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# **ANALYSIS OF THE CONCENTRATION OF FX SUPPLY AND DEMAND IN THE LOCAL MARKET**

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## **Analysis of the concentration of FX supply and demand in the local market**

Aleksa Smiljanić

**Abstract:** The paper looks into the impact of the concentration of residents and non-residents' FX supply and demand on the total amount of FX supply and demand of these banking clients. Our intention was to identify any trends and correlations with other market indicators in the observed ten-year period. For the purpose of studying the concentration of FX supply and demand, we used the Herfindahl-Hirschman index which has been proven to be a statistically significant regressor when explaining movements in net FX demand by residents and non-residents. The results showed the presence of a multi-year positive trend of decrease in the concentration of FX supply, i.e. diversification of FX sources, driven by dynamic growth in the number of residents supplying FX. On the other hand, there are multiple indicators suggesting that our FX market is still characterised by relatively low liquidity. However, during the period of structural appreciation pressures, namely in 2017, there was a noticeable gradual increase in the FX supply capacity to “absorb” FX demand on days when demand was more concentrated, which reflects the increase in the number of residents supplying FX and the diversification of FX sources.

**Keywords:** concentration of FX supply and demand, Herfindahl-Hirschman index, diversification of FX sources

**[JEL Code]:** C20, F31

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## **Non-technical summary**

This paper presents movements in the segment of the FX market that includes the purchase and sale of FX between banks and their clients – residents and non-residents. Given the large daily transaction volume, this market segment is particularly important from the aspect of influence on banks' FX open position (difference between FX assets and liabilities), which gives rise to appreciation or depreciation pressures in the interbank FX market (i.e. FX surplus or deficit in the market). The value of transactions between banks and residents and non-residents is rising on a par with growth in economic activity, with the last two years recording particularly dynamic growth, notably between banks and residents.

The analysis includes the period of the past ten years and was conducted based on daily data from reports submitted by commercial banks to the National Bank of Serbia. The concentration of FX supply and demand was measured on a daily basis, with the intention of looking into its connection to the total amount of FX supply and demand, as well as in order to potentially recognise more relevant trends and correlations with other market indicators.

The results of the analysis showed a multiyear positive downward trend in the concentration of resident and non-resident FX supply, i.e. diversification of FX sources. Diversification was mostly driven by residents supplying FX, and their number almost continuously rose more quickly than the number of resident FX buyers, where their growth picked up particularly over the past two years.

On the other hand, based on several indicators, the analysis confirmed that the liquidity of the local FX market is still relatively low, namely that for the most time the market lacks the capacity to “absorb” FX supply and demand of the largest residents and non-residents. However, during periods of structural appreciation pressures (since 2017), the capacity of the FX supply to “absorb” a more concentrated FX demand has gradually increased, reflecting the rising number of residents supplying FX and the diversification of FX sources.

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## 1 Introduction

Pursuant to the Decision on Operating Terms and Procedures in the Foreign Exchange Market of the National Bank of Serbia (hereinafter: NBS), foreign exchange and foreign cash may be purchased/sold in the local foreign exchange market. In addition to banks, trading in foreign cash is also allowed to authorised exchange dealers and the public postal operator, whereas FX trade, as a significantly larger market segment, is entrusted solely to banks, which are obligated to submit detailed daily reports to the NBS about their activities in the FX market. This way, the NBS monitors one of the most important factors affecting banks' open FX position and, by extension, the emergence of appreciation or depreciation pressures on the dinar.

In terms of the date of FX purchase/sale, the Decision envisages spot, forward and swap FX purchase/sale, as well as purchase/sale deals with the execution date earlier than the spot currency date, noting that:

- spot sale/purchase takes place two business days from the day of the conclusion of such purchase/sale contract, and/or trading date (spot currency date);
- forward purchase/sale takes place on a specified date which is later than the spot currency date;
- swap purchase/sale means entering into two simultaneous transactions: the purchase of foreign exchange for dinars and the sale of foreign exchange for dinars, with different contract execution dates.

This paper focuses on the FX purchase/sale with spot currency date and execution date different from the spot currency date, i.e. it covers all market segments except spot purchase/sale of foreign exchange.

Another important form of market segmentation is the division into different bank clients in the business of FX purchase/sale. These can be:

- other banks (interbank FX market, whose trading is the basis for setting the official middle exchange rate of the dinar against the euro);
- residents;
- non-residents.

The paper focuses on FX trading between banks and residents and non-residents (purchase/sale of all foreign currencies<sup>1</sup> in exchange for the dinar, expressed in euros).

In the period since the start of 2013 and until the end of the first half of 2023, the value of FX trading between banks and residents and non-residents rose almost continually, with the exception of the years 2014 and 2020, when real GDP posted a fall (Table 1). The highest growth rates were recorded in 2021 and 2022 (28% and 30%, respectively), and trade with

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<sup>1</sup> Foreign currencies eligible for trading in the local FX market are prescribed by the Decision on Types of Foreign Exchange and Foreign Cash to be Purchased and Sold in the Foreign Exchange Market.

residents recorded a more dynamic growth (30% and 31%, respectively), while FX trade with non-residents also recorded above-average growth (10% and 27%, respectively).

**Table 1 Total FX purchase/sale between banks and residents and non-residents with spot currency date and execution date different from spot currency date**

Year	Residents and non-residents (in EUR bn)	Y-o-y growth rate	Residents (in EUR bn)	Y-o-y growth rate	Non-residents (in EUR bn)	Y-o-y growth rate
2013	24.3		18.8		5.4	
2014	23.7	-2%	19.0	1%	4.7	-13%
2015	24.0	1%	19.7	4%	4.3	-9%
2016	25.9	8%	21.4	8%	4.5	5%
2017	28.8	11%	24.3	13%	4.6	1%
2018	32.3	12%	26.7	10%	5.6	22%
2019	36.1	12%	30.2	13%	5.9	4%
2020	32.7	-9%	28.8	-5%	3.9	-33%
2021	41.8	28%	37.5	30%	4.3	10%
2022	54.4	30%	49.0	31%	5.4	27%
2023 (until 30 June)	26.4	3%	24.1	5%	2.3	-10%

\* Growth rates in H12023 were calculated relative to H12022.

Source: NBS, author's calculation.

The paper analyses the concentration of FX supply and demand by residents and non-residents based on data from banks' daily reports over the observed ten-year period (for working days). The first part shows the connection between concentration and the amount of FX supply and demand by residents and non-residents, while the second part points out the downward trend of FX supply concentration against the backdrop of dynamic growth in the number of residents supplying FX.

## 2 Analysis of the concentration of FX supply and demand by residents and non-residents

For the purpose of analysing the concentration of FX supply and demand, we used the Herfindahl-Hirschman index (hereinafter: HHI). This indicator is largely used for establishing the level of competition in a specific market – the most well-known user of this index is the U.S. Department of Justice Antitrust Division, which partly relies on it when assessing whether potential mergers of specific large companies would impair market competition to a serious extent. Though its initial role was to monitor market competition, in literature the HHI is used for other purposes as well, such as estimating the concentration of revenue sources and financial sustainability of non-profit organisations (*Chikoto et al., 2016*) and universities in the USA (*Webb, 2015*).

The HHI is calculated according to formula (1).

$$HHI = \sum_{i=1}^n s_i^2 \quad (1)$$

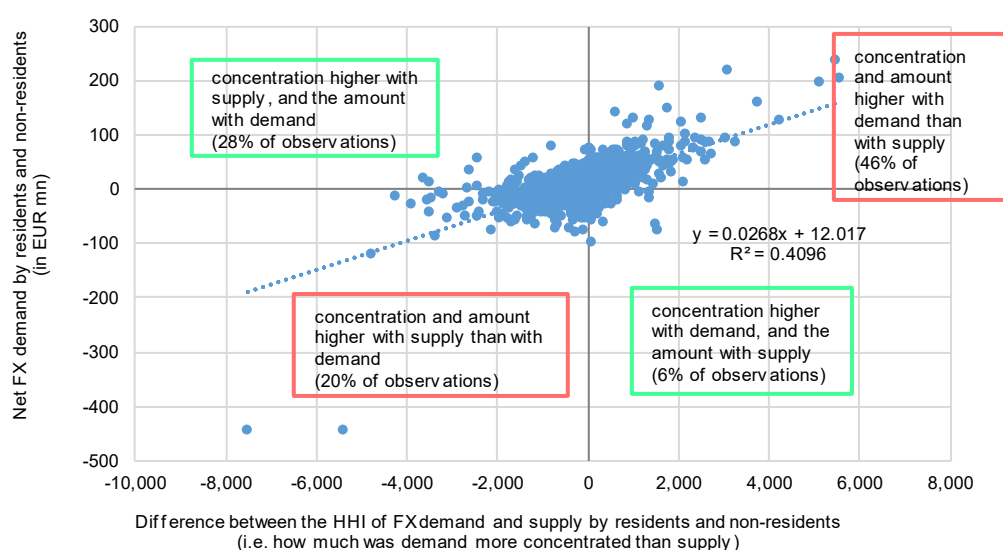
In formula (1),  $s_i$  is the market share of the company  $i$ , and  $n$  is the number of companies in the market. The HHI strives towards the minimum value of 0 in conditions of a large number

of market participants with an equal market share (perfect equality, i.e. diversification) and, on the other hand, it strives towards the maximum value of 10,000 in conditions when one market participant covers almost the entire market, regardless of the number of market participants (perfect inequality, i.e. concentration). This indicator was chosen to monitor movements in the concentration of FX supply and demand bearing in mind that it is convenient for comparing longer time intervals being significantly less sensitive to the increase in the number of market participants over the years than other indicators that could be used for similar purposes (such as the Gini coefficient).

## 2.1 Concentration of FX supply and demand and net FX demand of residents and non-residents

It is intuitively clear that on days when extremely large transactions are concluded, the direction of total net FX demand<sup>2</sup> by bank clients is determined by the needs of the biggest client. However, by relating the HHI, which takes into account the shares of all bank clients,<sup>3</sup> to their net FX demand, we can generalise this observation and conclude that most of the time, the side (supply or demand) that is more concentrated on the given day is also the larger one.

Chart 1 **Daily differences between the HHI of FX demand and supply by residents and non-residents and daily net FX demand by residents and non-residents for the period January 2013 – June 2023**



Source: NBS, author's calculation.

Chart 1 shows the regression of daily net FX demand by residents and non-residents (dependent variable) on the daily difference between the HHI of FX demand and supply by residents and non-residents (that is, how much is demand more concentrated than the supply;

<sup>2</sup> Positive net FX demand means that FX demand is higher than FX supply, and negative – that FX supply is higher than FX demand.

<sup>3</sup> It needs to be noted that the amount of net FX demand excludes certain residents and non-residents whose transactions were lower than EUR 10,000, and which banks can report under the “SUM” category (see Appendix for details).



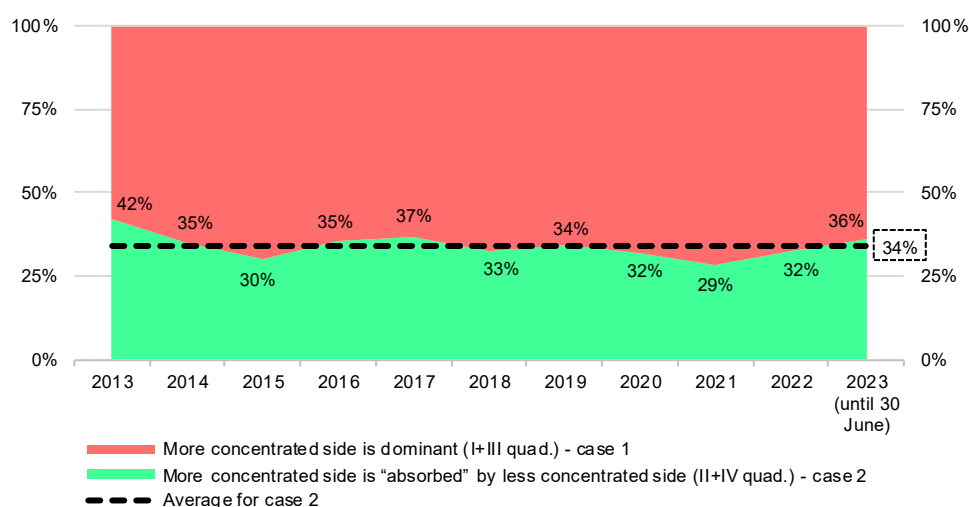
independent variable). The coefficient assessed with the HHI has shown to be statistically significant with a plus sign, suggesting that higher concentration on the FX demand side relative to the supply leads to higher net FX demand and vice versa.

Quadrants I and III are marked in red and they represent days when the more concentrated side was dominant (66% of working days in all), and quadrants II and IV are marked in green, representing days when the more concentrated side was “absorbed” by the less concentrated side (34% of working days in all).

This confirms that bigger clients, even on days with no excessively large transactions, mostly dictate appreciation and depreciation pressures on the exchange rate from the market between banks and residents and non-residents, indicating the relatively low liquidity of our FX market.

Approximately 2/3 of the time, net FX demand by residents and non-residents was dictated by the more concentrated side of the market in each of the previous ten years (Chart 2). Chart 2 shows the sum of quadrants I and III (the case when the more concentrated side is dominant; red colour) and quadrants II and IV (the case when the more concentrated side is “absorbed” by the less concentrated side; green colour) from Chart 1 by year.

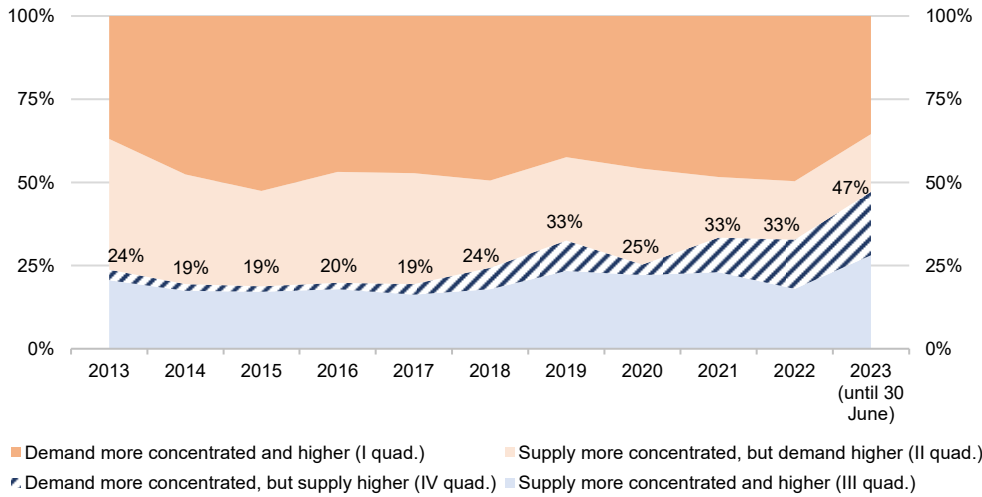
**Chart 2 Number of days in the year when the sign of net FX demand was dictated by whether FX demand or supply was more concentrated**  
(in %)



Source: NBS, author's calculation.

Though “absorption” of the more concentrated side by the less concentrated side remained relatively low and stable, at the level close to the average 34% throughout the ten-year period, its structure during the period of structural appreciation pressures (since 2017) has improved. Namely, there have been more days when the broader base of FX suppliers managed to cover the entire FX demand in conditions when demand is more concentrated than the supply (hatched region in Chart 3).

**Chart 3 Increased capacity of FX supply to “absorb” FX demand on days when demand is more concentrated, i.e. when there are relatively more large clients on the demand side than on the supply side**  
(in %)

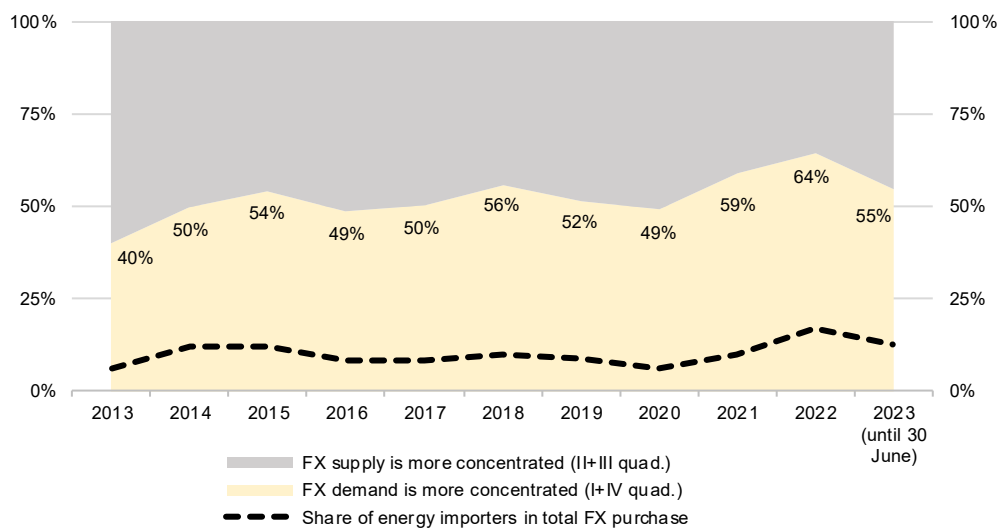


Source: NBS, author's calculation.

Also, there has been an increase in the number of days in the year during which FX supply was higher than FX demand from around 20% before 2018 to 33% in the period between 2019 and end-2022 (with the exception of the crisis year of 2020 during the coronavirus pandemic), and this trend continued in the first half of 2023 (an increase to 47%).

During 2021 and 2022, there was an exceptionally high FX demand by domestic companies – energy importers (due to the global energy and geopolitical crisis and the rise in energy prices in the international market), which visibly contributed to the relatively larger growth in concentration of FX demand relative to the concentration of FX supply in that period (Chart 4). At the same time, a high linear correlation (0.80) is noticeable between the number

**Chart 4 Number of days in the year during which FX supply or demand was more concentrated**  
(in %)



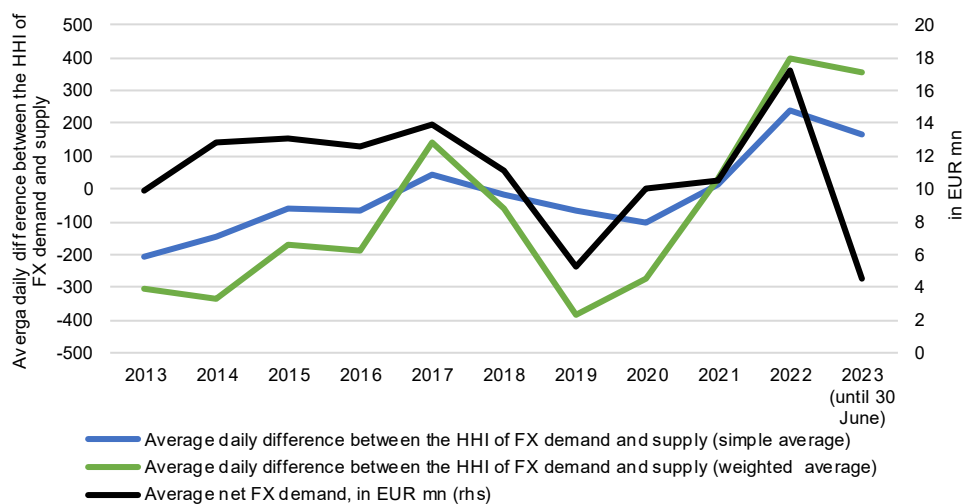
Source: NBS, author's calculation.

of days during which demand is more concentrated than supply and the share of energy importers in the total demand during the entire ten-year period.

The relationship between net FX demand by bank clients and the HHI of FX supply and demand is, except in a binary sense (higher concentration of demand → positive net demand (i.e. demand greater than supply)); higher concentration of supply → negative net demand (i.e. supply greater than demand)), noticeable in absolute terms as well, as shown in Chart 5.

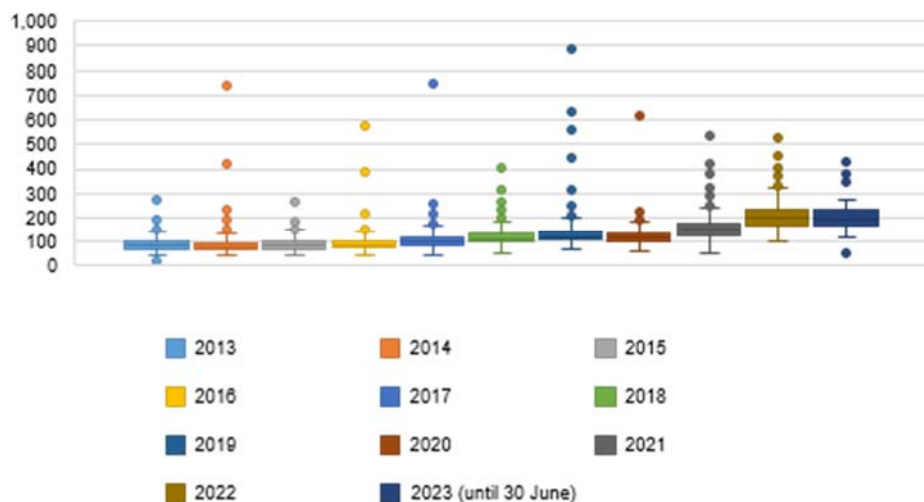
Until 2018, the movement of net FX demand is better described by the simple average of the daily difference between the HHI of FX demand and supply, after which it has a better correlation with the weighted average (where the weight is represented by the daily FX

**Chart 5 Movement in average daily net FX demand and average daily difference between the HHI of FX demand and supply by residents and non-residents**



Source: NBS, author's calculation.

**Chart 6 Box plot for total daily FX purchases/sale between banks and residents and non-residents**  
(in EUR mn)



Source: NBS, author's calculation.

purchase and sale by residents and non-residents for the HHI of FX demand and supply, respectively). This can perhaps be attributed to the increased variability of daily FX purchase and sale between banks and residents and non-residents, which is reflected in the widening of the interquartile range and the increased number of outliers, shown in Chart 6.

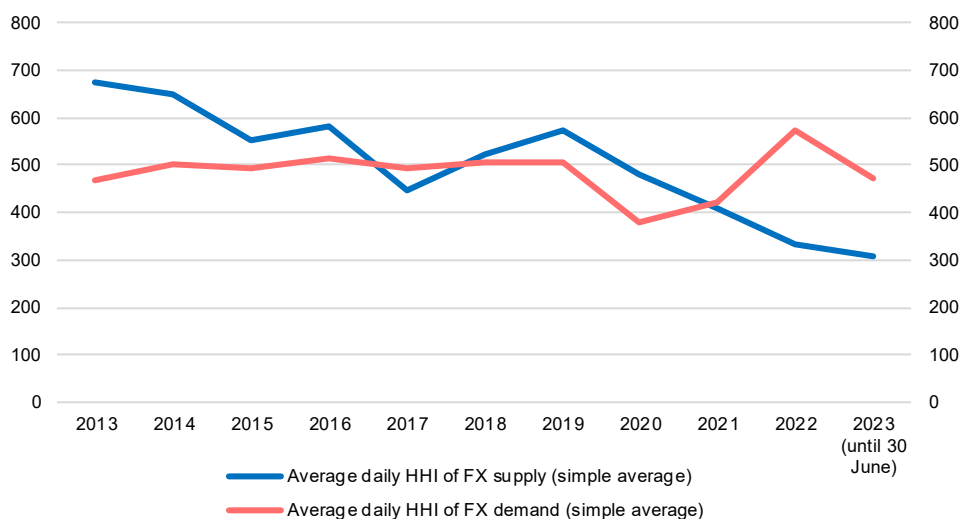
Chart 5 also shows that in the first half of 2023, there was a relatively greater decline in net FX demand than the reduction in the difference between the HHI of FX demand and supply, which occurred in conditions of a significant increase in FX supply by residents.<sup>4</sup> Excluding the first half of 2023, the linear correlation between the average daily net FX demand and the average daily difference between the HHI of FX demand and supply is 0.61 for the simple average of the HHI difference, and 0.74 for the weighted average.

The correlation between the net FX demand by residents and non-residents and the difference between the concentration of FX demand and supply indicates that changes in the concentration of daily FX supply and demand do not only affect the direction of appreciation or depreciation pressures from this market segment, but their intensity as well.

## 2.2 Downward trend in the concentration of FX supply by residents and non-residents, supported by the rising number of resident FX suppliers

While the HHI of FX demand by residents and non-residents has been quite stable over the past ten years (with mild shifts during the last three years which can be linked to the activities of domestic companies – energy importers), the HHI of FX supply recorded an almost continuous decrease (Chart 7). More significant exceptions are the years 2018 and

Chart 7 Average daily HHI of FX supply and demand by residents and non-residents



Source: NBS, author's calculation.

<sup>4</sup> The net FX demand in the first half of 2023 becomes negative when the trade of clients from the “SUM” category is included, i.e. the FX supply in this period was greater than the demand.

2019, when there were relatively more extremely large FX sales by residents and non-residents in a single day.

The decrease in the HHI of FX supply by residents and non-residents reflects the positive trend of diversification of FX sources.

The continuous growth in the number of residents who appeared on the FX supply side helped mitigate the concentration of FX supply by bank clients. As shown in Table 2, this growth was particularly pronounced in 2021 and 2022 (25% and 14%, respectively). Also, during almost the entire period, the number of residents appearing on the FX supply side recorded higher growth rates than the number of residents appearing on the FX demand side (with the exception of 2014).

**Table 2 Number of residents and non-residents participating in FX purchase/sale with spot currency date and execution date different from spot currency date**

Year	Residents					Non-residents
	Appeared on FX supply side	Y-o-y growth rate	Appeared on FX demand side	Y-o-y growth rate	Total No of residents	
2013	22,536		15,842		33,505	42
2014	22,494	0%	15,993	1%	33,730	42
2015	23,444	4%	16,228	1%	35,031	37
2016	24,742	6%	17,388	7%	37,241	35
2017	26,902	9%	18,372	6%	40,020	31
2018	28,811	7%	18,128	-1%	41,320	35
2019	30,427	6%	17,961	-1%	42,722	29
2020	31,520	4%	17,003	-5%	43,477	25
2021	39,430	25%	17,777	5%	51,923	28
2022	45,129	14%	18,970	7%	57,903	27
2023 (until 30 June)	32,803	8%	14,918	2%	43,720	17

\* Does not include all residents and non-residents whose transactions were lower than EUR 10,000, and which banks can report under the "SUM" category. The assumption for calculating the y-o-y growth rate is that the share of the number of these clients in total number of clients is stable over time, i.e. that the number of these clients rises at the same pace as the number of other clients.

\*\* The number of non-residents is shown only for spot currency - for the segment "different from spot currency" it is not possible to determine the number of non-residents as non-resident trade without the SWIFT code, which most often occurs in the "different from spot currency" segment, is disclosed in reports aggregately, under the name of the bank that traded with them.

\*\*\* Growth rates for H12023 are calculated relative to H12022.

Source: NBS, author's calculation.

Parallel to the rising number of residents, the number of non-resident participants in the FX market has gradually decreased over the past ten years, which can be related to the decrease of their share in the government bonds of the Republic of Serbia.

### 3 Conclusion

For years, the domestic FX market has recorded an increase in the value of transactions and the number of participants, which is naturally related to growth in the country's economic activity. The aim of this paper was to examine the structure of the growing market and to identify possible trends and correlations that are present over a longer period of time,

especially bearing in mind that during the observed period there was a structural change from depreciation to appreciation pressures on the domestic currency (in 2017), with this period also including the global health, energy and geopolitical crises of recent years.

The results showed a multi-year decline in the concentration of FX supply by residents and non-residents, which unequivocally indicates a positive trend of diversification of FX sources. Diversification was facilitated by growth in the number of residents appearing on the FX supply side, which during almost the entire period recorded higher growth rates than the number of residents appearing on the FX demand side, with this growth being particularly strong during 2021 and 2022 (25% and 14%, respectively).

On the other hand, the results confirm that our FX market is still characterised by relatively low liquidity. Several indicators affirm this assertion:

- around 2/3 of the working days during each of the previous ten years, the more concentrated side of the market (mainly the FX demand side) “prevailed” over the less concentrated side, which indicates the relatively low capacity of the market to “absorb” the activity of the largest residents and non-residents;
- a correlation was established between the net FX demand by residents and non-residents and the difference between the concentration of FX demand and supply, which indicates that changes in the concentration of daily FX supply and demand do not only affect the direction of appreciation or depreciation pressures from this market segment, but their intensity as well;
- the share of domestic companies – energy importers, which are among the largest FX buyers, in the total FX demand is highly correlated with the number of working days in the year during which FX demand is more concentrated than the supply, confirming that their influence on the creation of depreciation pressures can be significant.

Nevertheless, despite the fact that the market’s capacity to “absorb” the activity of the largest residents and non-residents in the observed period remained relatively low, a positive trend during the period of structural appreciation pressures is clearly visible. Namely, the days when a wider base of FX suppliers manages to cover the entire FX demand in conditions where the demand is more concentrated than the supply have become more frequent, which is a reflection of growth in FX supply by residents, as well as the diversification of FX sources.

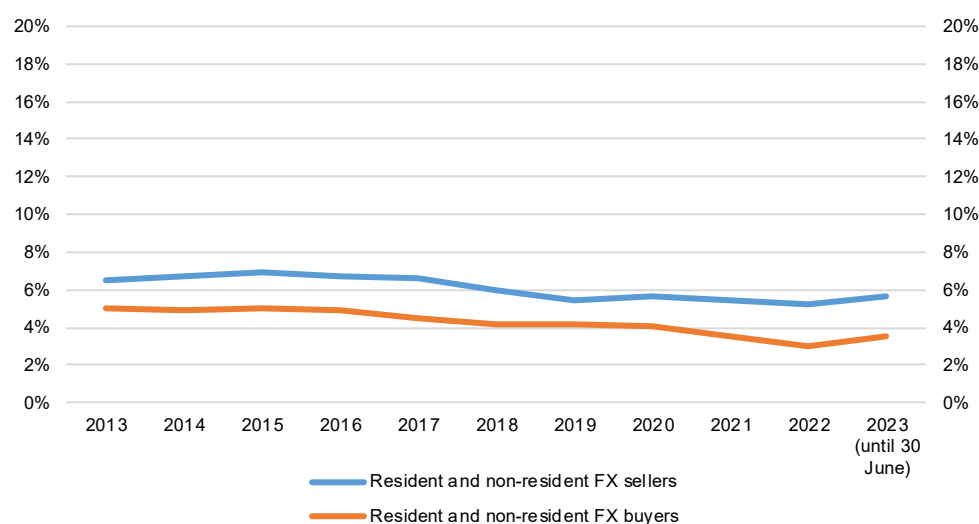
## Appendix

### *The “SUM” category*

In reporting daily to the NBS on their FX trade, banks have the option to report transactions worth less than EUR 10,000 which have the same parameters (type of resident/non-resident client, same foreign currency and exchange rate, same execution date), collectively under the “SUM” category.

Given that it is not possible to identify the banking clients behind this category, their trade was not the subject of the analysis. Nevertheless, we can point out that the share of this category was at a stable low level throughout the entire ten-year period for both clients selling FX (about 6%) and clients buying FX (about 4%), as shown in Chart A1.

**Chart A1 Share of residents and non-residents from the “SUM” category in total amount of FX purchase/sale (all foreign currencies)**



Source: NBS, author's calculation.

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