

Working Paper on the principles of interest rate index calibration method and its impact on the framework for the operation of financial institutions

April 2025

In connection with its role as benchmarks' administrator, GPW Benchmark is obligated to conduct activities related to the provision of benchmarks and indices that can be used as such, determining the given benchmark or index offered for use by application of a formula or other method of calculation or by an assessment of input data provided for that purpose. The administrator is obliged to administer the arrangements for determining a benchmark in such a way as to adapt the method of developing the benchmark in question, including the formula or method of its calculation, to its characteristics, the type and range of input data used to determine its value, and the characteristics of the market which is intended to be measured. Adapting the method of such an index means ensuring that it is properly calibrated, that is, its optimal parameters and calculation rules are determined.

In view of the GPW Benchmark's obligations as administrator of the future POLSTR benchmark¹, the activities related to conducting the initial calibration of the method are subject to the validation rules applied to the WIRON benchmark currently under provision. An important role in the process of reviewing and validating the method of a given benchmark is held by the Oversight Committee of Interest Rate Benchmarks. GPW Benchmark adopts the POLSTR validation rules taking into account (1) the need to ensure continuity in the recalibration processes for its subsequent reviews, (2) the need for transparency in the index documentation, including the areas of information on the adopted basis for determining the elements of the index method, and (3) the need to determine simulations of the historical values of POLSTR, but mainly in order to provide proper tools to fulfill the administrator's obligations related to future index, which is chosen to be a replacement to WIBOR critical benchmark in the event of a decision to discontinue provision of the latter. One such tool is the historical POLSTR values, which will allow the calculation of the historical adjustment spread, for the determination of which, the administrator must also adopt the method for its determination which is also the best from the point of view of past periods (i.e., for which it will conduct simulations of historical values)

Previous analytical materials referring to the National Working Group's public consultation on review and evaluation of alternative interest rate indices have allowed an assessment of the sensitivity to the selection of certain parameters of the RFR-type index provision method, including, in particular, the impact of the selection of certain parameters on index volatility statistics.

While volatility can be considered an immanent feature of the indices possible for the domestic money market compared to some RFR-type indices and benchmarks developed in other monetary regimes (particularly, however, in highly developed financial markets), it was observed during the consultations that too high a level of volatility could limit the effectiveness of the index's implementation into the domestic financial system, which was one of the elements raised in the justification for the change in the recommendation for a replacement for the WIBOR benchmark in the event of its possible discontinuation. Not only was the fact that cumulative factors give rise to volatility considered a significant risk factor, but also the uncertainty of how the volatility of the index will develop in the future, working against scenarios for its popularization by, for example, increasing the cost of its implementation into the national system.

The Administrator conducted a time series analysis of the identification of factors that affect the behavior of certain index proposals, the results of which are presented in Appendix 1 to this document². The subjects of the study were WIRF and POLSTR. The results of the survey conducted are in line with the rationale of the National Working Group's Steering Committee and the overtones of the position of those who participated in the consultation, identifying POLSTR, the index with the technical name WIRF- (and not the WIRF index) as the "new" recommended future RFR index. Volatility statistics for WIRF- were relatively low compared to the alternative proposals. Significantly, however, already the sensitivity analysis for WIRF and POLSTR in the NGR consultation document (Appendix 3) allows us to conclude that in the case of the statistic describing the modified standard deviation of first differences (hereafter: DIFF.SD.MOD or "modified deviation"), the designated simulations of this feature show a significantly lower level relative to the standard deviation of first differences (hereafter: DIFF.SD or "deviation").

¹ POLSTR, or Polish Short Term Rate, is the name chosen by the NGR Steering Committee for the index technically named WIRF-.

² "Analysis of the determinants of cyclical declines in the level of selected index proposals and the volume of their Eligible Transactions Pool at the end of the month."

Noteworthy in the case of the modified deviation for both index proposals, the levels of this feature in the calibration ranges of the Minimum Single Transaction Volume Threshold (hereinafter: Minimum Volume Threshold) of interest to the administrator are similar. Differences to the disadvantage of WIRF become apparent in the situation of inference from volatility statistics that take into account the determination of index proposals at the end of the month (e.g., DIFF.SD). This means that an important factor in the management of the mechanisms of the benchmark and its application may become the possibility of systemic identification and addressing of the determinants of end-of-month volatility, allowing to reduce the risks associated with the selection of index proposals based on the evaluation of its volatility.

In light of the adopted validation principles of the WIRON method, the method calibration activities undertaken by the administrator concern the total information on a given index proposal and refer, as in the case of index proposal selection, to knowledge of the total volatility presented by the simulated run of a given index proposal. Thus, information regarding the behavior of the index on a particular day cannot be omitted from the inference, especially since the method of determining indices submitted for predefined terms takes into account all determinations of the underlying index. Inference in this regard requires, in the administrator's opinion, to undertake the present consultation on the parameters of the method, taking into account the validation rules that constitute the GPW Benchmark framework for RFR indices and which the administrator has reviewed in order to make the method more robust.

General framework of index validation rules in GPW Benchmark

The overall framework for the validation of the WIRON benchmark was presented in the 2024 consultation document, and assumes a sensitivity analysis of the provision of descriptive statistics depending on the choice of certain parameters, taking into account, however, the assumption of determining the expected level of representativeness of the index, by determining the acceptable fluctuations in the provision of the average daily level of the index's Eligible Transactions Pool volume over the period of analysis.

Given the observed high sensitivity of index proposals to the level of the Minimum Volume Threshold in terms of the formation of two basic descriptive statistics on volatility (i.e., the standard deviation of the first differences of daily index proposal values and the average centralized 5-day spread of index proposals³), it becomes an important element to make a decision based on the assessment of financial market participants related to the formation of the index under provision, taking into account the identified factors that determine its characteristics, which in light of market changes may change their impact over time. The above makes the calibration algorithm an algorithm that is conditioned by dynamic factors hence the legislator has obliged administrators of benchmarks to conduct reviews of the method of benchmarks provided.

In the validation rules, GPW Benchmark considered a 24-month period⁴ as the primary analysis period. This is the period of analysis to indicate whether there has been a change in the economic environment

³ RANGE.5D.MEAN - average centered 5-day spread of the index proposal; RANGE.5D.MEAN.MOD - modified average centered 5-day spread of the index proposal.

⁴ The validation principles indicate that the basic analysis period is a 2-year period, whereby in justified cases or in connection with the expectation of the Oversight Committee, Administrator may extend this period to ensure verification of conclusions drawn from the basic analysis period, with the most important factor working in favour for extended analyses regarding validation of possible corrections to historical data or, for example, the status of the reference indicator already being developed, which may affect the adequacy of the analysis period. Therefore, the sensitivity analysis was carried out for a 2-year period, in accordance with the basic assumption. In light of the results of the analysis for the 2-year period, a sensitivity analysis was carried out for the 3-year period (2022-2024), i.e. a period identical in terms of length as in the case of consultation documents regarding the verification of the selection of the future reference indicator (2021-2023). The sensitivity analysis carried out taking into account data for 2024 means that in the case of the 3-year period, the year 2024 is included in the analysis and the year 2021 is excluded. The conclusions from the 3-year analysis period were consistent with the conclusions from the 2-year period, indicating the justification for increasing the Minimum Volume Threshold from PLN 40 million set in the 2024 consultation document. More specifically, the results of the sensitivity analysis after taking into account the year 2024 in the light of the principle followed by the Administrator that only a significantly limited potential for further improvement in the value of descriptive volatility statistics (i.e. up to 1 basis point) does not justify further limitation of the Transaction Resource by increasing the Minimum Volume Threshold (of course within the previously determined range of its permissible levels), indicated the justification for increasing the Minimum Volume Threshold to PLN 50 million (assuming that the threshold value is rounded to a multiple of PLN 5 million). The fact that there was a significant change in the recommended level of the Minimum Volume Threshold as a result of shifting the analysis period forward by one year (i.e. from 2021-2023 to 2022-2024) justified the verification of the validation rules, indicating the validity of using the analysis period extended to 5 years when determining the Minimum Volume Threshold and the cut-off level in the Main Correction in order to ensure greater stability of the method parameters.

in the short term that justifies taking⁵ further action on a change in the method regarding the adjustment of the Minimum Volume Threshold.⁶ The procedure answers the question of whether - given the limitations on acceptable attrition in the level of the average daily volume of the index's Eligible Transactions Pool - at a different level of the Minimum Volume Threshold an improvement (i.e., a decrease) in volatility statistics is observed.

The assumptions guiding the GPW Benchmark are to maintain the average daily volume level of the Eligible Transactions Pool at an average level not lower than the total information resource level of the index in question, with an acceptable level of downward deviation of the average daily volume of the Eligible Transactions Pool after a change in the Minimum Volume Threshold from the average daily volume of the eligible transactions pool of historical determinations of the index in question, shall be set at (1) 10% of the value of the average daily volume of the Eligible Transactions Pool during the analysis period or at (2) the value of the standard deviation of the daily volume of the Eligible Transactions Pool during the analysis period, whichever is lower. This means that the administrator always takes a more restrictive approach to representativeness.

GPW Benchmark performs verification of the provision of the maximum permissible value of the Minimum Volume Threshold also for selected individual calendar years included in the full analysis period using the type of measure of permissible deviation of the average daily volume of the Eligible Transactions Pool already applied for the entire analysis period. For such analysis, selected are only those calendar years included in the analysis period for which the average daily volume of the Eligible Transactions Pool is lower than the average daily volume of the Eligible Transactions Pool for the full analysis period, minus the standard deviation of the daily volume of the Eligible Transactions Pool over the full analysis period.

The final adopted maximum permissible value of the Minimum Volume Threshold for a given analysis period is determined at the minimum of the maximum permissible values of the Minimum Volume Threshold calculated for the full analysis period and for the aforementioned selected individual years from that analysis period.

Longer term analysis as tool of verification of the applicability of the Minimum Volume Threshold

In the course of analytical work, GPW Benchmark recognized that unconditionally following the results of the analysis in the short term (i.e., the last 2 years) may mean increasing the sensitivity of the method to factors that may affect the determination of the Minimum Volume Threshold and generate higher volatility in the index method itself. In other words, relying on an algorithm that is expected to lead to a change in the Minimum Volume Threshold on the basis of a short-term (2-year) analysis should be verified with a medium-term case so that in a situation where a method based on past events (inference from past market behavior into parameters for the future) does not lead to a temporary change in parameters due to transitional factors. In the case of implementation of conclusions from the application of the algorithm assuming a "loosening" of the requirements for the maximum permissible level of the Minimum Volume Threshold based on a short analysis period (i.e., if the 24-month analysis period shows that this maximum permissible level has risen in relation to the level used in the previous review), there is an increasing risk of volatility in the parameters of the index, in a situation in which the next review would indicate a reduction in the maximum permissible level of the Minimum Volume Threshold and conclusions of the current review would indicate that the Minimum Volume Threshold should be raised.

It is worth remembering that the GPW Benchmark, when calibrating an index or benchmark, does not make a choice of parameterization based on a specific target level of the index, but given the possible impact of parameterization on the average level of the index, the goal of the administrator's actions should be to ensure such a combination of parameters that will ensure that the method gains stability over time and allow it to stabilize over time, yet allowing for its necessary adjustments when permanent changes in conditions occur (in the case of the 2023-2024 period, the change of the Minimum Volume Threshold from PLN 40 million to PLN 50 million, recommended by the GPW Benchmark in this

⁵ So far, the GPWB has included a rationale for extending the period of analysis for review and validation of the WIRON benchmark method if past revisions of the input data are noted.

⁶ The validation rules do not apply only to the Minimum Volume Threshold but also to the other elements of the method. It is worth noting that, as a rule, the validation of the cutoff level in the Main Adjustment are verified on the basis of sensitivity analysis together with the Minimum Volume Threshold, as the common goal of validation of both these parameters is to look for such a configuration of them that allows to achieve the effect of ensuring the provision of a representative index but with as limited variability as possible.

document, resulted in an increase in the index level by 0.7 bps, and by 0.3 bps in the 2020-2024 period). Indeed, the essence of provision of indices is inter alia their continuity and sustainability of the decisions made - which means that the validation rules, and above all the calibration method, should as far as possible provide for solutions that are durable and do not allow for high volatility of parameters which, however, may change over time under the influence of regulatory, structural or systemic changes.

Taking into account the goal of protecting the representativeness of the developed indices, GPW Benchmark included in its actions the assumption that if an increase in the Minimum Volume Threshold improves the level of volatility (as measured by both accepted volatility statistics) in an insignificant way (i.e. by less than 1bp), it does not justify a reduction in the Eligible Transactions Pool. In light of POLSTR's choice, in conducting a review of the validation rules used, GPW Benchmark conducted sensitivity analyses with an extended analysis period (i.e., 5 years). The extension of the analysis period in this case - unlike in the case of the review of the 2024 WIRON benchmark - was not due to an adjustment of the input data, as this element in the case of POLSTR is not a prerequisite.

The extension of the period of analysis beyond the short-term assessment of market phenomena was motivated by the rationale to avoid the transitory changes made in the parameterization of indices by supporting these changes with information from the analysis in the medium term. GPW Benchmark now assumes that the occurrence of an indication of a change in the parameters of the method in the short term does not mean that it is a permanent change, and it is necessary in this situation to identify medium-term trends with gradual consideration of market changes in each subsequent year of index provision, in order to avoid reactive adjustments to index parameters, which, after all, affect the future anyway based on past market behavior. Such verification should concern both the mode of determining the maximum permissible level of the Minimum Volume Threshold, as well as its recommended level on the basis of sensitivity analysis, which limits the scale of its volatility.

In view of the above, the analysis carried out to verify the restrictions on the maximum permissible level of the Minimum Volume Threshold, as well as the sensitivity analysis taking into account the calibration targets for two descriptive statistics of index volatility (each in a version that takes into account the index values determined on the last day of the month and that does not), was carried out for the period from 2020 to 2024, a period of 5 calendar years. The analysis concerning the determination of the maximum acceptable level of the Minimum Volume Threshold was carried out for all multi-year sub-periods cumulatively backwards, i.e. for the sub-periods 2023-2024, 2022-2024, 2021-2024 and 2020-2024. The lowest value of the maximum acceptable level of the Minimum Volume Threshold was determined for the sub-period of 2022-2024 and amounted to PLN 50 million and its highest value was recorded for the 24-month analysis period (i.e. 2023-2024) and amounted to PLN 56 million.⁷

Thus, it should be observed that if a year with a similar information resource to 2022 were to be recorded in the future, and the Minimum Volume Threshold had previously been set only on the basis of the 2023-2024 analysis period (hypothetically at the maximum allowable level, i.e., PLN 56 million), then after a review covering subsequent years, the threshold would have to be adjusted downward in order not to violate the limitations related to the protection of the POLSTR Eligible Transactions Pool.

According to GPW Benchmark, there was therefore a need to update the rules for the validation of RFR-type indices so that the period of analysis is a 5-year period, taking into account the principle of sub-period analysis described above in the context of determining the maximum acceptable level of the Minimum Volume Threshold.

For avoidance of a doubt, GPW Benchmark reiterates that POLSTR is intended to be an index in provision of which no discretion is exercised, hence the desire to verify the existence of a long-term framework for optimizing its method. Nevertheless, in the event of significant regulatory changes or a significant impact of changes in market conditions on the conclusions regarding a process of recalibration of an optimal level of the Minimum Volume Threshold, public consultation remains a tool used by the administrator.

⁷ The method does not assume the determination of the value of the maximum permissible Minimum Volume Threshold on the basis of the average of the individual years of analysis, since the method is designed to take into account the total aggregate of transactions in a given period of analysis. In the individual sub-periods, the values of the maximum permissible MVT level were for 2020-2024: 53 million PLN, for 2021-2024: 55 million PLN, for 2022-2024: 50 million PLN and for 2023-2024: 56 million PLN. This means that relative to the 2-year lookback period, it was primarily the addition of 2022 to the analysis that lowered the maximum allowable level of the Minimum Volume Threshold.

Determination of the Minimum Volume Threshold based on sensitivity analysis

The sensitivity analysis conducted for the "new" extended analysis period of 2020-2024, carried out with a granularity of the range of potential values of the Minimum Volume Threshold (MVT) at the level of PLN 1 million, allows us to observe that in the case of the basic volatility statistics, understood as including data that take into the analysis the end of the month effect, there is a visible improvement (i.e. decrease) in their values after the MVT reaches the level of PLN 48 million (i.e. a decrease in DIFF.SD by 0.9 bp compared to the MVT level lower by only PLN 1 million, i.e. PLN 47 million) - assuming the use of a cut-off level in the Main Adjustment equal to 25%.⁸ Sensitivity analyses conducted for the sub-periods of the analysis confirm analogous decreases in the volatility statistics of DIFF.SD and RANGE.5D.MEAN. At the same time, it is noteworthy that further improvement in volatility statistics beyond the 48M level is limited (see Table 1).

For avoidance of a doubt, it is indicated that the adopted cutoff level in the Main Adjustment of 25% is assessed as reasonable. Given the compliance with the prevailing international standard and the good interpretability of the cutoff level in the Main Adjustment of 25%, as well as the fact that its value is missing among the alternatives considered so far (viz. 12.5%, 20%, 30%), which improves for the period of 2020-2024 (as well as for the period of the last two years) the volatility statistics (including, above all, DIFF.SD) over the entire permissible range of MVT formation (i.e., from zero to the maximum permissible MVT level)⁹, the administrator concludes that there is no indication that the cutoff level in the Main Adjustment of 25% should be modified.

⁸ For the period 2023-2024, the difference between the DIFF.SD values for MVT equal to PLN 48 million and PLN 47 million was almost 2 bp, and for the period 2022-2024 almost 1.5 bp. In the case of a change in MVT from PLN 40 to PLN 48 million, this difference was: for 2020-2024 1.1 bp, for 2023-2024 2.4 bp and for 2022-2024 1.6 bp.

⁹ It should be noted, however, that in the case of inference from volatility statistics that do not take into account the value of the index for the last day of the month, or in the case of regulatory mitigation of factors generating such significant fluctuations in the index on the last day of the month, a cutoff level of the Main Adjustment of 12.5% could be considered.

Minimum Volume Threshold (PLN mn)	Symmetric cut-off level in the Main Adjustment = 0,25				
	2020-2024				
	DIFF.SD	DIFF.SD.MOD	RANGE.SD.MEAN	RANGE.SD.MEAN.MOD	RANGE.SD.MAX
0	0,168	0,104	0,202	0,159	2,059
1	0,167	0,104	0,201	0,159	2,063
2	0,167	0,104	0,200	0,159	2,062
3	0,166	0,104	0,200	0,159	2,080
4	0,165	0,104	0,199	0,159	2,069
5	0,164	0,104	0,199	0,159	2,041
6	0,164	0,104	0,198	0,159	2,028
7	0,163	0,104	0,198	0,159	2,029
8	0,163	0,104	0,198	0,159	2,057
9	0,162	0,104	0,198	0,159	2,040
10	0,162	0,104	0,197	0,159	2,017
11	0,160	0,104	0,197	0,159	1,999
12	0,159	0,104	0,196	0,159	1,922
13	0,158	0,104	0,196	0,160	1,882
14	0,157	0,104	0,195	0,160	1,852
15	0,156	0,104	0,195	0,160	1,852
16	0,156	0,104	0,195	0,160	1,852
17	0,156	0,104	0,195	0,160	1,851
18	0,155	0,104	0,194	0,160	1,789
19	0,155	0,104	0,194	0,160	1,853
20	0,156	0,104	0,194	0,160	1,893
21	0,156	0,105	0,194	0,160	1,916
22	0,156	0,105	0,194	0,160	1,916
23	0,155	0,105	0,194	0,160	1,903
24	0,155	0,105	0,194	0,160	1,903
25	0,155	0,105	0,194	0,161	1,903
26	0,153	0,105	0,193	0,161	1,790
27	0,153	0,105	0,193	0,161	1,821
28	0,153	0,105	0,193	0,161	1,821
29	0,153	0,105	0,193	0,161	1,821
30	0,153	0,105	0,193	0,161	1,821
31	0,154	0,105	0,194	0,161	1,826
32	0,153	0,105	0,194	0,161	1,827
33	0,153	0,106	0,194	0,162	1,827
34	0,153	0,106	0,193	0,162	1,827
35	0,153	0,106	0,194	0,162	1,827
36	0,157	0,106	0,195	0,162	2,002
37	0,157	0,106	0,195	0,162	2,002
38	0,157	0,106	0,195	0,162	2,002
39	0,157	0,106	0,195	0,162	2,002
40	0,151	0,106	0,193	0,162	1,647
41	0,151	0,106	0,194	0,162	1,647
42	0,149	0,106	0,193	0,163	1,472
43	0,149	0,106	0,193	0,163	1,472
44	0,149	0,106	0,193	0,163	1,472
45	0,149	0,106	0,193	0,163	1,476
46	0,149	0,107	0,193	0,163	1,476
47	0,149	0,107	0,193	0,163	1,476
48	0,140	0,107	0,188	0,163	1,321
49	0,140	0,107	0,189	0,163	1,321
50	0,141	0,107	0,189	0,163	1,321
51	0,141	0,107	0,190	0,164	1,306
52	0,141	0,107	0,190	0,164	1,306
53	0,141	0,107	0,190	0,164	1,306
54	0,140	0,107	0,189	0,164	1,238
55	0,140	0,107	0,190	0,164	1,241
56	0,141	0,108	0,190	0,164	1,241
57	0,141	0,108	0,190	0,164	1,241
58	0,141	0,108	0,190	0,164	1,241
59	0,141	0,108	0,190	0,164	1,241
60	0,141	0,108	0,190	0,164	1,238
61	0,141	0,108	0,190	0,165	1,241
62	0,141	0,108	0,190	0,165	1,241
63	0,141	0,108	0,190	0,165	1,241
64	0,141	0,108	0,190	0,165	1,241
65	0,141	0,108	0,190	0,165	1,241
66	0,141	0,108	0,190	0,165	1,241
67	0,141	0,108	0,191	0,165	1,241
68	0,141	0,108	0,191	0,165	1,241
69	0,141	0,108	0,191	0,165	1,241
70	0,141	0,108	0,191	0,165	1,241
71	0,141	0,108	0,191	0,166	1,241
72	0,141	0,108	0,191	0,166	1,241
73	0,141	0,108	0,191	0,166	1,241
74	0,141	0,109	0,192	0,166	1,241
75	0,141	0,108	0,191	0,166	1,241
76	0,141	0,109	0,192	0,166	1,243
77	0,141	0,109	0,192	0,166	1,243
78	0,141	0,109	0,192	0,166	1,243
79	0,142	0,109	0,192	0,166	1,243
80	0,142	0,109	0,192	0,166	1,243
81	0,142	0,109	0,193	0,167	1,243
82	0,142	0,109	0,193	0,167	1,246
83	0,142	0,109	0,193	0,167	1,249
84	0,142	0,109	0,193	0,167	1,249
85	0,142	0,109	0,193	0,167	1,249
86	0,142	0,109	0,193	0,167	1,249
87	0,142	0,109	0,194	0,167	1,252
88	0,142	0,109	0,193	0,167	1,252
89	0,142	0,109	0,193	0,167	1,252
90	0,141	0,109	0,193	0,167	1,252
91	0,142	0,109	0,193	0,167	1,252
92	0,142	0,109	0,194	0,167	1,252
93	0,143	0,109	0,194	0,167	1,252
94	0,145	0,109	0,195	0,167	1,340
95	0,145	0,109	0,195	0,167	1,340
96	0,144	0,109	0,194	0,168	1,340
97	0,144	0,109	0,194	0,167	1,340
98	0,144	0,109	0,195	0,168	1,340
99	0,144	0,109	0,195	0,168	1,340
100	0,144	0,109	0,195	0,168	1,340
125	0,143	0,111	0,196	0,170	1,360
150	0,124	0,111	0,185	0,170	1,110

Table 1 Sensitivity analysis of the provision of descriptive statistics on POLSTR volatility depending on the level of Minimum Volume Threshold in the period 2020-2024

Taking into account the results of the sensitivity analysis (see Table 1), GPW Benchmark decided to apply the rounding algorithm and introduce it into the validation rules for benchmarks based on transaction data, and assume in particular that the final recommended value of the Minimum Volume Threshold (hereinafter also "MVT") should be the result of rounding the optimal level of the Minimum Volume Threshold resulting from the sensitivity analysis (i.e. minimizing volatility within the range of permissible MVT values) to a value that is a multiple of PLN 5 mn (e.g. PLN 5, 10, 15 million, etc. - i.e. from the optimal MVT level of PLN 48 mn, it is rounded to PLN 45 or 50 mn). towards one of the adjacent rounded values for which the volatility statistics are closer to their values for the optimal MVT level. The algorithm also assumes the absolute validity of the principle that the rounded MVT level must be within the permissible range of MVT values (i.e. in some cases, it may only be possible to round down).

Taking the above into account, GPW Benchmark indicates that the recommended level of the Minimum Volume Threshold for POLSTR based on the 2020-2024 analysis period is **PLN 50 million**.

Optimizing MVT only within the permissible MVT values ensures that the recommended MVT level does not exceed the maximum permissible MVT level resulting from the 2020-2024 analysis period (i.e. PLN 50 million).

It is worth mentioning that if the 24-month analysis period is applied, the recommended level of the Minimum Volume Threshold would also be PLN 50 million (with the maximum allowed MVT level of PLN 56 million).

For the avoidance of doubt, it is worth observing that, in the event that economic reality was "directed" toward nullifying the end-of-month effect, the recommended Minimum Volume Threshold could be set at a lower level (in principle, it could be argued that, from the perspective of volatility features, the Minimum Volume Threshold might not be applied at all).

From the point of view of the implementation of the index, however, it is worth noting that the introduction of calibration limiting the level of volatility of the index and, at the same time, the impact of the month-end effect may be subject to the risk of changes in the conditions of the financial market structure affecting the level of the Minimum Volume Threshold minimizing this effect.

Assessing the risk factors for implementing the index with calibration that effectively reduces its volatility

In light of the relevant factors that users are asked to consider in their response to the GPW Benchmark consultation document, GPW Benchmark will refer to an example of a method change carried out for the method of developing the SWESTR, the risk free rate provided by the Swedish Central Bank.

SWESTR has "mostly" significantly lower levels of volatility than national index proposals, but nevertheless the behavior of the index at the end of the calendar year has become the subject of public consultation. The subject of public consultation in Sweden has become a potential change in method to address the behavior of the index on this day, when primarily the tax base for the "bank tax" is calculated and transfers to the national guarantee funds are made. The scale of the index's decline on the last day of the year significantly exceeds the deviation levels recorded on this day for the national WIRON benchmark. SWESTR at the end of 2022 was at -9.038% (on the previous business day, i.e. December 29, 2022: 2.375%, and on the next business day i.e. January 2, 2023: 2.372%), at the end of 2023 at -5.413% (December 28, 2023: 3.894%, January 2, 2024: 3.892%), and at the end of 2024 at -4.347% (December 27, 2024: 2.622%, January 2, 2025: 2.622%)¹⁰

The method of determining the values of indices calculated on predefined backward dates on the basis of a compounding percentage naturally translates into a temporal fixation of the impact of this unit SWESTR reading in the values of the 1M, 3M and 6M indices that are provided.

It is not the subject of this paper to make inferences about the features and plans for reform in Sweden, but it is worth referring to the decisions of those participating in the Swedish consultation on the year-end effect, in which a minority of those indicating that measures should be brought to bear on the method to avoid recording the year-end effect observed to date. Participants in the consultation were overwhelmingly in favor of such a decision, which would mitigate the risk of deviating from the 'recorded' norm, resulting in a reduction in the required minimum level of total transaction volume for the last working day of the year to a level that reduces the likelihood of using a proxy method referring to the central bank's official rate, adjusted by previous SWESTR readings. This is because a determination made on the basis of the central bank's corrected reference rate would refer to and approximate "normal" SWESTR levels, which would mean a break in the medium-term pattern that certainly formed the basis for valuation models including OIS quoting rules for SWESTR at the respective dates of composite index provision for SWESTR. The SWESTR administrator i.e. the Swedish Central Bank, furthermore applied an adjustment to the substitute method of determining the SWESTR for the first business day of the year, so that the year-end value determined in accordance with the standard method (that is, with a high probability taking into account a significant decline in the index) would not affect the value for the next business day.

In the opinion of the GPW Benchmark, the above considerations indicate that it is necessary to make such decisions on the method of determining the index that, in view of the characteristics of the Polish money market, the market standards in which financial institutions operate, the level of sophistication of the reform, but most importantly, the extent to which interest rate benchmarks are used in financial products and contracts, will provide an adequate and appropriate solution for the market.

In the course of the consultations that are underway for interest rate indices from 2022 onward, it has been pointed out that the element of unpredictable volatility range is a limiting factor for the chance to implement such an index. Accordingly, the GPW Benchmark has decided to set as a calibration objective to limit, as far as possible, the level of volatility of the index, with the important factor being the recognition of the effects of calibration in light of the noting of differential standards arising from market expectations when the new index proposal is launched. It is worth noting that the SWESTR is an index that records specific "behavior" on a single day of the year, while domestic interest rate indices, also due to banking tax rules, record specific readings at the end of each month and, depending on the arrangement of systemic and market factors, an end-of-year effect (which, however, is incomparable in scale to the SWESTR).

The Swedish case indicated that, also in terms of volatility and market-specific features, the index measurement solutions should be confirmed with the evaluation and validity of the index provision method calibration activities.

¹⁰ Charging a bank taxing once on the level of assets at the end of the year leads to a profound unprofitability of taking deposits on that day, which in the case of O/N translates into the possibility of recording negative levels of interest on deposits on the last working day in Sweden.

Other elements regarding the determination of the Minimum Volume Threshold

As indicated above, GPW Benchmark plans to introduce a rule that in order to change the Minimum Volume Threshold, there would have to be a difference between the optimal level of the threshold resulting from the sensitivity analysis and its applicable value by more than PLN 5 million. An additional element imposing a restriction on the level of the Minimum Volume Threshold in the review and validation of the method is the verification that, in the absence of any rationale for changing the applicable level of the Minimum Volume Threshold resulting from the rules for using the results of the sensitivity analysis, there is no violation of the maximum permissible level of the Minimum Volume Threshold specified in the review. For the avoidance of doubt, the limitation resulting from the determination of the maximum permissible level of the Minimum Volume Threshold determined in the extended analysis period is always decisive. Violation of the maximum permissible MVT will result in the determination of a new Minimum Volume Threshold based on the above-mentioned algorithm in search of a new calibration optimum within the permissible range of MVT formation.

The recommended Minimum Volume Threshold for POLSTR of PLN 50 million is maintained within the framework of the commitments made to impose a framework for the acceptable level of the Minimum Volume Threshold from the acceptable level of attrition of the Eligible Transactions Pool expressed in terms of average daily transaction volume, as already indicated above. It is observed here that raising the Minimum Volume Threshold from PLN 40 million to PLN 50 million reduces the average daily volume level of POLSTR by PLN 89 million per day in the 2020-2024 analysis period (from PLN 5,891 million to PLN 5,802 million) and in the short term, i.e. in the last two years, by PLN 84,8 million (from PLN 6,119 million to PLN 6,034 million). For 2024, the average daily volume level at the Minimum Volume Threshold for POLSTR was PLN 6,162 million¹¹.

Consideration of the analysis over a longer period makes the reasonableness and sustainability of the recommended Minimum Volume Threshold more plausible, given the results of the sensitivity analysis and the identification of the maximum acceptable level of the Minimum Volume Threshold in the medium term. Extending the analysis to a 5-year look-back period makes, in the GPW Benchmark's opinion, the inference of the optimal level of the Minimum Volume Threshold more plausible and resilient to transitional effects that could belatedly affect POLSTR values in a misguided manner during the period when these transitional effects have subsided.

At the same time, GPW Benchmark indicates that in the event of a change in regulatory elements affecting month-end effects, GPW Benchmark will conduct studies related to assessing the appropriateness of adjusting the Minimum Volume Threshold as part of the extraordinary review. As indicated above and as shown in the sensitivity analysis, in the event that the "month-end effect" is eliminated due to, for example, the cessation of the regulatory factor resulting from the rules for determining the tax base of the so-called "banking tax" on the state of certain assets on the last day of the month, there is a chance to expand, if such a need is observed, the Eligible Transactions Pool of the index without negatively affecting the volatility of such an index. At the same time, if we consider that the average behavior of volatility statistics would approach the levels of modified statistics, it can be assumed that the level of the Minimum Volume Threshold could then be significantly reduced and the Eligible Transactions Pool be consequently safer.

¹¹ Comparison of descriptive statistics for POLSTR under MVT at 40 mn PLN and 50 mn PLN calculated in extended period of analysis (2020-2024).

STATISTICAL MEASURE	POLSTR 40 PLN mn 25%	POLSTR 50 PLN mn 25%
CONTR.NUMBER.MEAN	7,998	7,841
CONTR.NUMBER.MIN	3	3
MEAN_TRANSVOL (PLN)	5 891 017 403	5 801 798 181
MIN_TRANSVOL (PLN)	1 055 196 401	966 621 749
MEAN_TRANSVOL (MVT=0) (PLN)	6 386 180 373	6 386 180 373
MEAN_TRANNUMBER	25,7	23,7
MIN_TRANNUMBER	7	6
MEAN (%)	3,453	3,456
STASTISTICAL MEASURE	POLSTR 40 PLN mn 25%	POLSTR 50 PLN mn 25%
SHARE.RANGE.MEAN (pp)	34,799	35,219
DIFF.SD (pp)	0,151	0,141
DIFF.SD.MOD (pp)	0,106	0,107
RANGE.SD.MEAN (pp)	0,193	0,189
RANGE.SD.MEAN.MOD (pp)	0,162	0,163
RANGE.SD.MAX (pp)	1,647	1,321
INTERQUATILE.RANGE.MEAN (pp)	0,232	0,223
FALLBACK.NUMBER	1	2

The current changes related to the calculation of the reserve requirement set forth in the National Bank of Poland's announcement may positively affect the month-end effect due to the avoidance of overlapping of certain regulatory factors, but in light of the analysis presented in Appendix 1, the primary factors that should trigger a review relate to the rules for calculating the banking tax base and the NBP's fine-tuning (non-standard) operations, and these, in view of the shift of the offer of standard cash bills to Mondays, may not necessarily weaken in their frequency, which may be particularly worth watching in terms of the offer of fine-tuning operations before the weekend. GPW Benchmark will periodically monitor the impact of this change on the impact of the identified factors as indicated in Appendix 1.