rate risk factor for the i -issue of securities that is calculated using YAS and YASN functions in Bloomberg information terminal as security fair value relative change, based on the assumption of probable shift of the yield curve in respective currency in unfavorable direction (i.e. up) by 0.02 (200 basis points), according to the following formula:

$$\Delta IR_i = \left| \frac{P_i^{shift} - P_i}{P_i} \right|, \quad (4)$$

where P_i is fair value of a security of the issue i

P_i^{shift} – adjusted fair value of a security of the issue i .

Output shall be rounded to the nearest figure in multiples of 0.005 [MS Excel function “ROUND(ΔIR_i ;0,005) ”].

(Section III paragraph 21 as amended according to NBU Board Decision

No. 935 dated 16 December 2019)

IV. Interaction of the National Bank of Ukraine during Securities Revaluation

22. Risk management unit shall measure securities’ fair value and control uploading information in form of securities rates to ABS BARS Millennium system to reflect the securities revaluation in accounting, as a rule, before 11 a.m. of the current business day, controlling downloaded information compliance with calculations made. If it is not possible to download information at a predetermined time, an employee of the risk management unit shall communicate the reasons for the delay and the estimated time of information downloading by phone to the employees of Operational Department, who are in charge of securities revaluation accounting.

(Section IV paragraph 22 as amended according to NBU Board Decision

No. 935 dated 16 December 2019)

23. Risk management unit shall inform the Open Markets Operations Department of securities fair value in the form of FX rates file (.xls format) using e-mail, as a rule, before 11 a.m. of the current business day.

(Section IV paragraph 23 as amended according to NBU Board Decision

No. 935 dated 16 December 2019)

24. Operational Department shall reflect in accounting the securities revaluation to the fair value using ABS BARS Millennium system based on information in form of securities rates that was downloaded to the system.

25. Risk management unit performs quarterly, as of the date of compiling the interim or annual financial statements of the National Bank of Ukraine, the analysis of availability of the active securities market according to Section II paragraph 8 hereof to confirm the accuracy of securities classification in the hierarchy of fair value according to International Financial Reporting Standard 13 Fair Value Measurement.

(Section IV supplemented with paragraph 25

*According to NBU Board Decision
No. 539 dated 21 August 2020)*

Director
Risk Management Department Igor Budnyk