Transactions-based Interest Rate Benchmarks

Public consultation results – substantive conclusions on the method of developing RFR-benchmarks

Analytical supplement

including the analysis of impact of historical data revision carried out by data contributors and description of new elements of the method

Warsaw, November 2022

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1. Introduction

1.1. Main reasons for publication of the supplement to the Summary

In the course of work on the method of transactions-based interest rate benchmarks the Administrator, i.e. GPW Benchmark, carried out a number of activities related to clarifying the principles of the index determination processes as well as, importantly, the final selection of the RFR index that would be chosen and used as the potential WIBOR successor.

After the publication of the consultation document "Transactions-based Interest Rate Benchmarks", which took place in May 2022, a document summarizing this stage of works was published which included presentation of (1) comments and observations of entities participating in the public consultation on certain aspects of methodology and introduction of an alternative interest rate benchmark and (2) detailed rules of index determination referring to newly defined filters and procedures, namely:

(1) Maximum volume threshold of a single transaction,

(2) Minimum required number of contributors

(3) Fallback procedure

(4) Extreme outliers filter parameter

Details of the above-mentioned filters and procedures are defined in the Summary (https://gpwbenchmark.pl/pub/BENCHMARK/files/WIBID_WIBOR/Public_consultation_results_Substantive_Conclusions_08.2022.pdf).

The Summary presented partially verified supplementary information on the versions of RFRs, including some previously not described in the consultation document statistics concerning the number of eligible transactions within the sample verified during the analysis period. As stated in the Summary, the period of analysis was redefined to 2017 - H1'2022, following the transaction data verification process performed by banks identified as candidates for data providers for transactions-based interest rate benchmarks calculation. The data verification process turned out to be one of the crucial elements of the methodology development process.

In connection with the publication of the Roadmap for the replacement of WIBOR and WIBID benchmarks with WIRON index and the efforts of NGR[1] to smoothly and safely replace WIBOR with the new RFR (risk-free-rate), intensive work was carried out in order to provide the Administrator with a verified transaction dataset that could be used to determine fully acknowledgeable history of transactions-based indices for 2017, 2018, 2019 and January 2020.

Potential data contributors updated the transaction data provided to GPW Benchmark and confirmed the data verification in the following fields:

(1) transaction data on unsecured deposits for the DDP groups 3.1.1, 3.1.4, 3.1.5, 3.1.10, 3.1.14 for the period January 2019 - January 2020 (inclusive) were verified including full bilateral transaction

[1] NGR – abbreviation for the Polish National Working Group for benchmark reform.

verification[2], consistently with the rules and assumptions of the Data Delivery Procedure attached to the WIBID and WIBOR Reference Rates Code of Conduct (DDP).

(2) transaction data on unsecured deposits for the DDP groups 3.1.1, 3.1.4, 3.1.5, 3.1.10, 3.1.14 for the period from January 1, 2017 to December 31, 2018 were verified to the extent ensuring the highest possible compliance with the rules and assumptions of DDP, yet without full bilateral transaction confirmation.

The purpose of the verification of the aforementioned datasets was to ensure the highest possible legitimacy and thus data quality in the process of determining the historical value of an interest rate benchmark based solely on transactions (RFR), which would be ensured by stating compliance with quality requirements regarding input data provision imposed by the Administrator starting from February 2020. The WIRON values determined on the basis of the verified transaction dataset may constitute the pre-production history of the WIRON index confirmed by the Administrator and starting from January 2, 2019.

Taking into account the current global practice of replacing IBOR-type indices with RFR-type indices, it has become an important element to ensure the possibility of determining a historical spread adjustment between both indices, which should ensure economic equivalence of valuations resulting from financial instruments at the moment of IBOR-type index cessation.

As the currently dominating standard for determining the spread adjustment is based on differences in the course of indices over the past 5 years, it has become necessary to define an acceptable and representative range of historical data that is the best possible approximation of the RFR index value in the period in which the index history is not provided.. In the case of WIRON such a simulation was performed for 2017-2018[3] and was possible thanks to the verification of historical data by banks.

The activities related to the verification of the input data carried out by the banks were aimed at assessing whether the standards of the dataset provided to Administrator before the implementation of the Data Delivery Procedure (i.e. February 2020) were identical in terms of quality and scope with the dataset provided by the banks following the DDP rules. In fact, the assessment showed that in terms of data qualification there were deviations from the principles adopted in and required by the DDP procedure. Corrections of these inconsistencies translated into a non-trivial reduction of total value of the transaction volume in the period of analysis due to the superfluous qualification of the transaction data provided to the Administrator for 2017, 2018 and 2019 in the past. This verification influenced mainly (1) the path of indices (historical time series), (2) the structure of indices, i.e. the share of deposits of credit institutions, financial institutions and large enterprises in the transaction dataset and (3) statistics on the shares of single data contributors in the eligible transactions pool.

Due to the fact that the transaction dataset was verified for 2017-2019 and the beginning of 2020 (dataset for 2016, which was included in the period of analysis in the Consultation Document, was not revised) and that GPW Benchmark performed additional analysis on indices and transaction dataset until mid-2022, the information presented in this supplement defines the period of analysis as 2017 - H1'2022.

As regards secured transactions dataset, the data contributors also revised and sent the dataset for repo and buy/sell-back transactions made starting from Jan 2019 till Jan 2020. There was no obligation

[2] Bilateral transaction verification means verification of conditions of transactions between two potential data contributors within the DDP group 3.1.1.

[3] WIRON data for this period do not constitute the official history of the index and are only submitted to the entitled entity so that it can calculate the spread adjustment on their basis.

nor expectation to revise the data in this area for 2017-2018 as WRR could not, due to the significantly smaller reference market size in relation to the indices based on unsecured deposits, be a real alternative in choosing the future interest rate benchmark or the replacement index. Hence there was also no need to generate a longer history of the WRR index for the purposes of determination of the adjustment spread.

The WRR index is not subject to verification in this supplement. However, works on the WRR including further analysis and verification of the elements of its methodology and the level of parameters used in the process of its determination will take place as soon as possible, yet at a later date (in 2023). Currently, the WRR data are published on the GPW Benchmark website for information purposes and the index is not allowed at this stage to be used as an interest rate benchmark. The WRR index will be intended to be used as a benchmark after an additional round of public consultation so that the index could be used as an alternative benchmark in relation to the WIRON index.

1.2. New elements in the WIRON method

Due to the selection of the WIRON – Warsaw Interest Rate Overnight (formerly WIRD) as an alternative interest rate index, GPW Benchmark decided to discontinue calculation and publication of the WIRF index. The WIRF index will be a reference point in the Administrator's internal analyses, including analyses regarding the validation of the selected interest rate index (WIRON) methodological assumptions. Nevertheless, some disclosure of information and values regarding the WIRF index will be provided in this document in order to provide transparent information about the impact of the above-mentioned verification of the historical time series data for both WIRF and WIRON indices.

The selection of the WIRON index and, above all, further in-depth consultations and analyses carried out as part of the works of the National Working Group led to the introduction of additional elements of the WIRON index determination method. The main scope of work was to ensure the resilience, representativeness and robustness of the index in connection with the potential concentration of eligible transactions within a single contributor or in one of the segments constituting the economic reality that the index is intended to measure.

The need to introduce mechanisms limiting concentration within the WIRON index was raised mainly due to incorporation into the index methodology of a relatively wide range of transaction data in various types of segments, the detailed analysis of which cannot be carried out by the Administrator. As part of the method, the Administrator aimed to limit the impact of such potential situations which could lead to an incidental deterioration of the index quality on a day when such risks would materialize.

In order to manage the risks related to excessive concentration within the index, the following new elements were introduced to the WIRON index methodology:

(1) Maximum threshold for a single contributor transactions share in the index,
(2) Volume scaling-down procedure in the case of concentration in a given transaction group.

2. Detailed description of the new elements introduced into the WIRON index method

(1) The maximum acceptable level of transactions concentration within a single contributor is introduced as one of the conditions that are required for calculation of the index on the basis of the standard method of its determination.

	WIRON
Maximum threshold for a single contributor transactions share in the index	75% of volume of the eligible transactions pool[4], i.e. the pool of transactions that were accepted for the index calculation after the preliminary preparation of input data

As for the process of verification of the maximum threshold for a single contributor transactions share in the index, it is checked whether the transaction volume of any single contributor exceeds 75% of volume of the whole eligible transactions pool, i.e. a pool of transactions after the preliminary preparation of transaction data, that is after applying the minimum volume threshold filter, the maximum volume threshold filter for a single transaction, the extreme outliers filter and transaction matching procedure[5]. The verification of the maximum threshold for a single contributor transactions share takes place simultaneously with the verification of requirements concerning the minimum required number of contributors and the minimum required level of the total daily volume of eligible transactions, which happens before applying the main adjustment.

Verification of the level of concentration in the index is often a part of the methodology of global RFR indices, for instance in the case of SWESTR or ESTR. However, methodological consequences of implementation of concentration-related measures are various. In the case of WIRON, the fulfillment of the condition of “having” over 75% of volume of the eligible transactions pool "in the hands" of a single data contributor results in abandoning the standard method of index calculation, i.e. on the basis of the input data. As a consequence a fallback procedure for index determination will be used, as defined in the Summary. [6]

(2) Volume scaling-down procedure is used in the case of concentration in a given transaction group

	WIRON
Volume scaling-down procedure in the case of concentration in a given transaction group	The purpose of this procedure is to reduce the transaction volumes of a contributor that meets the criteria of the dominating entity ("dominator") in a given transaction group in accordance with the procedure described below. The procedure defines two transaction groups that are examined: (a) pool of deposits of financial institutions (DDP group 3.1.5) and other financial institutions (3.1.10), (b) pool of deposits of large enterprises (a subgroup of the DDP group 3.1.14).

[4 i 5] In the case of transaction matching procedure – which consists of matching of the parties of transactions from the DDP groups 3.1.1, 3.1.7 and 3.1.8 - a „matched” transaction between two data contributors is included in the pool of transactions of both of these entities.

[6] Public_consultation_results_08.2022.pdf (gpwbenchmark.pl) , see p.10, point (5).

	If one of the above-mentioned groups of transactions exceeds the threshold of 50% of volume of the index eligible transactions pool, then it is verified whether within this group there is a contributor with a share exceeding 50% („dominator") of this transaction group volume. If such a contributor exists, the volumes of its transactions within this transaction group are scaled down by multiplying them by a proportion that is calculated as 50% of total volume of the dominating transaction group divided by the total transaction volume of this contributor within this transaction group.

The applied method of scaling down the transaction volume of a contributor that exhibits characteristics of a "dominator" on a given day is aimed at limiting the scale of impact of such an entity on the index level, but does not presume complete elimination of its impact. The analysis presented in this document confirms that in the history of the WIRON index and more broadly in the history of the money market, the cases of significant concentration of transactions „in the hands" of a single contributor were rare. However, during the works on an adequate method ensuring reduction of the risk of impact of such concentration it has been confirmed that on some days there was exceptionally large concentration in some market segments (with the dominator's share reaching as much as 80%), still the overall condition of the money market allowed for the limiting of the impact of such an extreme situation in a single market segment on the overall index. The Administrator considered it appropriate to introduce a procedure limiting concentration, bearing in mind that the index is designed to reflect the actual situation of the market and that the method should limit the risk of excessive exposure of the index to exceptional situations that could lead to possible distortion of information describing the state of the money market on a given day.[7]

The results of the analyses presented in the first part of the supplement indicate that the impact of the above-mentioned changes in the index calculation method on the historical values of WIRON and WIRF indices was very limited[8]. A comprehensive comparative analysis of the history of indices and their structure before and after all the changes and updates (revisions of transaction data and changes in the index calculation method) is presented later in this document.

[7] For the purposes of presentation and comparison, in the case of the WIRF index, which is presented for comparison in the further part of the document, the maximum threshold for a single contributor transaction share in the index that is used to trigger the fallback method of index calculation is the same as in the WIRON index and is equal to 75%; in the case of the volume scaling-down procedure the WIRF index uses a threshold of 70% for the share of a given transaction group in the volume of the eligible transactions pool (for WIRON it is 50%) and a threshold of 50% for the contributor's share in the volume of a given transaction group (the same level as in the case of WIRON).

[8] The analysis of impact of method changes was carried out on the revised transaction database.

3. Impact of selected elements of the index calculation method on the index historical path

As for the impact of the maximum volume threshold being introduced into the WIRON and WIRF methodology already in the previous stage of the method development process, the statistics reflecting the actual cases of activation of the procedure of overwriting the single transaction volume[9] are presented in tab. 1. It is clear that the number of transactions the volume of which exceeded the maximum volume threshold was very small in the past years and it concerned mainly deposits of financial institutions (DDP group 3.1.5) and deposits of other financial institutions (3.1.10), while the interbank market (3.1.1 and 3.1.4) was almost free of such cases. The segment of large enterprise deposits (a subgroup of 3.1.14) generated the need to adjust excessive transaction volumes mainly in H1'2022.

Tab. 1. Cases of transactions exceeding the maximum volume threshold of a single transaction*

Period	Number of transactions exceeding the maximum volume threshold				
	3.1.1	3.1.4	3.1.5	3.1.10	3.1.14
2017	0	0	0	0	0
2018	0	0	2	1	0
2019	0	1	25	0	1
2020	0	0	0	23	3
2021	0	0	0	0	0
H1-2022	0	0	7	0	10

* Analysis was carried out on the revised transaction database.

Source: GPWB.

In tab. 2 one can see the frequency statistics of the cases when a newly added procedure of volume scaling-down was activated for both WIRF and WIRON (cases are broken down into the affected transaction groups). The data indicate that this procedure was activated very rarely. For example, in 2018-2019 it was not launched even once for both indices and the highest annual number of its activations is only 7 for WIRON and 3 for WIRF (both results for the year 2020). It is also worth noting that in the case of WIRON, most of the triggers of the volume scaling-down procedure were related to deposits of financial institutions and other financial institutions (i.e. DDP groups 3.1.5 & 3.1.10), while cases in the field of deposits of large enterprises (3.1.14) appeared only in H1'2022.

[9] The maximum volume threshold is determined separately for each year according to a strictly defined procedure (in 2022 it amounts to PLN 2 bn). The volume of each transaction exceeding the threshold is reduced to the threshold level. Summary, see p. 8, point (2).

Tab. 2. Cases of activation of volume scaling-down procedure*

Period	Number of index calculations with activation of volume scaling down procedure		
	WIRON		WIRF
	3.1.5 & 3.1.10	3.1.14	3.1.5 & 3.1.10
2017	1	0	0
2018	0	0	0
2019	0	0	0
2020	7	0	3
2021	2	0	0
H1-2022	0	3	1

* Analysis was carried out on the revised transaction database.

Source: GPWB.

The index calculation method defines the conditions that the eligible transactions pool on a given day must meet in order to be used as the basis for the index calculation. The first condition is the minimum threshold for the total volume of transactions eligible for index calculation set at PLN 1 bn. The second condition is the minimum required number of data contributors whose transactions belong to the eligible transactions pool on a given day – it is currently set at 3. The third condition, which was introduced by the Administrator during the works of the National Working Group, is the maximum threshold for a single contributor transaction share in the index – it is set at 75%.

Both for the WIRON and WIRF indexes there were no cases of activation of the fallback method[10] within the analysis period (i.e. 2017-H1'2022), which means that the eligible transactions pool always met the requirements that were set for it and consequently the index calculation based on a fallback procedure was not needed.

[10] The fallback procedure is a procedure of alternative calculation of the index and it is triggered in case the eligible transactions pool fails to meet certain requirements on a given day (i.e. the minimum overall volume of the pool, the minimum number of contributors within the pool, the maximum threshold for a single contributor transaction share in the pool).

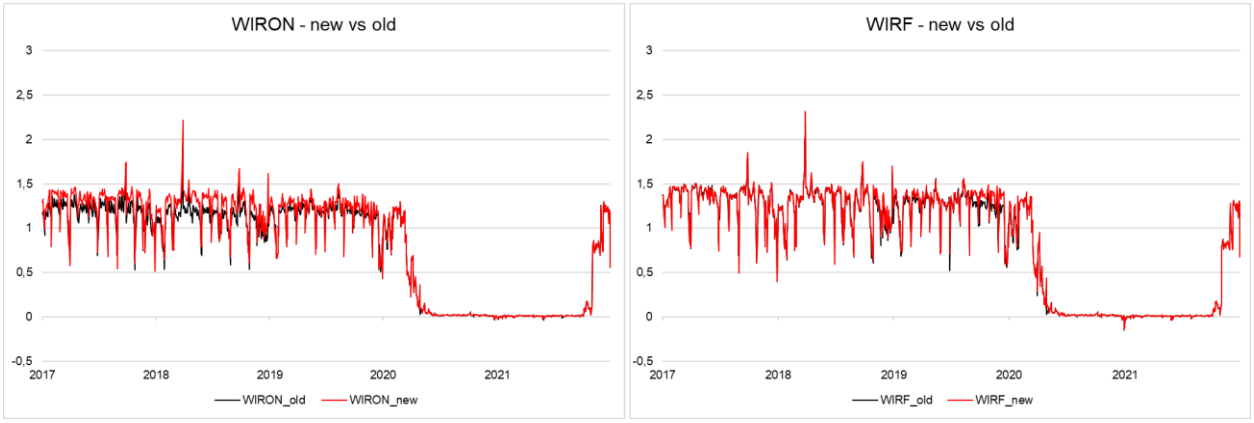
4. Verification of selected elements of analysis of WIRON and WIRF indices

This section presents the verified statistics and information on the WIRON and WIRF indices that were originally presented in the Consultation Document. The chapter summarizes, above all, the impact of transaction data verification on the values of indices and their structure. It also draws attention to the dynamics of changes in the indices in the first half of 2022 in relation to the intensification of the monetary policy tightening cycle in Poland.

4.1. Analysis of level and volatility of the indices

In connection with the verification of the input data on transactions the historical values of the WIRON (formerly WIRD) and WIRF indices were recalculated. Fig. 1 presents the WIRF and WIRON indices in two versions: before ("old") and after ("new") the revision of historical data by the data contributors combined with the change of the index methodology by the Administrator (i.e. introduction of the maximum threshold for a single contributor transaction share in the index and the volume scaling-down procedure in the case of concentration within a transaction group).

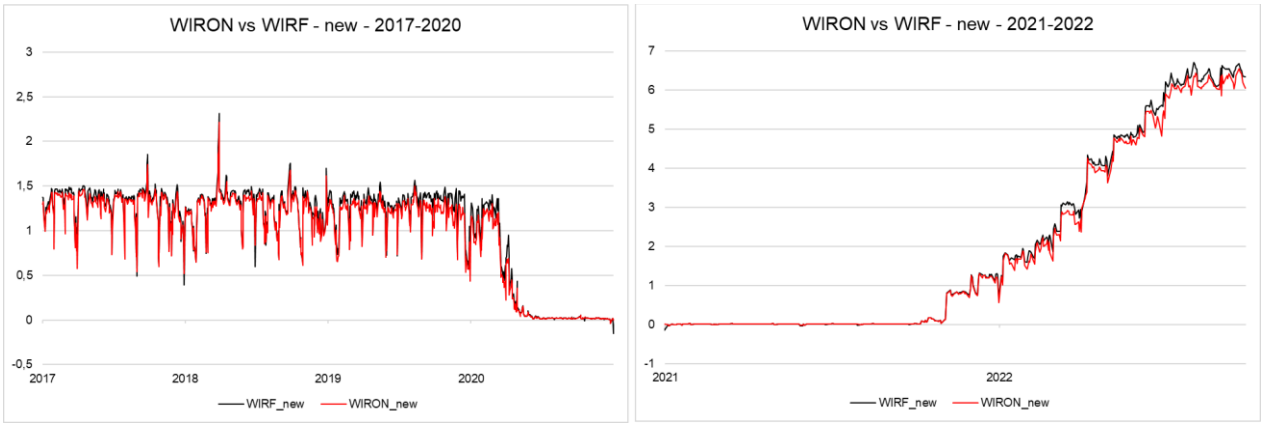
Fig. 1. WIRON and WIRF indices before and after the data revision and changes in the calculation method (2017-2021)



Source: GPWB.

Figure 2 shows the WIRF and WIRON indices after the input data revision and changes of the index methodology („new") - to improve charts readability, the time series are presented for two periods: 2017-2020 and 2021-2022.

Fig. 2. WIRON and WIRF indices after the data revision and changes in the calculation method



Source: GPWB.

As a result of the above-mentioned revision of transaction data, the average level of both the WIRON and WIRF indices increased during the analysis period compared to the state before the revision, while the average level of WIRON increased to a much greater extent than the average level of WIRF and - as a result - after the revision the average WIRF is only slightly higher than the average WIRON. Both indices, however, remain significantly lower than the POLONIA rate, which can be seen in tab. 3 presenting detailed statistics on the average level and volatility of both indices as well as the POLONIA rate. The considerable increase in the average level of WIRON as a result of the transaction data revision is mainly related to a large decrease in transactions in the enterprise deposits segment (DDP group 3.1.14), which were characterized by lower interest rates on average than in the other market segments.

In dynamic terms, it is worth noting that along with the increase in interest rates in the years 2021-2022 the spread between WIRF and WIRON also rose significantly. Amid ultra-low interest rates in H1'2021 both indices were at similar levels (around 0.01% on average) and as a result the spread between them practically dropped to zero (which is related, among others, to a radical decline in creation of deposits in the enterprise segment), while as a consequence of interest rate hikes by the NBP at the turn of 2021/2022 this spread increased to ca. 7 bp on average in H1'2022 (compared to ca. 4 bp on average in the period 2017-2021).

Tab. 3. Average level and volatility of WIRON, WIRF and POLONIA

Period	Index	Average value (%)	Standard deviation of first difference (pp.)
2017-2021	WIRON_old*	0,776	0,102
2017-2021	WIRF_old	0,863	0,135
2017-2021	WIRF_new**	0,876	0,142
2017-2021	WIRON_new	0,832	0,134
2017-2021	POLONIA	0,937	0,145
H1-2021	WIRON_old	0,009	0,010
H1-2021	WIRF_old	0,008	0,011
H1-2021	WIRF_new	0,008	0,011
H1-2021	WIRON_new	0,009	0,010
H1-2021	POLONIA	0,014	0,008
H2-2021	WIRON_old	0,329	0,105
H2-2021	WIRF_old	0,340	0,104
H2-2021	WIRF_new	0,340	0,104
H2-2021	WIRON_new	0,329	0,105
H2-2021	POLONIA	0,363	0,094
H1-2022	WIRON_old	-	-
H1-2022	WIRF_old	-	-
H1-2022	WIRF_new	3,464	0,192
H1-2022	WIRON_new	3,294	0,218
H1-2022	POLONIA	3,626	0,164

* The "old" version of the WIRF/WIRON index means an index simulation published in the consultation document "Transactions-based Interest Rate Benchmarks" (May 2022), which was based on the method of index calculation before adjustments that were made after the publication of the above document and on the transaction data before the revision for the period Jan'2017-Jan'2020.

** The "new" version of the WIRF/WIRON index means an index simulation based on the index calculation method after adjustments that were made after the publication of the consultation document " Transactions-based Interest Rate Benchmarks " (May 2022) as well as on the transaction data after the revision for the period Jan'2017- Jan 2020.

Source: GPWB, NBP.

As for the volatility of the RFR ON indices (measured by the standard deviation of their first differences), as a result of the data revision it increased both in the case of WIRON and WIRF, while in the case of WIRON on a much larger scale than in the case of WIRF. Consequently, after the revision the volatility of WIRON (ca. 13 bp in 2017-2021) is only slightly lower than the volatility of WIRF (ca. 14 bp in 2017-2021). On the other hand, the volatility of WIRF - as a result of the revision - almost equalled the volatility of the POLONIA rate. The significant rise in the volatility of WIRON resulting from the transaction data revision is mainly related to the aforementioned decline in transactions in the enterprise deposits segment, which translated into a considerable reduction of the extensive eligible transactions pool of this index, which translated into increased susceptibility of WIRON to elevated volatility.

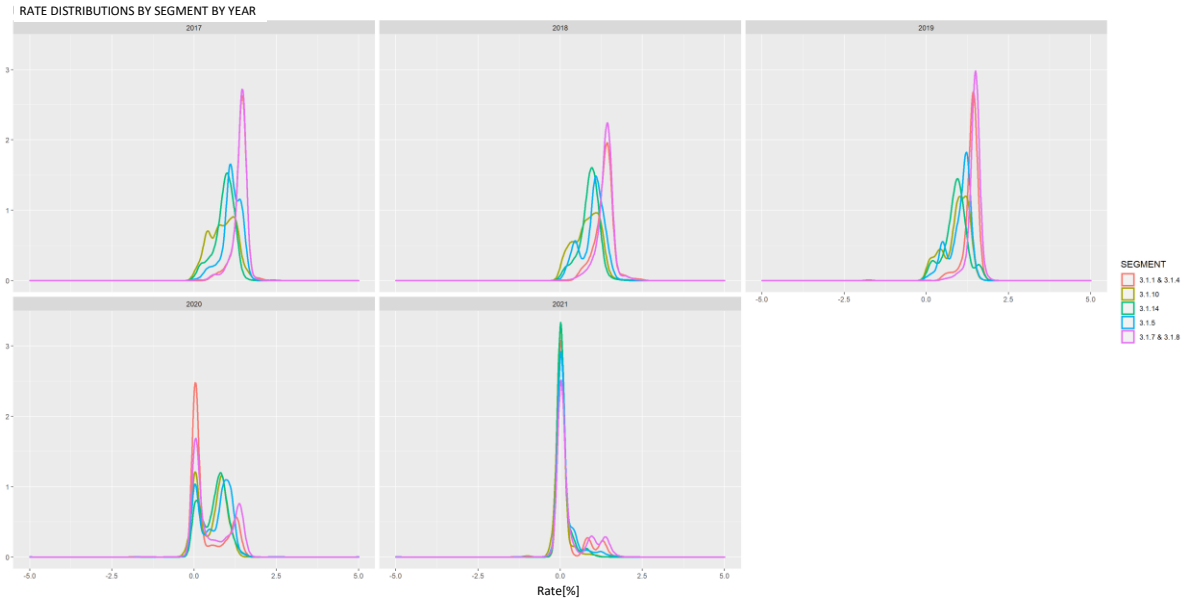
It is also worth noting that in the period of rising interest rates, i.e. in H1'2022, the volatility of WIRON (approx. 22 bp) exceeded the volatility of WIRF (approx. 19 bp), while both of them were higher than the volatility of the POLONIA rate (approx. 16 bp). The elevated volatility of RFR indices in the case of the Polish financial market remains a factor that distinguishes them from other RFR indices that are calculated in the foreign markets.

4.2. Distribution of interest rates of eligible transactions

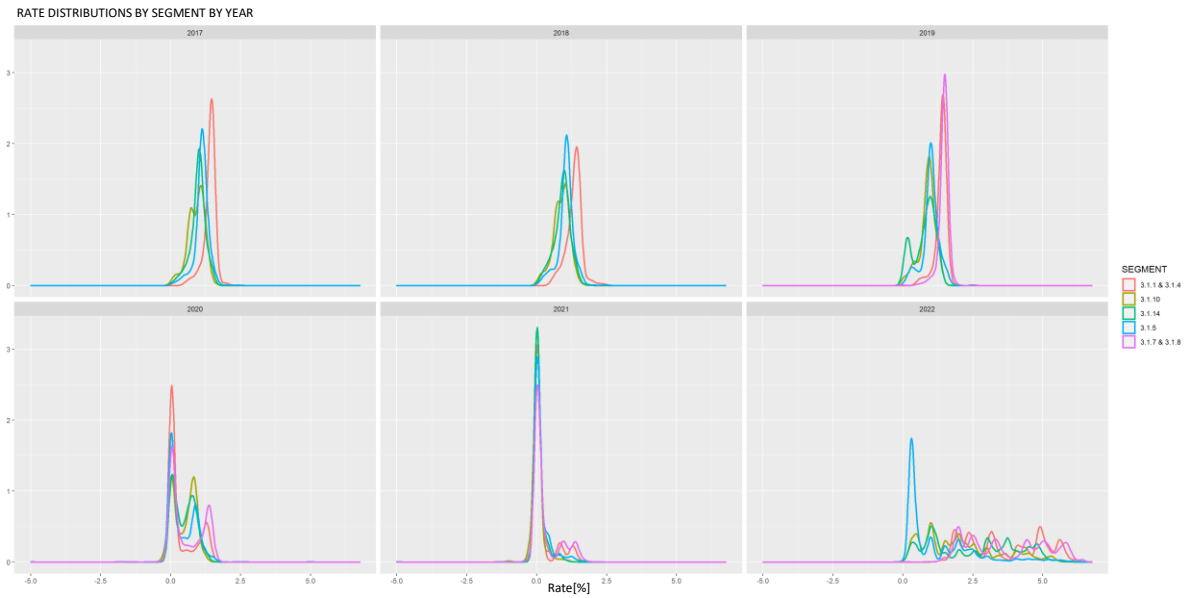
Fig. 3 shows empirical distributions[11] of interest rates for transactions with ON maturity in various market segments for individual years in the period 2017-2022[12] and compares distributions for transaction datasets before and after their revision for the period Jan'17-Jan2020.

Fig. 3. Empirical distributions of ON interest rates by market segment

(a) before revision



(b) after revision*



* 2022 data are data for H1'2022. Lack of revised data for 3.1.7 and 3.1.8 (i.e. repo and buy/sell-back transactions) for the years 2017-2018.

Source: GPWB.

[11] Empirical distribution of a variable shows the frequency of occurrence of its values in the sample. In this analysis it is visualized by the estimated kernel density function.

[12] 2022 data are data for H1'2022. Revised data on repo and buy/sell-back rates (i.e. DDP groups 3.1.7 and 3.1.8) start from 2019.

As shown in fig. 3, the data revision resulted in a noticeable narrowing of the interest rate distribution in the years 2017-2019 in terms of deposits of financial institutions (DDP group 3.1.5), deposits of other financial institutions (3.1.10) and deposits of large enterprises (3.1.14) . This is confirmed by the data in tab. 4, which presents the quartiles[13] of interest rate distribution within individual segments of the deposit market broken down by the years of the data revision period (i.e. 2017-2019). The most common pattern of changes in the rate distribution as a result of data revision is an increase in the first quartile (Q.25) and a decrease in the third quartile (Q.75), which results in the narrowing of the interquartile range (i.e. the difference between the third and the first quartile of the distribution), thus increasing the concentration of rates around the median of their distribution.

Tab. 4. Quartiles of empirical distribution of ON interest rates by market segment

		After revision			Before revision			Change		
SEGMENT	YEAR	Q.25	Q.50	Q.75	Q.25	Q.50	Q.75	Q.25	Q.50	Q.75
3.1.1 & 3.1.4	2017	1,350	1,450	1,500	1,350	1,450	1,500	0,000	0,000	0,000
3.1.1 & 3.1.4	2018	1,200	1,390	1,490	1,200	1,390	1,490	0,000	0,000	0,000
3.1.1 & 3.1.4	2019	1,350	1,420	1,470	1,350	1,420	1,470	0,000	0,000	0,000
3.1.10	2017	0,700	1,000	1,110	0,520	0,880	1,189	0,180	0,120	-0,079
3.1.10	2018	0,700	0,900	1,070	0,500	0,848	1,110	0,200	0,053	-0,040
3.1.10	2019	0,790	0,930	1,010	0,700	1,000	1,210	0,090	-0,070	-0,200
3.1.14	2017	0,870	1,000	1,110	0,780	0,960	1,120	0,090	0,040	-0,010
3.1.14	2018	0,740	0,950	1,060	0,750	0,920	1,070	-0,010	0,030	-0,010
3.1.14	2019	0,500	0,870	1,040	0,730	0,920	1,090	-0,230	-0,050	-0,050
3.1.5	2017	1,050	1,100	1,200	1,050	1,100	1,370	0,000	0,000	-0,170
3.1.5	2018	0,990	1,050	1,150	0,775	1,050	1,240	0,215	0,000	-0,090
3.1.5	2019	0,900	1,000	1,100	0,860	1,150	1,240	0,040	-0,150	-0,140

Source: GPWB.

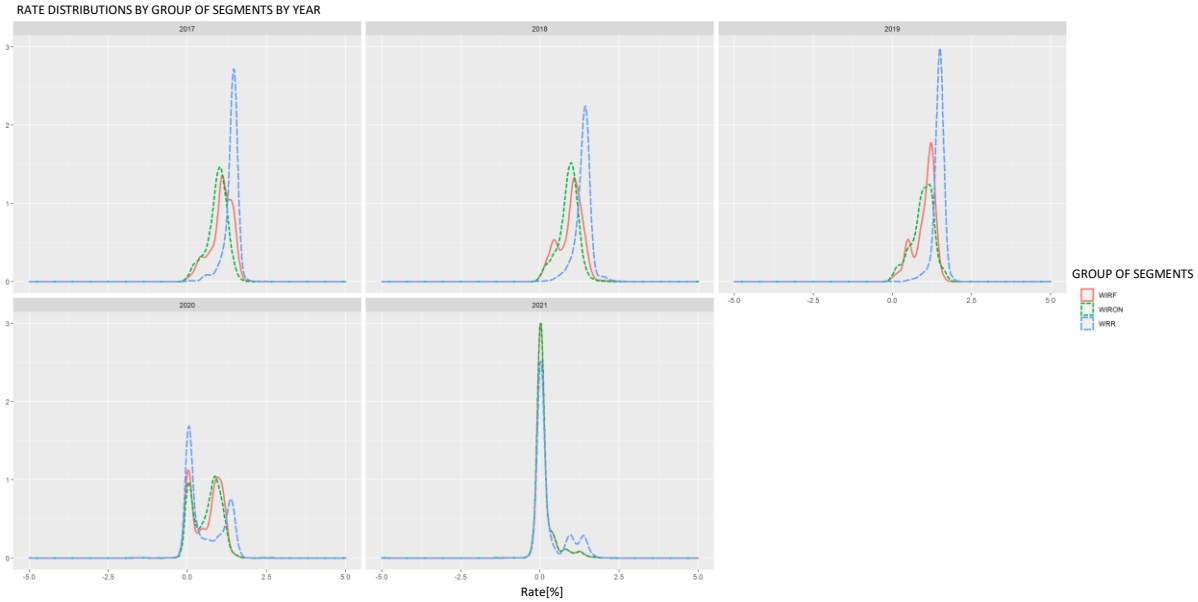
Overall changes of transaction rates distributions due to the data revision are rather moderate. In terms of the average scale of shift of the distribution quartiles, the largest changes affected deposits of other financial institutions (3.1.10), slightly smaller changes affected deposits of financial institutions (3.1.5) and deposits of large enterprises (3.1.14), while in the case of interbank deposits (3.1.1 & 3.1.4) there were no visible changes.

As for the consequences of the transaction data revision for the distribution of rates within the total eligible transactions pools of WIRF and WIRON (see fig. 4 and tab. 5), they are related to the changes in individual market segments discussed above. Thus, one can see the narrowing of the rate distribution both in the case of WIRF and WIRON (see: „slimmer" distributions for 2017-2019 in fig. 4 and the narrowing of interquartile range shown in tab. 5) amid a generally moderate scale of changes in the distribution.

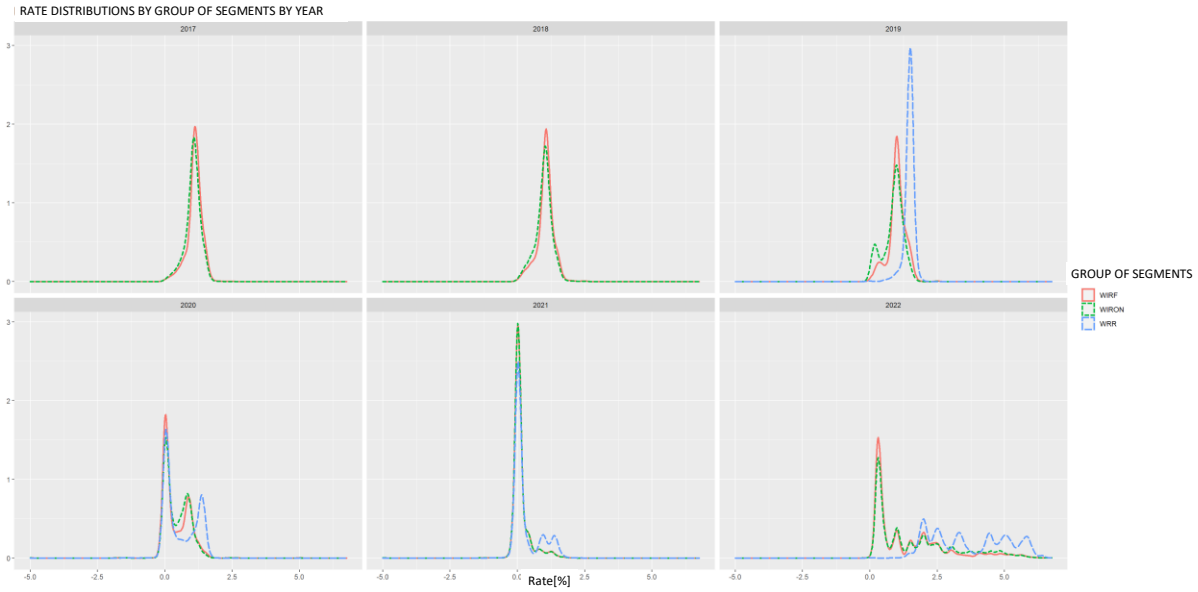
[13] Quartiles: Q.25 (first quartile) - value of a variable below which 25% of its observations are located, Q.50 (second quartile) - value of a variable below which 50% of its observations are located, Q.75 (third quartile) - value of a variable below which 75% of its observations are located.

Fig. 4. Empirical distributions of ON interest rates by group of market segments

(a) before revision



(b) after revision*



* 2022 data are data for H1'2022. Lack of revised data for WRR group of segments (i.e. repo and buy/sell-back transactions) for the years 2017-2018.

Source: GPWB.

Tab. 5. Parameters of empirical distribution of ON interest rates by group of market segments

		After revision			Before revision			Change		
GROUP OF SEGMENTS	YEAR	Q.25	Q.50	Q.75	Q.25	Q.50	Q.75	Q.25	Q.50	Q.75
WIRON	2017	0,940	1,080	1,200	0,790	0,990	1,150	0,150	0,090	0,050
WIRON	2018	0,820	1,000	1,120	0,740	0,940	1,090	0,080	0,060	0,030
WIRON	2019	0,680	0,950	1,100	0,760	1,000	1,200	-0,080	-0,050	-0,100
WIRF	2017	1,040	1,100	1,250	0,900	1,100	1,350	0,140	0,000	-0,100
WIRF	2018	0,950	1,050	1,200	0,700	1,050	1,230	0,250	0,000	-0,030
WIRF	2019	0,900	1,000	1,180	0,850	1,150	1,240	0,050	-0,150	-0,060

Source: GPWB.

4.3. Statistics of the daily eligible transactions pool

Tab. 6 shows statistics of the daily eligible transactions pool for WIRON and WIRF.

Tab. 6. Characteristics of the daily eligible transactions pool for WIRON and WIRF

Index	Period	Avg. daily transaction volume (PLN bn)	Avg. daily number of transactions	Avg. daily number of contributors	Min. daily transaction volume (PLN bn)	Min. daily number of transactions	Min. daily number of contributors
after revision							
WIRON	**2017-2021**	**8,411**	**246,7**	**8,8**	**2,259**	**35,0**	**5,0**
	H1-2021	5,642	59,8	8,5	2,259	42,0	6,0
	H2-2021	6,715	76,9	8,8	2,924	40,0	7,0
	H1-2022	11,395	201,0	8,8	5,421	89,0	7,0
WIRF	**2017-2021**	**6,753**	**123,6**	**8,8**	**1,978**	**22,0**	**5,0**
	H1-2021	5,526	55,7	8,4	1,978	36,0	6,0
	H2-2021	6,350	70,6	8,7	2,904	37,0	7,0
	H1-2022	8,066	136,8	8,8	4,314	66,0	7,0
before revision							
WIRON	**2017-2021**	**13,503**	**762,2**	**8,8**	**2,259**	**40,0**	**6,0**
	H1-2021	5,642	59,8	8,5	2,259	42,0	6,0
	H2-2021	6,715	76,9	8,8	2,924	40,0	7,0
WIRF	**2017-2021**	**7,508**	**200,7**	**8,7**	**1,978**	**33,0**	**6,0**
	H1-2021	5,526	55,7	8,4	1,978	36,0	6,0
	H2-2021	6,350	70,6	8,7	2,904	37,0	7,0

Source: GPWB.

As for the assessment based on the full period of comparison (i.e. 2017-2021; the comparison period ends on Dec 31, 2021 as this is the end of the dataset before revision) a very strong shrinkage of the average daily eligible transactions pool of WIRON is visible as a result of the revision - both in terms of volume (from PLN 13.5 bn to PLN 8.4 bn) as well as the number of transactions (from 762 to 247), with the number of transactions dropping much more than the volume due to a significant reduction in transactions in the enterprise deposits segment, which is characterized by a large number of transactions with a relatively low volume.

In the case of WIRF, the scale of reduction of the eligible transactions pool as a result of the data revision is much smaller than in the case of WIRON because the revision mainly affected enterprise deposits, which are included only in the latter index. The average daily volume of WIRF decreased from PLN 7.5 bn to PLN 6.8 bn, while the average number of transactions fell from 201 to 124.

As a result of the above changes, the difference between statistics for the eligible transactions pools of WIRON and WIRF decreased significantly. While before the revision the eligible transactions pool in the case of WIRON was on average almost 4 times larger than in the case of WIRF in terms of the number of transactions and 80% larger in terms of volume, then after the revision the WIRON eligible transactions pool was on average only 2 times larger than the WIRF eligible transactions pool in terms of the number of transactions and its advantage in terms of volume dropped to 25%.

Importantly, the data revision did not significantly affect the average number of data contributors that stay behind the daily eligible transactions pool for both indices. It remains close to 9, which is the total number of data contributors.

It is also worth noting that in 2021 the eligible transactions pools of both indices were rather comparable (both in terms of volume and the number of transactions) due to the strong decline of the number of enterprise deposit transactions in this period (this is the “segment of difference” between the two indices). In turn, in H1'2022 - along with interest rate hikes – one could see a considerable

increase in volume of the eligible transactions pools of both indices, with a larger scale of growth in the case of WIRON, which proves a strong rebound in the segment of enterprise deposits.

As for the frequency of the days with extremely small daily eligible transactions pools, the values of the minimum daily volume for both WIRON and WIRF did not change after the historical data revision (still ca. PLN 2.3 bn for WIRON and PLN 2.0 bn for WIRF). On the other hand, there was a decrease of the level of the minimum daily number of transactions (to 35 from 40 for WIRON and to 22 from 33 for WIRF) as well as the minimum number of contributors, which in the period 2017-2021 for both indices reached 5 against 6 before the revision. Generally, the data revision did not result in a considerable shrinkage of the eligible transactions pools on the days when the market activity was the lowest - especially in terms of the key measure in the light of the assumed methodology, which is transactions volume.

4.4. Structure of eligible transactions pool by market segment

Fig. 5-6 show the shares of the key market segments in the volume of eligible transactions pools of WIRON and WIRF each year of analysis.

In the case of WIRON, the data revision reduced mainly the share of the large enterprise deposits segment (3.1.14). This is particularly visible in the period of 2017-2018 - before the revision this segment dominated the entire index structure (its share was reaching almost 60% of the index volume), while the data revision significantly reduced this share to ca. 20%.

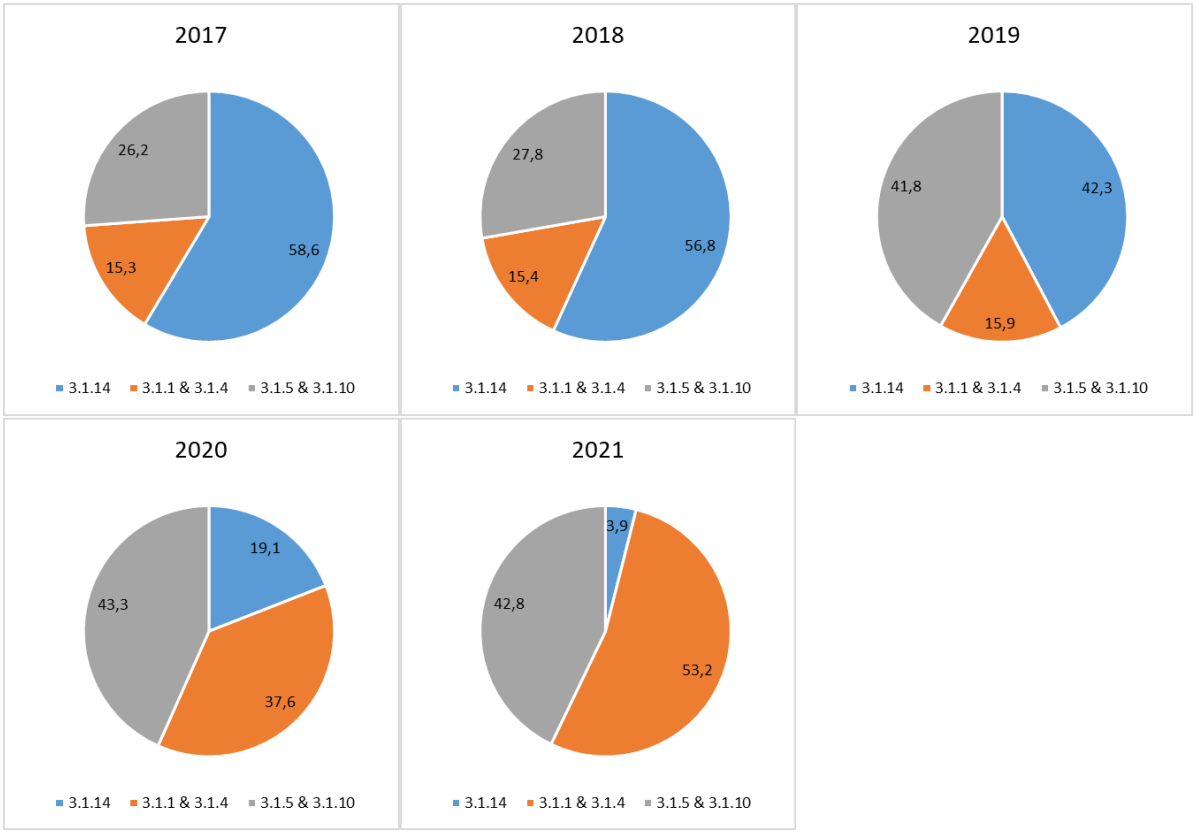
The years 2020-2021, on the other hand, are marked by a strong shrinkage of the large enterprise deposit segment, the share of which in 2021 reached it's low of around 4%. In H1'2022, however, there was a clear revival of this market segment, which came along with interest rate hikes by the NBP (the segment noted an increase in its share in the index to ca. 29%).

As a result of the data revision, deposits of financial institutions and other financial institutions (3.1.5 & 3.1.10) became the dominant segment in the WIRON eligible transactions pool. Their stable dominance is visible throughout the entire analysis period (share at 40-50%), except for 2021, when interbank deposits (3.1.1 & 3.1.4) made up slightly more than 50% of the index volume. It is also worth noting that currently(data for H1'2022) the volume of WIRON was divided relatively evenly between its three main segments (each share around 30-40%).

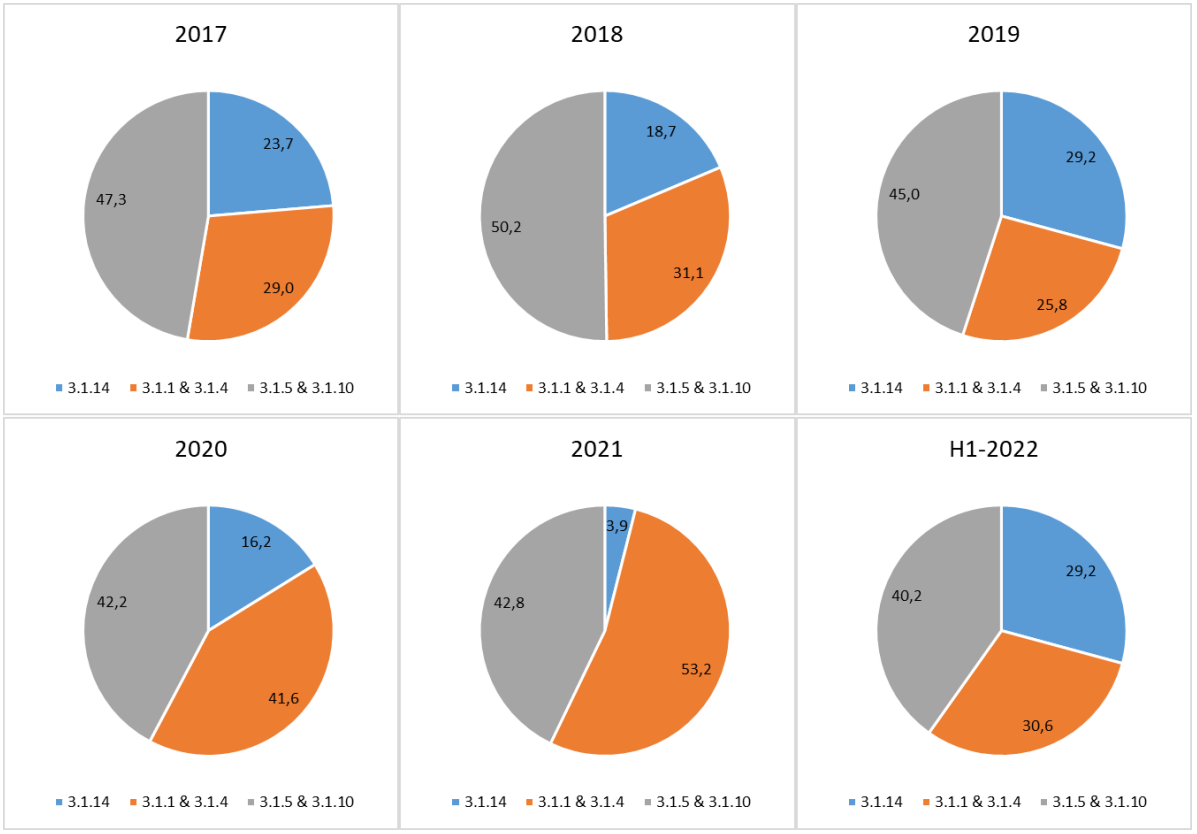
As far as the WIRF index is concerned, the scale of changes in the structure of its eligible transactions pool resulting from the data revision was much smaller than in the case of WIRON. What is crucial, the long-term dominance of deposits of financial institutions and other financial institutions (3.1.5 & 3.1.10) was maintained and this segment usually makes up ca. 50-60% of the index volume (except for 2021, when interbank deposits took over the dominance temporarily). The main noticeable change in the structure of the WIRF eligible transactions pool concerns the year 2019, when the share of deposits of financial institutions and other financial institutions decreased from ca. 73% to ca. 64%.

Fig. 5. Shares of market segments in the volume of WIRON eligible transactions pools

(a) before revision



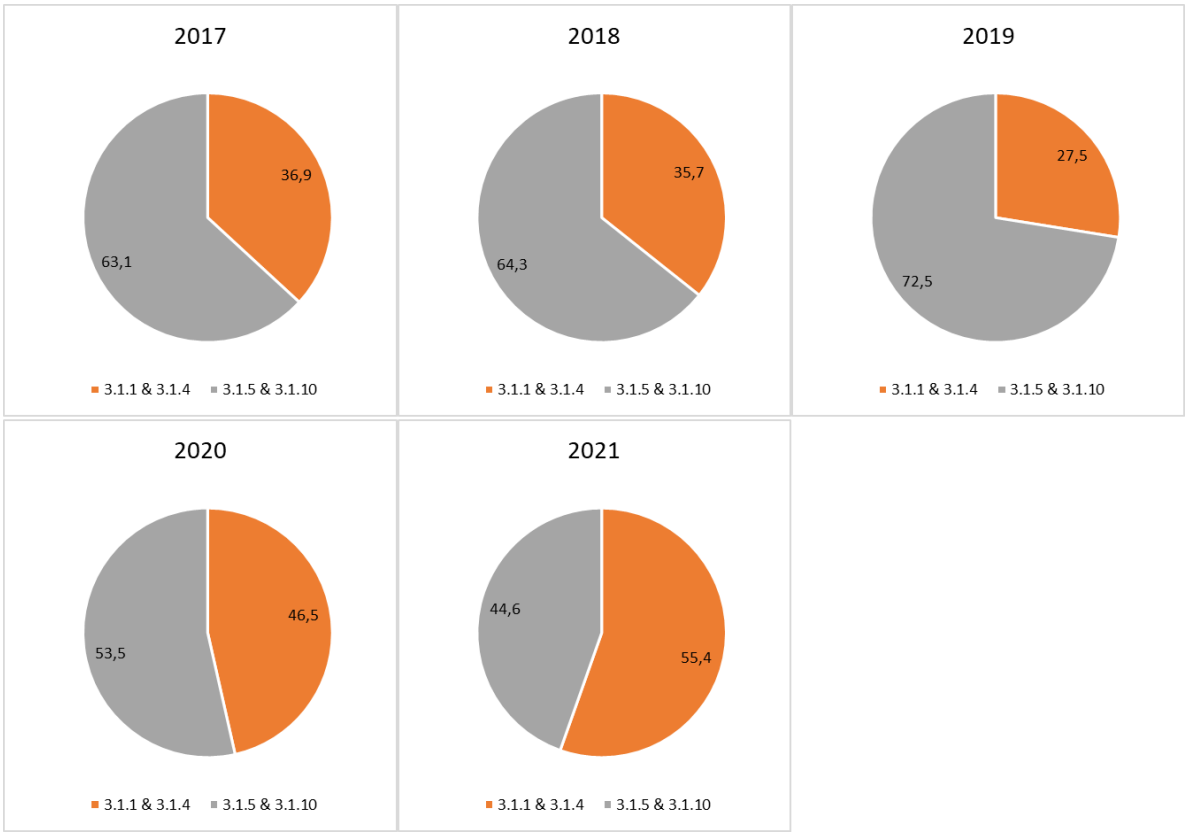
(b) after revision



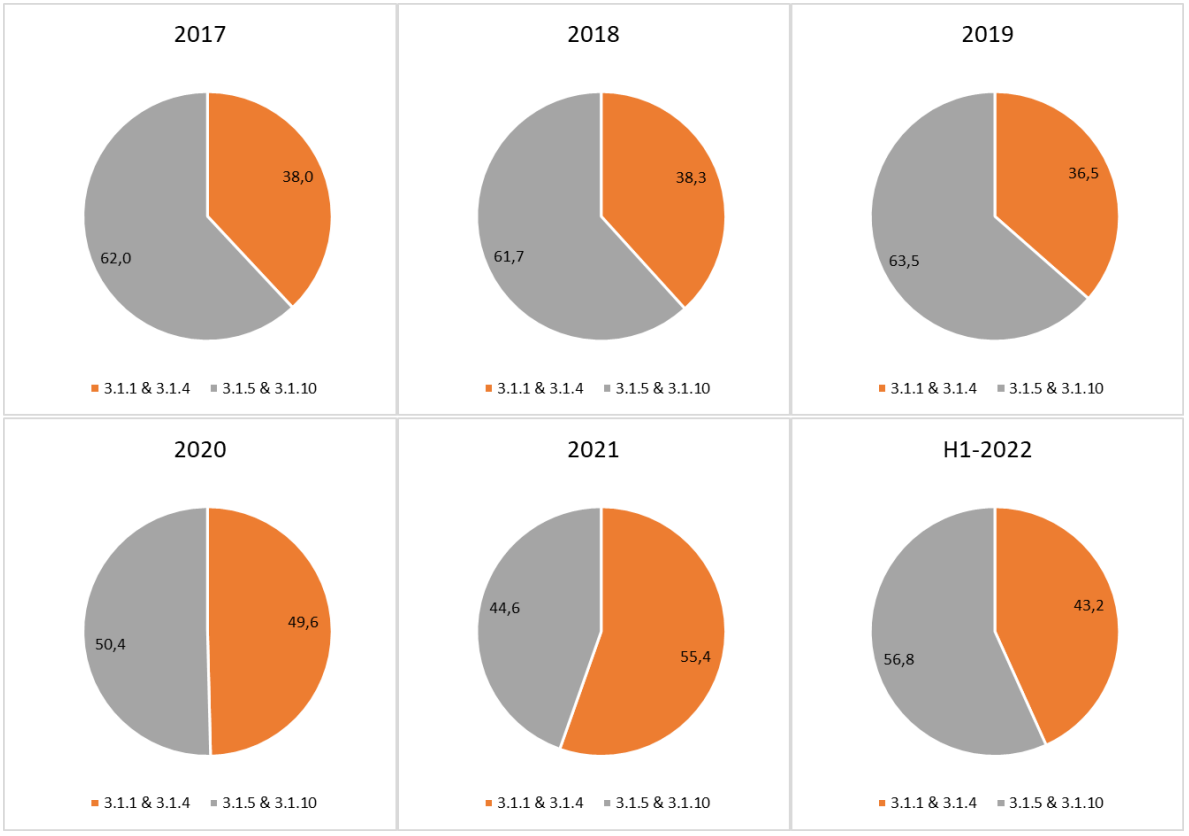
Source: GPWB.

Fig. 6. Shares of market segments in the volume of WIRF eligible transactions pools

(a) before revision



(b) after revision

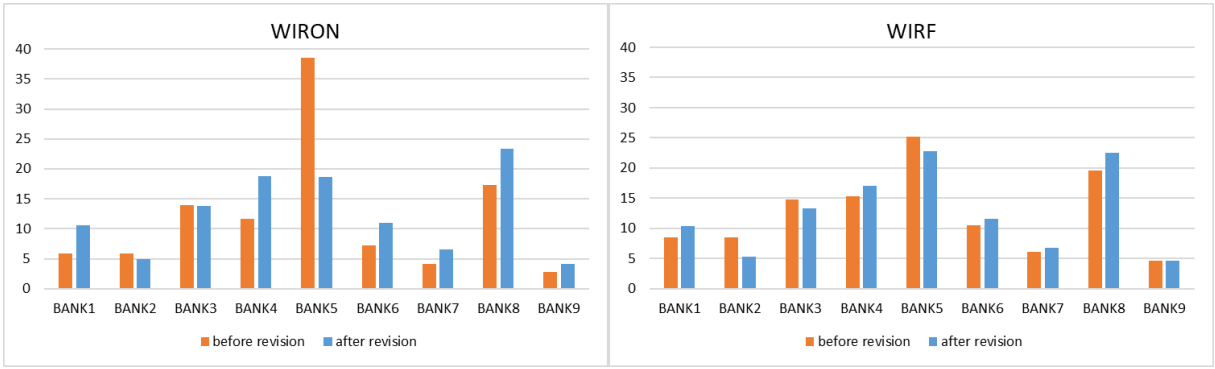


Source: GPWB.

4.5. Structure of eligible transactions pool by data contributor

The revision of transaction data for the years 2017-2019 translated into a significant change in the shares of individual data contributors in the eligible transactions pool, mainly in the case of WIRON. In the case of WIRF this impact was quite moderate and did not change the overall picture in terms of volume concentration (see fig. 7.). These results imply that the verification of transaction data affected mainly the data on large enterprise deposits and confirmed the need for such verification.

Fig. 7. Shares of data contributors in WIRON and WIRF eligible transactions pool volume (period 2017-2021)*



* The sum of shares of individual data contributors in the total volume of WIRON/WIRF exceeds 100% due to the fact that the eligible transactions pools of both indices include transactions between two data contributors, the volume of which is assigned to both their parties.

Source: GPWB.

The data shows also that Bank 5 had the largest share in the volume of the WIRON eligible transactions pool (almost 40%) before the data revision, while the remaining 8 data contributors held shares below 20%. Two banks with the largest shares (Bank 5 and Bank 8) had a total of over 50% of the total index volume, which indicated a certain scale of concentration. After the revision, however, concentration was significantly mitigated as a result of a strong decrease in the share of Bank 5 (to slightly below 20%) and a total share of the two banks with the largest shares was only around 40%.

In the case of WIRF, concentration was very moderate and the combined share of the two banks with the largest shares in the index volume (Bank 5 and Bank 8) did not exceed 50% - both before and after the data revision.

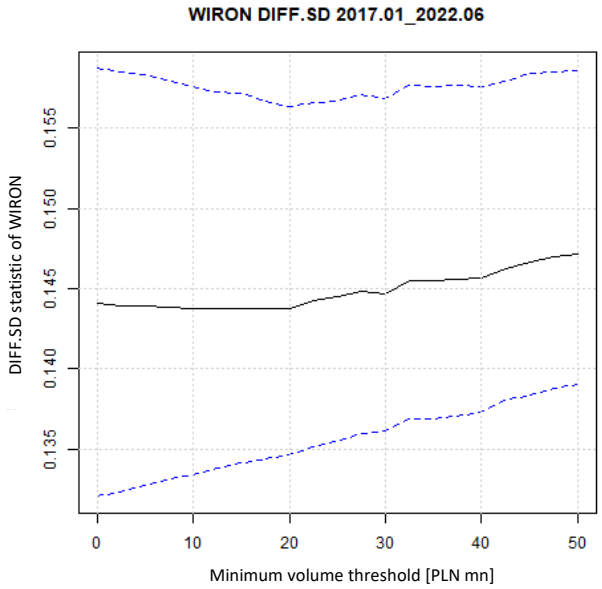
4.6. Sensitivity analysis

In relation to the transaction data revision the Administrator carried out an update of sensitivity analyses for the WIRON index that were presented in the consultation document (published in May 2022).

Minimum volume threshold – sensitivity analysis

The analysis of sensitivity to changes in the minimum volume threshold of a single transaction[14] (see fig. 8) shows that the volatility[15] of WIRON is relatively stable for threshold values ranging from PLN 0 to PLN 20 mn and then slightly rises along with an increase of the threshold above PLN 20 mn (the threshold rise from PLN 20 to 50 mn results in an increase in the volatility measure by ca. 0.5 bp).

Fig. 8. Volatility of WIRON measured by the standard deviation of its first difference (DIFF.SD) vs. the minimum volume threshold of a single transaction



Explanations: Black line - mean value of the index volatility measure, dashed blue lines – minimum and maximum values of the index volatility measure.

Source: GPWB.

Increasing the minimum volume threshold translates - at its higher levels - into a slight increase in the volatility of the index, which implies that there is no reason for setting a (too) high level of the minimum volume threshold from the volatility perspective. The threshold of PLN 1 mn proposed by the Administrator in the consultation document is therefore maintained and the revision of transaction data did not affect the conclusion concerning the level of this parameter. Nevertheless, the data revision (as well as the change of the period of analysis) flattened the graph of relation between the

[14] In the sensitivity analysis, simulations of the performance of the WIRON index in the period Jan'2017-Jun'2022 were calculated for different values of the minimum volume threshold (values ranging from PLN 0 to PLN 50 mn were tested with an interval of PLN 2.5 mn); a number of simulations were performed simultaneously for each threshold value using different values of the parameter determining the scale of the symmetrical cut-off in the main adjustment - this allowed for sensitivity analysis to both of these parameters. Consequently, the average of the measures of index volatility calculated using a number of separate simulations (each simulation for a different scale of the symmetrical cut-off in the main adjustment) was taken as the measure of index volatility for a given value of the minimum volume threshold.

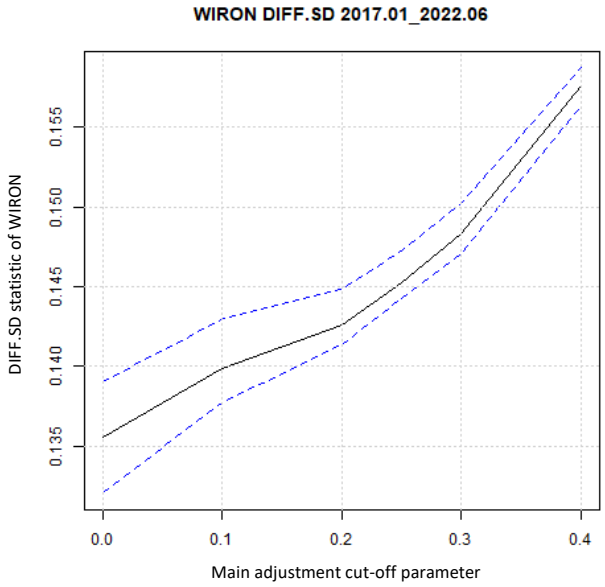
[15] The standard deviation of the first differences of the index (i.e. the difference between the value of the index on a given day and its value on the previous day) was used as a measure of the index volatility.

index volatility measure and the minimum volume threshold[16]. However, an increase of the minimum volume threshold would unnecessarily shrink the eligible transactions pool (e.g. an increase of the threshold from PLN 1 mn to PLN 10 mn would translate into a decline of the average daily volume of the WIRON eligible transactions pool in the period 2017-H1'2022 from PLN 8.68 bn to PLN 8.151 bn, i.e. by ca. 6%).

Cut-off scale in the main adjustment – sensitivity analysis

The analysis of sensitivity to changes in the cut-off scale in the main adjustment procedure[17] (see fig. 9) shows that the volatility[18] of WIRON increases along with the rise in the cut-off scale in the main adjustment (by approx. 2 bp after an increase in the cut-off scale from 0% to 40%), while the rise in volatility is clearly greater in the range between 20% and 40% than in the range between 0% and 20%.

Fig. 9. Volatility of WIRON measured by the standard deviation of its first difference (DIFF.SD) vs. the scale of cut-off in the main adjustment



Explanations: Black line - mean value of the index volatility measure, dashed blue lines – minimum and maximum values of the index volatility measure. Source: GPWB.

[16] See: https://gpwbenchmark.pl/pub/BENCHMARK/files/WIBID_WIBOR/Transactions_based_Interest_Rate_Benchmarks_05.22.pdf, p. 36, fig. 5.2.

[17] In the sensitivity analysis, simulations of the performance of the WIRON index in the period Jan'2017-Jun'2022 were calculated for different scales of the symmetrical cut-off in the main adjustment (the following values were tested: 0%; 10%; 20%; 25%; 30%; 40%); a number of simulations were performed simultaneously for each value of the cut-off scale using different values of the minimum volume threshold - this allowed for sensitivity analysis to both of these parameters. Consequently, the average of the measures of index volatility calculated using a number of separate simulations (each simulation for a different value of the minimum volume threshold) was taken as the measure of index volatility for a given value of the cut-off scale.

[18] As in the case of the sensitivity analysis to the minimum volume threshold, the standard deviation of the first difference of the index (i.e. the difference between the index value on a given day and its value on the previous day) was used as a measure of the index volatility.

These results imply that in the case of the chosen method of the two-sided adjustment[19] the scale of the symmetrical cut-off should not be too large as it would undesirably increase the index volatility. Taking into account the prevailing international standards, the Administrator concluded that the optimal solution is the adoption of the symmetrical cut-off scale at 25%, which is currently confirmed in the light of the results based on the verified transaction database. The cut-off threshold at 25% means that overall a half of the total volume of eligible transactions pool is subject to the cut-off[20].

When comparing the above results of the sensitivity analysis to the main adjustment procedure parameter with the results of this analysis presented in the consultation document, one should notice a significant steepening of the graph of the relation between the parameter and the WIRON volatility. This means that the verification of transaction data had an impact on the strength of this relation - primarily in the case of levels of the main adjustment parameter that exceed 20%.

4.7. Size and structure of the market

In connection with the verification of transaction data, presentation of updated statistics on the average daily volume and the average daily number of transactions in individual market segments is an important element illustrating the real structure of the market. This complements the general picture of the money market, following the statistics on the WIRON index presented in chapter 4.2 of this document.

Detailed information on the number and volume of transactions in individual segments of the money market after transaction data revision is presented in the tables 9 and 10. The analysis of the values contained therein allows one to look into the impact of applying the minimum volume threshold on the transactions dataset each year within the analysis period.

Tables 7 and 8 present the scale of the impact of the transaction data verification on the above-mentioned statistics. The greatest impact can be noticed in the case of the number and volume of enterprise deposits (including large enterprises), which has translated directly into the significant change in statistics for the WIRON transaction dataset.

[19] See: https://gpwbenchmark.pl/pub/BENCHMARK/files/WIBID_WIBOR/Transactions_based_Interest_Rate_Benchmarks_05.22.pdf, p. 29-30.

[20] According to the information from the consultation document, the only alternative value of this parameter used in international practice that was noted by the Administrator is 12.5% (in the case of the Swedish SWESTR index), but the decrease in volatility resulting from the change in the cut-off scale from 25% to 12.5% is so insignificant (only 0.5 bp) that the Administrator decided that it would be justified to use 25% as it is a much more common and intuitive standard.

Tab. 7. Differences in the level of the average daily number and the average daily volume of transactions in individual DDP groups

Segment	Group	2017		2018		2019		2020	
		Average daily number of transactions	Average daily transaction volume	Average daily number of transactions	Average daily transaction volume	Average daily number of transactions	Average daily transaction volume	Average daily number of transactions	Average daily transaction volume
Fixing Members	-	0,33	0,03	0,24	0,03	-0,08	-0,03	-0,03	-0,01
Banks (other)	-	-1,20	-0,08	-0,33	-0,05	1,06	0,19	0,10	0,01
Underlying Market	-	-0,87	-0,05	-0,08	-0,01	0,97	0,16	0,08	0,01
Financial Institutions	-	18,19	-0,25	83,82	0,07	890,82	2,60	102,81	0,36
Other Financial Institutions	-	75,73	0,38	66,65	0,39	17,54	-0,15	-1,07	0,00
Related Market	-	93,92	0,13	150,46	0,47	908,36	2,45	101,74	0,35
REPO	CIM					0,12	0,05	-0,14	-0,01
REPO	CFIM					-11,49	-1,13	-0,25	-0,01
BSB	CIM					-0,55	-0,31	-0,07	0,00
BSB	CFIM					-33,12	-2,40	-3,16	-0,15
REPO + BSB	CIM					-0,43	-0,26	-0,22	-0,01
REPO + BSB	CFIM					-44,61	-3,52	-3,41	-0,16
Enterprises	SME	2663,83	3,06	1401,95	1,65	3139,04	5,19	273,14	0,52
Enterprises	Large Companies	1941,92	8,82	2021,21	9,05	1045,13	4,49	65,66	0,35
Enterprises	-	4605,75	11,89	3423,14	10,70	4184,18	9,67	338,79	0,87

Source: GPWB, transaction data submitted by potential data contributors.

Tab. 8. Differences in the level of the average daily number and the average daily volume of transactions in individual DDP groups (with application of the minimum volume threshold of PLN 1 mn)

Segment	Group	2017		2018		2019		2020	
		Average daily number of transactions	Average daily transaction volume	Average daily number of transactions	Average daily transaction volume	Average daily number of transactions	Average daily transaction volume	Average daily number of transactions	Average daily transaction volume
Fixing Members	-	0,33	0,03	0,24	0,03	-0,08	-0,03	-0,03	-0,01
Banks (other)	-	-1,19	-0,08	-0,33	-0,05	1,06	0,19	0,10	0,01
Underlying Market	-	-0,86	-0,05	-0,08	-0,01	0,97	0,16	0,07	0,01
Financial Institutions	-	9,96	-0,25	30,49	0,07	239,05	2,49	28,48	0,34
Other Financial Institutions	-	28,95	0,36	23,17	0,38	10,98	-0,15	0,09	-0,01
Related Market	-	38,93	0,11	53,66	0,44	250,03	2,34	28,58	0,33
REPO	CIM					0,12	0,05	-0,14	-0,01
REPO	CFIM					-11,38	-1,13	-0,24	-0,01
BSB	CIM					-0,73	-0,31	-0,07	0,00
BSB	CFIM					-31,72	-2,39	-3,05	-0,16
REPO + BSB	CIM					-0,61	-0,26	-0,22	-0,01
REPO + BSB	CFIM					-43,10	-3,53	-3,29	-0,16
Enterprises	SME	575,79	2,48	318,92	1,37	917,72	4,48	83,53	0,47
Enterprises	Large Companies	845,95	8,48	902,61	8,71	489,17	4,29	36,49	0,34
Enterprises	-	1421,74	10,96	1221,54	10,07	1406,90	8,78	120,02	0,80

Source: GPWB, transaction data submitted by potential data contributors.

Tab. 9. Summary of money market size by segment in annual terms after the data verification for the period Jan'2017 – Jan'2020

Segment	Group	2017		2018		2019		2020		2021		H1'2022	
		Average daily number of transactions	Average daily transaction volume	Average daily number of transactions	Average daily transaction volume	Average daily number of transactions	Average daily transaction volume	Average daily number of transactions	Average daily transaction volume	Average daily number of transactions	Average daily transaction volume	Average daily number of transactions	Average daily transaction volume
Fixing Members	-	4,12	1,00	4,61	1,10	4,59	1,16	4,29	1,40	5,68	1,69	9,70	2,32
Banks (other)	-	19,33	2,08	16,35	1,91	15,33	1,59	10,45	1,76	7,59	1,88	6,94	1,34
Underlying Market	-	23,45	3,09	20,96	3,01	19,93	2,75	14,73	3,15	13,27	3,57	16,65	3,67
Financial Institutions	-	263,19	5,19	254,90	5,29	235,99	4,74	127,87	3,22	73,11	2,67	250,34	4,26
Other Financial Institutions	-	63,33	0,73	61,89	0,82	61,44	1,22	42,88	1,58	26,10	0,67	48,57	1,30
Related Market	-	326,51	5,92	316,80	6,10	297,43	5,96	170,75	4,81	99,21	3,34	298,91	5,55
REPO	CIM	-	-	-	-	6,15	0,87	3,38	0,36	5,04	0,20	6,99	0,46
REPO	CFIM	-	-	-	-	32,43	3,34	20,32	1,29	31,67	1,97	44,94	2,34
BSB	CIM	-	-	-	-	32,75	4,42	20,49	2,07	27,54	2,95	45,70	6,45
BSB	CFIM	-	-	-	-	229,76	12,73	160,78	6,87	163,33	7,20	261,30	12,31
REPO + BSB	CIM	-	-	-	-	38,90	5,29	23,87	2,43	32,58	3,15	52,69	6,91
REPO + BSB	CFIM	-	-	-	-	262,20	16,07	181,10	8,16	195,00	9,17	306,24	14,65
Enterprises	SME	613,70	1,30	655,81	1,49	857,14	2,35	332,55	1,11	66,94	0,38	298,23	2,45
Enterprises	Large Companies	452,47	3,84	406,42	3,07	623,17	4,37	235,93	2,17	30,56	0,76	174,82	5,32
Enterprises	-	1 066,17	5,14	1 062,24	4,56	1 480,31	6,73	568,48	3,28	97,50	1,14	473,05	7,77

Source: GPWB, transaction data submitted by potential data contributors.

Tab. 10. Summary of money market size by segment in annual terms after the data verification for the period Jan'2017 – Jan'2020 (with application of the minimum volume threshold of PLN 1 mn)

Segment	Group	2017		2018		2019		2020		2021		H1'2022	
		Average daily number of transactions	Average daily transaction volume	Average daily number of transactions	Average daily transaction volume	Average daily number of transactions	Average daily transaction volume	Average daily number of transactions	Average daily transaction volume	Average daily number of transactions	Average daily transaction volume	Average daily number of transactions	Average daily transaction volume
Fixing Members	-	4,12	1,00	4,61	1,10	4,59	1,16	4,29	1,40	5,68	1,69	9,70	2,32
Banks (other)	-	19,28	2,08	16,33	1,91	15,29	1,59	10,44	1,76	7,59	1,88	6,94	1,34
Underlying Market	-	23,40	3,09	20,93	3,01	19,89	2,75	14,73	3,15	13,27	3,57	16,65	3,67
Financial Institutions	-	157,63	5,15	148,24	5,25	138,74	4,71	75,00	3,21	49,35	2,66	117,57	4,22
Other Financial Institutions	-	31,33	0,73	33,99	0,81	31,96	1,21	20,96	1,58	14,29	0,67	30,82	1,29
Related Market	-	188,95	5,88	182,23	6,06	170,70	5,92	95,95	4,79	63,65	3,33	148,38	5,51
REPO	CIM	-	-	-	-	6,14	0,87	3,38	0,36	5,04	0,20	6,99	0,46
REPO	CFIM	-	-	-	-	32,14	3,34	19,63	1,29	31,00	1,97	42,84	2,34
BSB	CIM	-	-	-	-	32,26	4,42	20,07	2,07	27,05	2,95	44,52	6,45
BSB	CFIM	-	-	-	-	218,56	12,72	150,50	6,87	153,37	7,19	241,94	12,30
REPO + BSB	CIM	-	-	-	-	38,40	5,29	23,45	2,43	32,09	3,15	51,51	6,91
REPO + BSB	CFIM	-	-	-	-	250,70	16,07	170,13	8,15	184,36	9,16	284,78	14,64
Enterprises	SME	247,48	1,17	270,50	1,36	353,95	2,19	159,91	1,05	43,72	0,37	217,13	2,42
Enterprises	Large Companies	276,89	3,77	257,64	3,01	336,11	4,29	139,54	2,14	27,03	0,76	155,32	5,31
Enterprises	-	524,37	4,94	528,13	4,37	690,06	6,47	299,45	3,19	70,75	1,13	372,45	7,73

Source: GPWB, transaction data submitted by potential data contributors.

5. Annex no. 1 – Simulations of the spread adjustment

The Polish National Working Group (NGR) for benchmark reform aims at a secure implementation of the newly defined RFR index. In order to support such implementation and further transition process, GPW Benchmark conducted simulations of a theoretical spread adjustment, calculated in accordance with the most commonly used methodological standard. In order to broaden the analysis, the simulations included different versions of the algorithm parametrisation, which include an alternative way of determining the central tendency of daily spreads between the WIBOR reference index and the relevant WIRON compound index (determined in accordance with the method specified by the International Swaps and Derivatives Association (ISDA)) as well as alternative lengths of the lookback period.

The information provided in the documents summarizing the rounds of consultations regarding the spread adjustment by ISDA indicates that the scope of discussion on setting the optimal spread adjustment methodology included: (1) backward-looking approach – including the length of the lookback period in which historical values of two indices are compared and for which the daily spread values are determined, (2) the method of determining the central value of the spread in this defined period - i.e. a choice between the mean or the median of the spread values , (3) other concepts of the spread adjustment determination method – i.e. a concept other than the backward-looking approach (e.g. forward-looking approach or spot-spread approach).

Neither is the Annex intended to be consulted nor does it present a view or opinion of the Administrator. However, on the basis of such analysis one can reflect on the information resulting from the calculation of the spread, taking into account various versions of the backward-looking approach including changes in both (1) and (2) in order to ensure transparency and understanding of the economic processes and their impact on potential future events related to the replacement of the Polish critical benchmark – WIBOR.

One of the future events on the Polish interest rate benchmark transition Road Map is the determination of the spread adjustment. In the case of adopting the currently most frequently used ISDA standard, the continuous calculation (i.e. daily update of the spread adjustment value) will be stopped and “frozen” when the so-called regulatory event occurs. In the Road Map the Polish National Working Group acknowledged and supported adoption of the method defined in the ISDA Fallback Protocol so far and based on the 5-year median of the value of the spread between WIBOR and the WIRON index compounded in arrears in an adequate period.

Tab. 11. Simulations of the potential spread adjustment values in the event of their freezing on Aug 31, 2022, Sep 30, 2022 and Oct 31, 2022

		Aug 31, 2022			Sep 30, 2022			Oct 31, 2022		
Measure	**Period**	**SPR.ADJ.1M**	**SPR.ADJ.3M**	**SPR.ADJ.6M**	**SPR.ADJ.1M**	**SPR.ADJ.3M**	**SPR.ADJ.6M**	**SPR.ADJ.1M**	**SPR.ADJ.3M**	**SPR.ADJ.6M**
median	1 year	0,56014	0,19784	-0,31107	0,58634	0,22780	-0,38700	0,60818	0,29443	-0,38699
	3 years	0,37840	0,24037	0,25618	0,40618	0,24009	0,24813	0,41002	0,24009	0,24312
	5 years	0,41230	0,46628	0,54644	0,41673	0,47045	0,54644	0,42085	0,47456	0,54644
	10 years*	0,37079	0,44444	0,52458	0,37273	0,44430	0,52446	0,37593	0,44430	0,52446
	10 years**	0,38243	0,45506	0,53360	0,38502	0,45505	0,53338	0,38858	0,45505	0,53338
mean	1 year	0,47206	0,23238	-0,28565	0,51000	0,28239	-0,35348	0,56233	0,33168	-0,37052
	3 years	0,38783	0,38606	0,32012	0,39394	0,39473	0,28856	0,40334	0,40363	0,27306
	5 years	0,39952	0,42658	0,41652	0,40345	0,43267	0,39847	0,41165	0,43918	0,39025
	10 years*	0,38061	0,44209	0,49038	0,38341	0,44435	0,48158	0,38734	0,44647	0,47802
	10 years**	0,38896	0,45064	0,49922	0,39161	0,45273	0,49024	0,39536	0,45469	0,48652

* - for the years 2012-2016: WIRON = POLONIA rate + avg. spread WIRON-POLONIA in the period Jan'17-Oct'22

** - for the years 2012-2016: WIRON = POLONIA rate + avg. spread WIRON-POLONIA in the period Jan'17-Dec'19

Source: GPWB.

In table 11 one can see and compare a set of spread adjustment calculations that take into account (a) the median and (b) the mean in the period of (i) 5 years, but also (ii) 10 years, (iii) 1 year and (iv) 3 years .

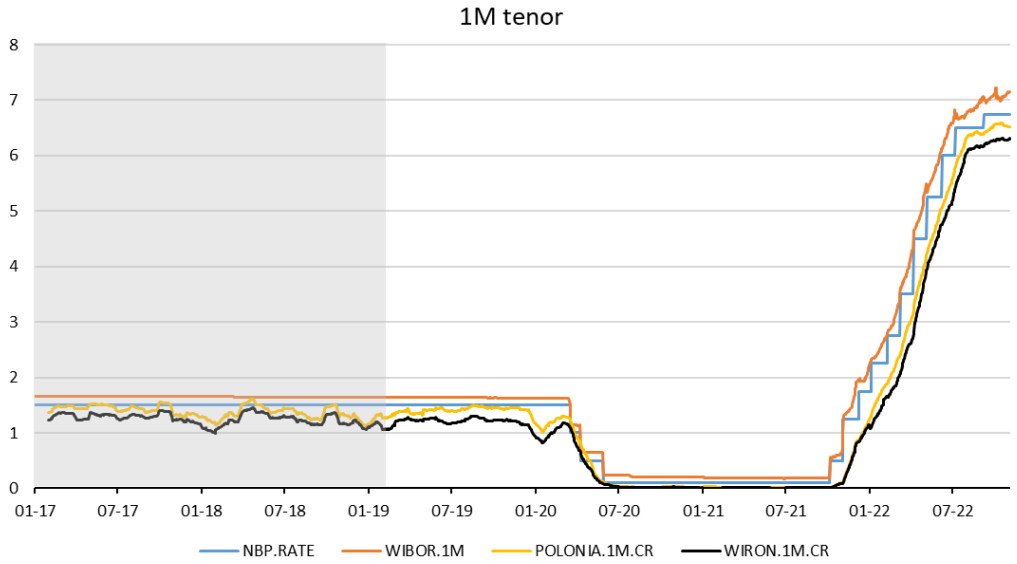
In order to determine the spread history for the previous 10-years, it was necessary to estimate the WIRON index for the period preceding the time of transaction data availability (i.e. for the years 2012-2016 - see footnotes to table 11). In the case of later years, GPW Benchmark prepared simulation of the WIRON index for 2017-2018 based on "proxy data" as stated before, and starting from 2019 the Administrator uses the history of the index based on the data revised by the banks and delivered to the Administrator consistently with the requirements set for the benchmark calculation, as described in this document. In order to calculate the spread for a period longer than 5 years, the historical simulation of the WIRON value was performed with the use of the value of the POLONIA rate corrected by the average level of the spread between WIRON and POLONIA in the period (*) 01.2017-10.2022 or (**) 01.2017-12.2019.

The results confirm a significantly different nature of economic processes taken into account in the short-term calculations and covered by the values representing the spread in the previous 1 and 3 years, compared to long-term historical observations (5- and 10-year lookback period). That simply shows the impact of the interest rate cycle on the shape of the money market curve and thus the current differences between WIBOR and compounded indices for predefined periods based on the Warsaw Interest Rate Overnight.

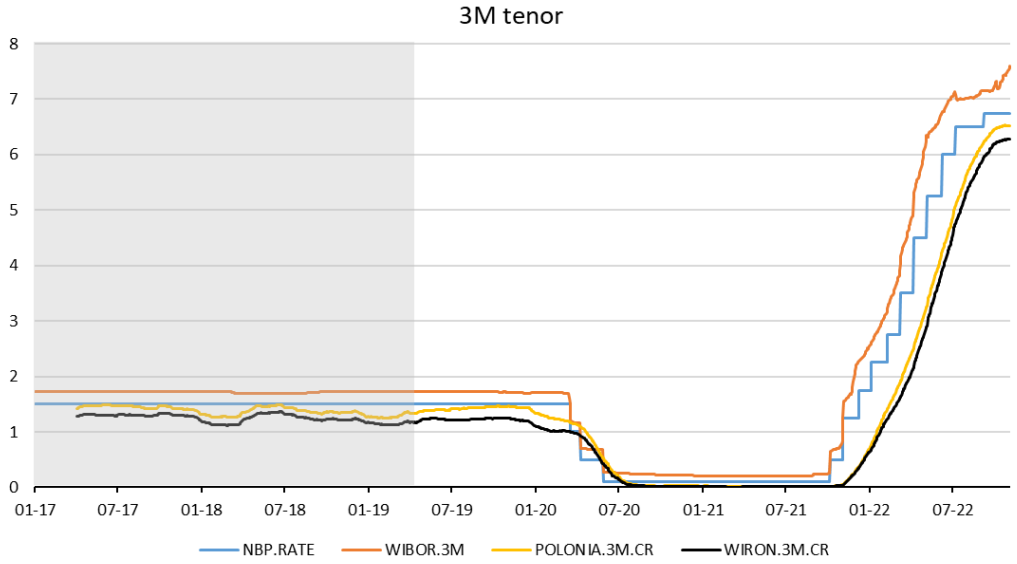
6. Annex no. 2 - Charts

The charts below present the verified values of the WIRON 1M/3M/6M Compound Rates compared with 1M/3M/6M compound rates based on the POLONIA rate as well as the values of WIBOR 1M/3M/6M and the NBP reference rate.

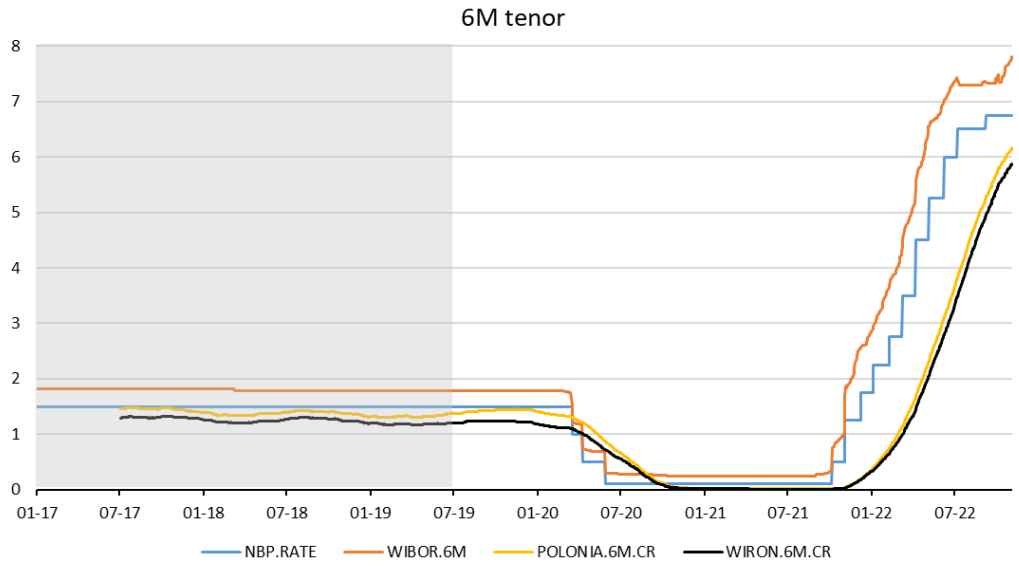
a) 1M tenor



b) 3M tenor



c) 6M tenor



Explanation: In the period marked with a gray background the WIRON 1M/3M/6M compound rate is partly or wholly based on the values of the WIRON ON index that are calculated on the basis of transaction data for the years 2017-2018, which are "proxy data".

Source: GPWB, NBP.