Challenges of Reducing Interest Expenses on the Minimum Reserve in Small Open Economies – The Case of Hungary*

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Several central banks responded to the challenges posed by enlarged central bank balance sheets reported at the beginning of the 2020s and the higher interest rates resulting from the inflation shock by raising reserve requirement ratios and lowering the interest rates paid on the reserve requirement. After providing the relevant theoretical background, a brief historical overview and international examples, this paper examines the reform of the Magyar Nemzeti Bank's reserve requirement system between 2022 and 2024 as a case study. It presents the impact the steps may have had on banking behaviour and the market yield environment, and the responses of the central bank. Based on Hungarian experience, there are significant, strong limitations on reducing the interest rate paid on the minimum reserve: given the overall interest rate environment, such a move may reduce central bank interest expenses as a technical consequence, but this may be limited by the fact that the change may have unintended consequences for the general financial market environment and foreign currency availability. These unintended consequences may vary over time and space, depending on the economic-financial situation of the country and thus very cautious introduction should be considered. The Hungarian experience may be particularly relevant for small open economies that have less developed financial markets and use their own currency.

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1. Introduction

Following the 2008 financial crisis, the functioning of central banks changed fundamentally,[1] one of the consequences of which was a substantial enlargement of central bank balance sheets. The resurgence of inflation following the Covid-19 crisis of 2020 and the energy crisis linked to the Russia–Ukraine war of February 2022 – which, in the classification of *Borio et al.* (*2023*), in many of its features gave rise to an economic-financial regime with high price dynamics not seen for decades – resulted in tighter interest rate policies worldwide. In conjunction with enlarged central bank balance sheets and banking system liquidity,[2] this led to a sharp surge in central bank interest expenses. This challenging operating environment[3] prompted global central banks to rethink their toolkits and instruments.[4] In this respect, one of the monetary policy instruments that was examined with special attention and scrutiny was the minimum reserve system.

Recently, for the reasons mentioned above, central banks have rediscovered the potential of minimum reserves as a monetary policy and central bank instrument, and several advanced and emerging market central banks have reduced the interest rate paid on minimum reserves. In addition to the attention also demonstrated in practice, modification of the minimum reserve has also become a topic of public economic policy and political debate, with respected economists making proposals on the interest rate on the minimum reserve, generating professional debates.

Some central banks pay no interest or only partial interest on the central bank reserve requirement. The issue of the minimum reserve and the interest paid on such is linked to a number of central banking issues that have materialised in recent years. During the tightening cycles, the focus shifted to mounting central bank losses and the related issue of capital replenishment.[5] Rising central bank interest expenses led to an increase in bank profits[6] and, because of the interest payments, the rise in banking system liquidity is a self-reinforcing process. While central banks do not have a profit objective, as public institutions, cost-effective operation of the monetary toolkit is also an important objective, provided that the central bank continues to achieve its primary objective. On the banks' side, if the rising profits can be considered as windfall profit, one instrument to deduct such may be the imposition of lower interest rates on the minimum reserve. The interest rate on the minimum reserve is also linked to liquidity in the banking system in several ways: for example, the sharp increase in liquidity contributed to the fact that interest rate

[1] *Vonnák* (*2017*).
[2] On its concept, see: *Kolozsi – Horváth* (*2020*) and *Monnet* (*2023*).
[3] *BIS* (*2024).*
[4] *Hoffmann – Kolozsi* (*2017*).
[5] See, among others: *Nordström – Vredin* (*2022*), *Belhocine et al.* (*2023*).
[6] *Banai et al.* (*2024*) demonstrate that the profitability of Hungarian banks was outstanding in 2023, with interest income from the MNB playing a crucial role.

hikes by the central bank only partially fed through to deposit rates, which led to an increase in bank profits. Moreover, in a context of abundant liquidity and high interest rates, interest payments may themselves have a liquidity-increasing effect, which, according to the quantitative approach, may even reduce the effectiveness of monetary tightening embodied in the high interest rates.

By presenting a case study on the reduction in the interest paid on the minimum reserve in Hungary, we wish to promote the inclusion of the country's empirical experience in the economic policy and political debate about the future role of reserve requirement systems. This experience may be relevant, despite the fact that the Hungarian measures were introduced to complement other measures aimed at managing liquidity in the banking system in general. Obviously, this notwithstanding, the Hungarian case is not universal, and these experiences may be primarily relevant for small open economies with less developed financial markets, using their own currency.

2. Literature review and theoretical background

The minimum reserve system is one of the most traditional central bank instruments and is designed to facilitate the proper functioning of the financial system. This type of regulation already existed in the 19th century. In the pre-World War II period, it was mostly characterised by US financial regulation in the developed world, and after 1945 it also became a widely-used tool in Europe and Asia.[7] In the 1980s and 1990s, the level of minimum reserve requirements and the complexity of regulation declined; nevertheless, the minimum reserve remains one of the most common central bank instruments. According to an IMF survey conducted in 2018, 116 of the world's 125 central banks included provisions on the reserve requirement in their central bank toolkit (*Della Valle et al. 2022*).

Under the statutory reserve requirement system, banks are required to hold a specified proportion of liquid central bank assets against a designated pool of credit institution liabilities subject to reserve requirements. These liability items are typically deposits, borrowings, debt securities issued and repos. The reserve requirement ratio is the value that determines the proportion of eligible liabilities that commercial banks are required to hold in liquid central bank assets, typically central bank account based money and occasionally, cash. As summarised by *Csávás et al.* (*2017*)*:*

The higher the reserve requirement ratio, and consequently the ratio of liquid assets to the bank's total assets, the more secure banking operations are in terms of liquidity. That said, more liquid assets allow banks to earn lower yields compared to longer-term assets, as a result of which holding liquid assets causes a yield loss

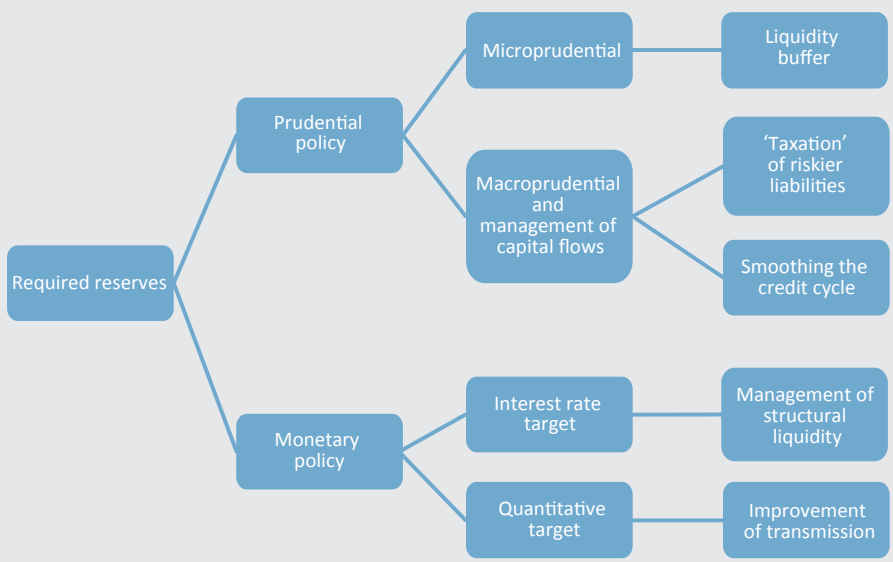
[7] Germany introduced reserve requirements in 1948, Japan in 1959 and the Bank of England in 1960.

to commercial banks. This yield loss may be mitigated by the central bank paying a market interest rate on the reserve requirement it imposes. (*p. 554*)

In other words, the amount of liabilities relevant to the reserve requirement, the rate defined, the assets eligible for compliance with the reserve requirement and the interest payment may vary in different countries and in different periods in accordance with the prevailing objectives.

The diversity of the objectives of reserve systems is presented in the study by *Della Valle et al.* (*2022*). There are two basic directions for regulation. Originally, the primary purpose of the reserve requirements was prudential, as it provided banks with liquidity to absorb potential shocks. Later, the objective of limiting risky activities and curbing excessive credit dynamics was also addressed via the minimum reserve requirement. One classic example of this is that numerous countries have attempted to prevent the rise in foreign currency lending by imposing substantial reserve requirements on foreign currency liabilities. An example of this was Romania, where in the early 2000s the reserve requirement for foreign currency liabilities was set at 30 per cent and the scope of eligible liabilities was extended to maturities longer than two years (*Hilbers et al. 2005*). In numerous cases, the reserve requirement was applied in line with monetary policy objectives, as it can also be used to influence market interest rates and strengthen transmission, for example by absorbing/reducing liquidity.

Figure 1
Objectives of the reserve requirement system



Source: IMF, cited in Della Valle et al. (2022)

Consistent with the above is *Bindseil'* s (*2004*) classification, according to which central banks have attributed or attribute the use of minimum reserves to one or a combination of the following reasons:

(a) supporting liquidity management for individual banks, in particular with regard to the risks posed by bank runs;

(b) ensuring and supporting monetary control over the financial system;

(c) facilitating the achievement of monetary policy objectives by using minimum reserves as a built-in stabiliser;

(d) improving the central bank's interest income by reducing interest expenses;

(e) fostering and encouraging competition between banks by requiring all banks to 'obtain' the liquidity needed to meet reserve requirements, which has a market-building effect;

(f) influencing the structural liquidity position of the banking system, shaping and stabilising the demand for reserves;

(g) managing short-term temporary liquidity shocks without the associated volatility of open market operations and short-term interest rates, which is ensured by the averaging mechanism that is a feature of the minimum reserve framework.

Which of the above functions the reserve system performs is reflected in the specification of the minimum reserve framework; moreover, the objectives and functions of the reserve system have been observed to change systematically over time, in the context of the evolution of the financial system of a country and of the increased knowledge of the minimum reserve requirement's impact on the monetary system. According to *Bindseil* (*2004*), the following parameters define the character and specification of the reserve requirements: (1) reserve base and the related reserve ratio/ratios; (2) reserve maintenance period; (3) amount of the minimum reserve; (4) interest rate; (5) the possibility of averaging; and (6) settlement of vault cash.

The focus of our study is the regulation and level of the interest paid on the minimum reserve. Our primary question, therefore, is what criteria determine the amount of interest paid on the minimum reserve and interest payment itself. There has been fierce professional debate in the literature on whether interest should be paid on the minimum reserve and whether the central bank setting a non-interest-bearing minimum reserve can be considered a tax. Analysis of this issue goes back a long time: *Friedman* (*1960*) suggested that the central bank should pay interest on the minimum reserves at the rate of safe and liquid assets, since the marginal

cost of creating bank reserves in a fiat money system is zero, and the central bank will be able to reduce the opportunity cost of holding bank reserves to zero if it pays market interest on the reserves.

Based on the rationale behind the interest-free minimum reserve, if banks do not pay interest on the demand deposits they hold, similarly, the central bank does not need to pay interest on commercial bank's money held with the central bank primarily for liquidity purposes. In simple terms, this argument claims that since the interest paid on the minimum reserve essentially enriches the bank – as commercial banks will not pass it on to other agents in the economy – in the case of interest-bearing reserves, central banks channel part of the profits from their monopoly position to the private sector, in particular, to the financial sector (*De Grauwe – Ji 2023a*).

At present, the interest-free reserve requirement is not a dominant theory. Critics note that, although it sounds simple and obvious, the explanation is not necessarily true in all situations. On the one hand, banks' non-interest-bearing liabilities do not necessarily correspond to the required reserves. On the other hand, the banking sector may claim the income thus lost on another asset or liability item, even if it is not 'earned' income. *Tovar et al.* (*2012*), for example, demonstrate that the effect of an interest-free reserve requirement depends, to a large extent, on which market is competitive in the banking sector. If banks face strong competition in the credit market, but due to their market power they can set rates in the deposit market, they will ultimately reduce the interest rate paid on deposits. Conversely, if there is competition between banks on the deposit side while they can set prices on the loan side, the interest rate on deposits will not change, but the cost of credit will increase, which lowers loan issuance. Obviously, these models simplify reality to a large extent, as the loan and deposit sides of banking decisions cannot be separated.

Similar considerations are outlined by *Della Valle et al.* (*2022*): the authors assert that the key issue for banks regarding the interest rate on the minimum reserve is the way in which the interest paid on the reserve relates to the interest rate on the 'competing product', which in practice may be the key policy rate. A very large deviation may cause significant distortion. Of course, the extent of this also depends on the level of banks' costs of borrowing. Furthermore, there may be other considerations in interest rate setting, such as the issue of financial stability. In some cases, the payment of interest may also become particularly important to ensure that the regulation does not impose additional costs on the financial sector, which – of course, depending on the circumstances – may jeopardise the capital or liquidity position of some institutions.

De Grauwe and Ji (*2023b*) propose that central banks raise the non-interest-bearing reserve ratio, which would eliminate the subsidy paid by the central bank, i.e. the transfer of central banks' profits to commercial banks. The authors argue that there is a way to raise market yields even if the central bank does not pay interest on the reserve requirement. By raising the reserve requirement, banks' demand curve for the reserves would shift, and the central bank can continue to shape interbank yields through the supply of reserves. In addition, as the reserve requirement may be considered as a form of implicit tax, banks would respond by raising lending rates, which benefits the fight against inflation. Profits from the central bank's monopoly should be transferred to the government rather than the banking sector. A similar argument is proposed by Claudio Borio (*Centralbanking 2023*), who underlines the political and economic dimensions of the issue and points out that the tightening may appear to be a central bank subsidy to the banks, which is an easy source of profit for them. The author proposes a tiering system where – similar to the system in Switzerland – central banks pay interest only up to a certain point and not beyond, which stimulates interbank trading.

De Grauwe and Ji (*2023c*) also proposed a two-tier reserve system for the European Central Bank (ECB), with no interest paid on the minimum reserve and the excess reserve remunerated at a rate similar to the current rate. Raising the reserve ratio from the current 1 per cent to 5 per cent would reduce the central bank's interest payments to banks by EUR 30 billion; if the ratio was raised to 10 per cent, it would lower these transfers by EUR 60 billion, while the amount of excess reserves would still remain EUR 2,000 billion. *De Grauwe and Ji* (*2024a*) argue that such a change would still allow central banks to maintain an operational framework and make monetary policy even more effective in combatting inflation.

According to *De Grauwe and Ji* (*2024b*), interest payments also undermine the transmission of monetary policy as banks' improving capital position increases their willingness to lend. Thus, while interest rate increases reduce demand for bank credit, transfers from the central bank to banks increase the supply of credit via higher capital, which in turn reduces banks' lending rates. *Fricke et al.* (*2023*) find that banks with substantial central bank reserves – and thus access to more interest income from the central bank – are less sensitive to monetary policy tightening than others. Central bank policymakers should take this into consideration, and one option may be the introduction of a two-tier minimum reserve system, increasing the non-interest-bearing reserve requirement. *Whelan* (*2021*) argues for partial interest payments citing the tiering system applied by the ECB and the Bank of Japan, where the central bank pays a lower interest rate up to a certain reserve level, above which it pays the key policy rate; consequently, the marginal cost of funds in the economy is the policy rate, and the central bank is still capable of shaping market interest rates. *Buetzer* (*2022*) proposes a method for reducing the

interest paid on reserves whereby the ECB would absorb liquidity in a long-term reverse repo facility at a lower interest rate, and encourage recourse to the repo facility by making the interest rate on the short-term deposit facility inversely proportional to its volume. The resulting losses for banks would be covered by profits from previously raised lending margins (the difference between lending and deposit rates).

Bindseil (*2014*) argues against the elimination of the interest rate on the minimum reserve. The non-interest-bearing reserve requirement can be considered as a tax levied by the central bank on deposits placed by non-banks with banks. This tax increases the cost of funding banks with deposits. A non-interest-bearing minimum reserve system may give rise to substantial capital outflows from the relevant deposit types and may also affect international capital flows. Retail depositors are unlikely to leave the euro area, but they may leave the banking system, flowing into the shadow banking system. Similarly, *McCauley* (*2023*) stresses the threats to financial stability, with euro area depositors moving their deposits to offshore accounts; the tax would be paid only by 'immobile' depositors, and the tax base and revenue would fall short. Undercapitalised, low-liquidity shadow banks that are not subject to the lender-of-last-resort rule would gain an edge over banks, which could undermine the financial stability of the euro area. *Kwapil* (*2023*) also stresses the disadvantages of the adjustment. Banks may replace retail deposits with wholesale deposits that are not subject to required reserves. Consequently, circumventing the reserve requirements is likely, which increases refinancing costs, thereby affecting the monetary policy stance. There are also financial stability risks. In the current environment of falling credit demand, banks are less likely to pass the tax burden on to their customers in full, which reduces banks' profitability and weakens financial stability in the euro area banking system. Likewise, *Kosonen* (*2023*) argues that a change in reserve requirements would negatively affect the stability of the euro area banking system at a crucial moment. In addition, the central bank can penalise certain types of funds if it considers them a stability risk.

Charnay and Hollegien (*2023*) find that a potential hike in the ECB's reserve ratio would also affect banks' profitability and liquidity. Such an increase would reduce banks' Liquidity Coverage Ratio (LCR), as in the euro area only the excess reserves are considered a liquid asset, while the minimum reserve part cannot be withdrawn at any time during stress conditions.[8]

There has been no consensus, overall, on the interest rate of the minimum reserve in recent debates. The arguments in favour of reducing or eliminating the interest paid on the required reserve are mainly based on the fact that interests thus paid

[8] At a reserve ratio of 10 per cent, the LCR ratio for some Member States would fall to levels approaching 100 per cent. Raising the reserve ratio to 9–10 per cent – also taking into consideration the maturity of targeted longer-term refinancing operations (TLTROs) – would deplete excess reserves by 50 per cent.

are unjustified and that the central bank will be able to keep market interest rates at the targeted level even after the reduction of interest payments. Critics arguing for the maintenance of the reserve requirement claim mostly that a reduction in the reserve requirement may lead to capital outflows, damage monetary policy transmission, deteriorate banks' liquidity and capital position and increase financial stability risks.[9]

The theoretical literature and professional debate presented above either examines the interest rate on minimum reserves in general terms, or provides suggestions for developed central banks only. Interest payments on the minimum reserves may have vastly different effects and consequences for developed and emerging central banks. In developed countries, for example, more mature capital markets and more widespread non-bank financial intermediation make it easier for banks to circumvent the regulation.[10]

In the empirical literature, we have not found any comprehensive analysis on recent changes implemented by developed market central banks in the minimum reserve system. However, in relation to the ECB's adjustment of the remuneration of minimum reserves in autumn 2023 market participants noted that overnight yields fell by 2–3 basis points at the end of September, and since this was the largest decline since 2020, it was related to the remuneration on the minimum reserve (*Gledhill 2023*).

Tovar et al. (*2012*) studied the results of reserve ratio hikes (and other macroprudential instruments) implemented in Latin American countries to curb excessive credit dynamics. In the countries concerned, central banks paid only partial interest on reserve requirements. Using the examples of Brazil, Colombia and Peru in the 2000s, the authors found that credit dynamics decelerated somewhat overall in the short term following the measures, but that the changes were not suitable to smooth the credit cycle in the longer term. *Reinhart and Reinhart* (*1999*) examined the practice of central banks in Latin America and Southeast Asia which, by raising the reserve ratio, sterilised the liquidity-boosting effect of central bank foreign currency purchases associated with the capital inflows observed in the 1990s. In the vast majority of the countries under review, spreads between lending and deposit rates rose following the reserve ratio increases; in more than half of the cases lending rates rose or deposit rates fell, consistent with the theoretically justified trends.

[9] According to some of the authors cited, the financial stability risk arises from the deteriorating capital position. It should be noted that in order to pose a stability risk, the drop in capital would require extreme reserve ratios and/or market interest rates, and banks not passing on, or only partially passing on, their tax burden.

[10] There may be differences between developed and emerging countries in terms of financial intermediation by banks, capital market intermediation and shadow banking; moreover, there may be divergences between emerging countries in respect of the Central and Eastern European region (*Bethlendi – Mérő 2020*; *Mérő – Bethlendi 2022*).

3. Adjustment of the minimum reserve system of the Magyar Nemzeti Bank (2022–2024) – a case study

In this section, we summarise the changes in international practice in respect of the reserve requirement before presenting in detail the past practice of the Magyar Nemzeti Bank (the central bank of Hungary, MNB) and the adjustment of the minimum reserve regulation imposed by the MNB between 2022 and 2024, with a focus on its implications for banks' behaviour and monetary transmission.

3.1. International practice

According to the IMF's 2018 survey, two thirds of central banks worldwide did not pay interest on the minimum reserves. Moreover, countries that did not pay interest applied a higher rate, on average, than those that paid. In the developed world as well, the practice of central banks paying interest on the minimum reserve has become widespread over the last two decades.

Prior to 1999, most European central banks did not pay interest on the minimum reserve. The European Central Bank started to pay interest after 1999, primarily under pressure from the Bundesbank, since the German central bank was one of the few that had previously paid interest on funds held with the central bank on a statutory basis. More significant changes to the ECB's minimum reserve were adopted after the 2007–2008 crisis, and in 2012 the ECB reduced the reserve ratio from 2 per cent to the current 1 per cent. Subsequently, during the period of negative interest rates, a tiering system was introduced in euro area countries, enabling banks to deposit up to 6 times their required reserves at a rate of 0 per cent, which was more favourable than the negative interest rate then in force. This is a good example of taking prudential considerations into account when paying interest on the minimum reserve. From autumn 2022, the ECB paid the O/N deposit rate on the minimum reserve, and the previous two-tier reserve requirement system was eliminated upon the introduction of positive interest rates. Prior to the decision, the amounts held in the reserve account were almost 25 times the reserve requirement, i.e. the amounts deposited were equivalent to a reserve ratio of around 30 per cent. The last change came in summer 2023, when the ECB reduced the interest rate paid on the minimum reserve to 0 per cent.

In the case of the Federal Reserve, the practice of unremunerated minimum reserves lasted even longer than at the ECB, as the Fed made no payments on banks' reserve balances until 2008 (*De Grauwe – Ji 2023a*). Before that, statutory limitations had not allowed the Fed to pay interest. Subsequently, from March 2020, the Federal Reserve lowered its previous two-tier reserve ratio of 10 per cent and 3 per cent to 0 per cent. The measure abolished the minimum reserve requirement for all depository institutions.

Similar significant changes have taken place in recent years in the Swiss National Bank's (SNB) regulation on minimum reserves. In autumn 2023, the SNB decided not to pay interest on the minimum reserve, in response to a sharp rise in interest expenses stemming from the tightening cycle. In 2024, it tightened the rules on the minimum reserve requirement further by raising the reserve ratio from 2.5 per cent to 4 per cent and by increasing the weight of certain liabilities within the reserve base. This move was clearly aimed at improving the cost-effectiveness of monetary policy.

As regards the CEE region, after the regime change central banks actively used the minimum reserve regulation to achieve various objectives. In many cases, reserve ratios were applied at or close to 10 per cent, which is significantly higher than the ECB's practice. The Bulgarian central bank applies a ratio of 10 per cent on funds raised by banks from residents and 5 per cent on funds raised from non-residents, while there is no minimum reserve requirement for liabilities deriving from the state and municipalities. The differentiation of liabilities by residence was justified by the central bank's efforts to curb excessive domestic lending in the second half of the 2000s. As described earlier, in the early 2000s, the Romanian central bank imposed different reserve ratios for liabilities denominated in the domestic currency and in foreign currency in order to prevent a surge in foreign currency lending. Even today, a different ratio is applied depending on denomination, with a reserve ratio of 8 per cent prescribed for leu-based liabilities and 5 per cent for foreign currency liabilities. The former ratio was reduced from 10 per cent in 2015. At 0.77 per cent for leu and 0.16 per cent for euro, the interest paid on the minimum reserve is particularly low for all denominations. The Croatian central bank lowered the reserve ratio from 12 per cent to 9 per cent in spring 2020, during the Covid-19 crisis. Following its accession to the euro area, the reserve ratio was gradually harmonised with the ECB: initially it was reduced to 5 per cent in summer 2022, and since the beginning of January 2023 Croatia, as part of the Eurosystem, applies a reserve ratio of 1 per cent.

Among the regional countries with lower reserve ratios, the Polish central bank sterilises a substantial part of excess liquidity through the reserve requirement, with objectives similar to the Hungarian approach. The National Bank of Poland (NBP) raised the reserve ratio in November 2021 and March 2022. The NBP set a rate of 0.5 per cent until October 2021, which was then raised to 2 per cent in November and to 3.5 per cent in March 2022. One of the objectives of the move was to facilitate the implementation of monetary policy, i.e. to stabilise the overnight interbank yield, the POLONIA, close to the reference interest rate. Moreover, the increase in the reserve ratio was also justified by the monetary tightening objective. The sterilisation role of the reserve requirement in the Czech banking system is somewhat more limited. The Czech central bank did not alter the reserve

requirement regulation for a very long period of time, applying a 2-per cent ratio since 2000. Because of this stability, it was of particular interest that in autumn 2023 Czech policymakers decided to abolish interest payments on the minimum reserve and subsequently increased the non-interest-bearing reserve ratio from 2 per cent to 4 per cent in autumn 2024.

Table 1
International examples of the size of the reserve requirements and the corresponding interest rates (percentage)

Country	Minimum reserve ratio	Interest paid on the minimum reserve	Key policy rate
Euro area	1	0	3.25
Switzerland	4	0	1
Czech Republic	4	0	4.25
Iceland	3	0	9
Poland	3.5	5.75	5.75
Romania	8	0.78	6.5
Bulgaria	10–12	0	3.4
Hungary	10	Base rate on a quarter of minimum reserve	6.5

Note: Values as at October 2024. In the Czech Republic, the 4-per cent reserve ratio will come into effect in January 2025.
Source: central bank websites

Among the emerging countries, numerous Latin American countries have applied the reserve requirement. Brazil sought to curb the credit boom that followed the 2007–2008 crisis by tightening its reserve requirements and by using the regulation as an incentive for larger banks to finance smaller ones. In a rather complex and frequently changing system, the Brazilian central bank set ratios of 20 per cent or more for many balance sheet items and only paid interest on a limited number of these. The current ratio is still 20 per cent for most liability items. Peru and Colombia have also actively used this instrument. In the case of Peru, along with curbing excessive credit dynamics, the explicit objective was to dampen dollarisation; consequently, the level of the reserve ratio for dollar liabilities has been significantly higher, even above 50 per cent, over the past decade.

3.2. Evolution of the reserve requirement system in Hungary from the 1990s to the present

Due to the relative underdevelopment of financial markets, in the early 1990s the central bank's ability to use market-type instruments was limited; therefore, application of the reserve requirement instrument had special importance. Through its effect on money multiplication, by altering the reserve ratio the central bank retained its control over liquidity. The central bank raised the ratio several times in

order to offset the acceleration of multiplication and tighten liquidity (*MNB 2002*). The regulation on the reserve requirement was changed, refined and consolidated almost continuously throughout the 1990s and beyond, but it did not become the main instrument for short-term monetary regulation (*Ábel forthcoming*).

As markets developed, as a result of the averaging mechanism of the reserve system, the main function of the minimum reserve was to reduce the volatility of yields (*MNB 2002*). The buffer offered by the minimum reserve makes it easier for the banking system to adjust to liquidity shocks. Owing to the averaging mechanism, reserve balances are allowed to fluctuate, and acting as a buffer, the required reserves reduce the volatility of O/N interbank lending rates.

The reserve ratio was gradually reduced by the MNB in the first half of the 1990s before it was raised, in several steps, to 17 per cent in 1995, the highest level during the period under review. The central bank explained the increase by the need to narrow domestic liquidity with the goal to achieve monetary tightening and stabilisation (*MNB 1996*). The central bank considered the increase in the reserve ratio as a temporary measure and gradually reduced the ratio to 12 per cent during 1996, in order to avoid putting the banking system at a competitive disadvantage in relation to OECD accession. In the early 2000s, to reduce implicit taxes, the central bank gradually lowered the reserve ratio further in the context of EU harmonisation, moving closer to the 2-per cent ratio applied by the ECB at the time. The rate was 5 per cent at the time of Hungary's accession to the EU in 2004 and remained at that level in the years to follow. In order to ease liquidity management in the banking system following the Lehmann crisis, the central bank reduced the reserve ratio to 2 per cent. Between 2010 and 2015, the MNB applied an optional reserve ratio, with banks voluntarily opting for a 5-per cent ratio, instead of the minimum ratio of 2 per cent. In December 2015, the reserve ratio was reduced to 1 per cent in connection with the quantitative limitation of the MNB's 3-month deposit facility, and the ratio remained unchanged until autumn 2022.

The central bank has been paying interest on the minimum reserve since September 1990 in order to partly compensate for the loss of income caused by the ratio, which was considered high by international standards. The interest paid on the reserve requirement was significantly below market rates in the 1990s. The interest paid on foreign currency liabilities (deposited in forints) was higher than the interest on forint liabilities, a distinction made necessary by the maintenance of a fixed exchange rate regime and the foreign exchange deficit. There has been no such difference in interest rates by denomination since 1998. When the minimum reserve was higher and the interest paid on it did not cover the holding costs, banks found several ways to circumvent the reserve requirement. The interest paid on minimum reserves fell short of the base rate until 2004, and the deviation from the base

rate – in other words, the implicit tax imposed on banks – was still high at over 5 percentage points when inflation targeting was introduced in 2001. Starting from 1 May 2004, the date of Hungary's accession to the EU, the interest rate paid on the required reserve was set at the base rate, on the grounds that the domestic banking system should not suffer a competitive disadvantage.

3.3. Reform of the MNB's minimum reserve system in 2022–2024, impact assessment

The prominent place of the reserve requirement in the domestic regulatory framework is demonstrated by the fact that it is one of the monetary policy instruments specified in the Act on the Magyar Nemzeti Bank currently in effect.[11] The Act also stipulates that the MNB 'may pay interest' on the minimum reserves and that the interest may be paid at different rates in accordance with the different types of reserve ratio elements and their different characteristics.

Another specificity of the minimum reserve is that the governor of the Magyar Nemzeti Bank is authorised to regulate in a decree – in accordance with the decision of the Monetary Council – 'the interest rate payable on the minimum central bank reserve, and the interest determined on the amount of money deposited with the MNB in excess of the level of the reserve ratio', as well as 'the calculation, the method of allocation and placement of the minimum central bank reserve, and the measures to be taken in the event of non-compliance', which, except for the base rate, is not a feature of other monetary policy instruments.

In the following, we describe the MNB's actions, the banking system's adjustment and the central bank's responses to such. Our analysis makes assumptions about possible bank reactions based on financial market developments.[12]

3.3.1. Raising the reserve ratio and reforming the interest rate

The MNB commenced a tightening cycle in summer 2021. In its decisions, the central bank has repeatedly stressed that the key to monetary transmission is to keep short-term interest rates consistent with the short-term rate considered optimal by the Monetary Council in all submarkets and in all periods. This was one of the reasons behind the introduction of the daily swap instrument in the summer of 2022 to replace the previous swap tender that provided euro liquidity only at the end of each quarter.

The reform of the minimum reserve system announced in summer 2022 was also aimed at improving the efficiency of monetary transmission through the long-term absorption of banking system liquidity. From October 2022, the reserve ratio was raised to 5 per cent from 1 per cent, and while previously it was sufficient to meet

[11] *Act CXXXIX of 2013 on the Magyar Nemzeti Bank.*
[12] Due to scope limitations, we do not examine potential effects on deposit and lending rates.

the reserve requirement as a monthly average, the minimum reserve ratio was now applicable at the end of each day. In addition, banks were allowed to opt for a reserve ratio of 6 per cent to 10 per cent – higher than the minimum 5 per cent – with interest rates corresponding to the base rate. As a result of these measures, the amount of liquidity absorbed in the reserve account over the long term increased significantly from around HUF 400 billion to HUF 2,700 billion. The MNB announced the reform as part of a package of measures aimed at the sustainable absorption of liquidity with a view to reducing the volatility of short-term yields and improving monetary transmission through the longer average maturity of the sterilisation stock:

- Discount bond auctions, previously used on an ad-hoc basis, were made regular with a maturity of one week.
- Starting from October 2022, a variable-rate deposit was announced with a maturity of more than one week (*MNB 2022*).

In spring 2023, the MNB introduced additional changes to the minimum reserve regulation:

- In order to increase the liquidity absorbed over the long term, the minimum reserve ratio was raised to 10 per cent from April 2023; consequently, by April 2023 the liquidity absorbed in the reserve base rose to HUF 4,400 billion. The optional reserve ratio above 10 per cent was increased to 11–15 per cent.
- The MNB modified the remuneration of the minimum reserve by introducing a stepped interest rate regime. On the one hand, it set the interest rate on the optional reserve component at a higher level than the previous base rate: the new rate corresponded to the overnight deposit tender rate, which encouraged banks to opt for the higher ratio. On the other hand, the interest rate on the minimum reserve component was also modified: the MNB pays no interest on 2.5 per cent of the reserve base, i.e. one quarter of the minimum reserve.[13] The stated purpose of the measure was to dampen the liquidity expansion resulting from the interest payments made by the central bank, which boosts liquidity as a snowball effect due to subsequent interest payments on central bank interest payments. In determining the level of the unremunerated portion of the reserve, the MNB also considered financial stability aspects (*Kolozsi 2023*).

[13] Paying interest on a part of the required reserve, the MNB followed a rarely used method. Many central banks have completely abolished the remuneration of the minimum reserves, paying zero interest on the total reserve requirement (e.g. ECB). In countries with partial central bank remuneration, the central bank typically sets a fixed nominal interest rate – that is lower than the base rate – for the total amount of the minimum reserve (e.g. Romania).

3.3.2. Under-remuneration of banks resulting from the reform of the interest on minimum reserves

If the central bank does not pay market interest on all or part of the required reserve, the resulting costs can be quantified.[14] The so-called '*under-remuneration*' resulting from the minimum reserve requirement may divert the pricing of eligible liabilities. Under-remuneration per unit of eligible liability can be quantified using the following formula:

$$\frac{T}{D} = (r_M - r_R) * R \quad (1)$$

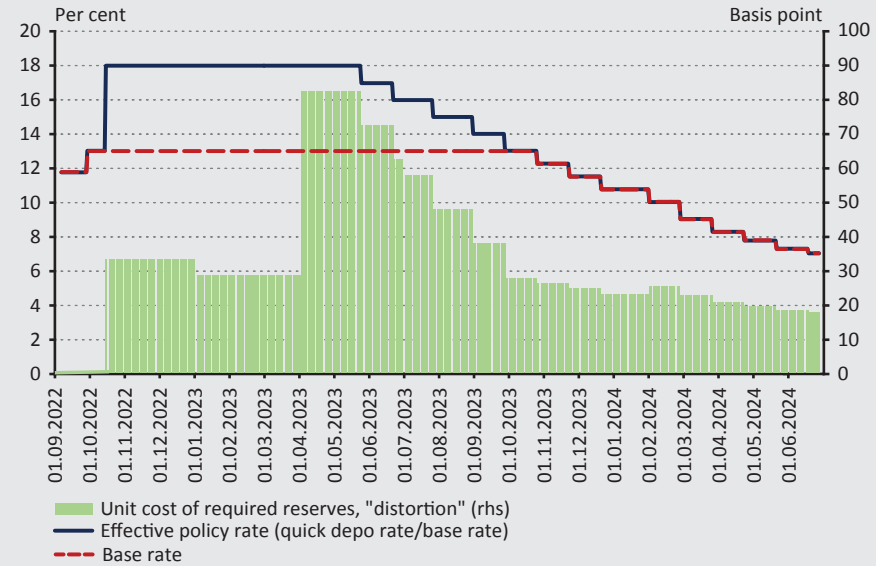
where *T* is the nominal amount of under-remuneration, *D* is the amount of eligible liabilities, r_M is the market interest rate, r_R is the interest paid on the minimum reserve, *R* is the reserve ratio (based on *Árvai* (*1995*), who uses the term 'income deduction' instead of 'under-remuneration'; we consider the latter term more appropriate for the indicator under review). Under-remuneration depends on the spread between the market interest rate and the interest rate on the required reserve, as well as the reserve ratio.

Under-remuneration per unit is the amount by which the bank would have to reduce the interest rate on the eligible liability in order to maintain profitability. This can also be understood as how much the interest rates on eligible liabilities would have to be reduced if banks were to pass the full cost on the eligible liabilities. This cost can also be approximated as follows: if a bank raises a unit amount of eligible liabilities and from that amount it deposits an amount that corresponds to the reserve ratio (*R*) in reserve, and deposits the remainder (*1–R*) in the central bank's deposit facility, it will lose the spread between the market interest rate and the reserve ratio only on that part of its liquidity from the eligible liability that covers the reserve ratio.

When quantifying under-remuneration in respect of the MNB's minimum reserve, in addition to the reserve ratio and the interest rate on the minimum reserve, we also took into account that from October 2022 the MNB introduced a deposit quick tender, the interest rate on which was the effective policy rate, which was higher than the base rate up until autumn 2023, while the remunerated part of the minimum reserve remained at the base rate. The MNB's decision to raise the reserve ratio again from April 2023 and to introduce tiered interest rates implied a substantial increase in under-remuneration (*Figure 2*). Our calculation is based on the average interest rate paid on the minimum reserve which, from April 2023, was 75 per cent of the base rate. This was modified between July 2023 and January 2024 by the eligibility of deposits longer than two weeks, which reduced the rate of under-remuneration, resulting in an effective non-interest-bearing reserve ratio

[14] In the literature, this concept is often referred to as an 'implicit tax'.

Figure 2
Estimated rate of under-remuneration of the MNB's minimum reserve



Note: Under-remuneration is obtained by multiplying the spread between the market interest rate and the interest paid on the minimum reserve by the reserve ratio.

Source: MNB, authors' calculations

of 2.13 per cent, instead of 2.5 per cent. Under-remuneration peaked in April 2023, when both the reserve ratio and the effective policy rate were at their highest. After the effective interest rate and then the base rate were lowered, the rate of under-remuneration decreased considerably. From the end of January 2024, the MNB phased out its long-term deposit tenders and accordingly, they are no longer considered in the calculation of the minimum reserve, which also altered the rate of under-remuneration somewhat. In summer 2024, under-remuneration amounted to around 20 basis points, lower than in autumn 2022. The dynamics will differ somewhat if the under-remuneration is measured in relative terms, in comparison to the effective policy rate. At over 4 per cent, this rate was highest in spring 2023 before gradually declining to 2.5 per cent. Accordingly, in relative terms the decline was smaller than in the case of nominal under-remuneration. In summer 2024, the relative indicator was slightly higher than in autumn 2022 (1.6 per cent versus 1.8 per cent).

3.3.3. Adjustment of the banking system to the unremunerated minimum reserve

There are several ways in which banks may adjust to the reform of the interest rates on minimum reserves. One way is to reduce the interest rate on eligible liabilities. If it corresponds to the abovementioned rate of under-remuneration, the banks will be able to restore their earlier profitability. However, this requires a permanent reduction of the interest rate on eligible liabilities, e.g. in the case of overnight deposits, for each day which can lead to the loss of customers thus cannot be applied in an unlimited way.

Another form of adjustment – that may be more expedient for banks – is to reduce their eligible liabilities. The reserve base comprises the liabilities of credit institutions operating in Hungary and of the Hungarian branches of foreign credit institutions with a maturity of less than 2 years. Since the central bank set the reserve base on the basis of balance sheet data as at the last day of the second month before the end of the review period, banks can temporarily reduce their eligible liabilities even for one day at the end of the month, thus reducing the cost of the minimum reserve. They can do this by applying a penalty pricing that is only applied for one day. It is also important that their customers are also willing to adapt. On the one hand, they need to be flexible in responding to interest rate conditions. On the other hand, to make the adjustment temporary, banks only need to reduce their minimum reserves at the end of the month. To do this, customers must also be aware that the interest rate conditions are only temporary, and the bank should inform their customers in this regard. Communication between the banks and their customers is important; the banks may also try to persuade the customers to reduce their bank deposit by means other than interest. Of course, this can be applied only for a limited range of key customers.

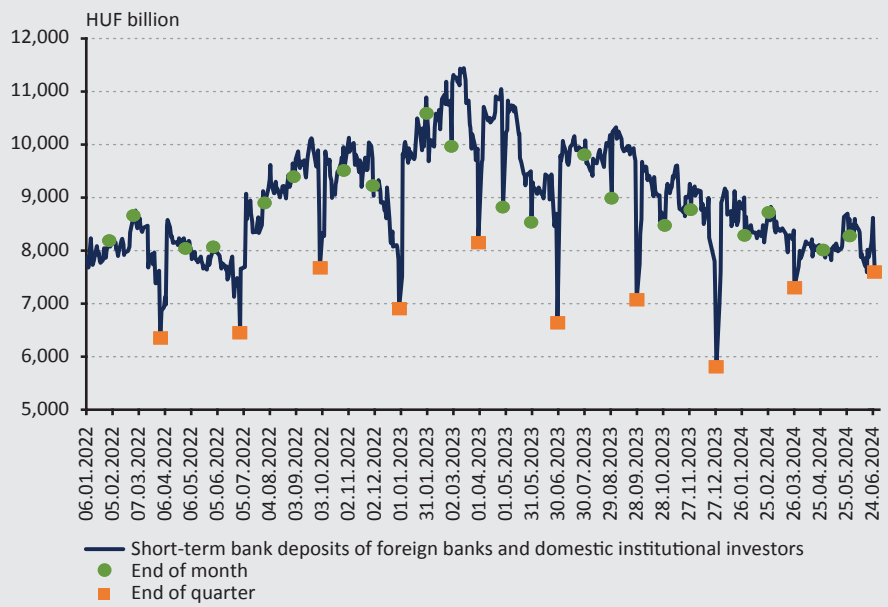
Banks will have to make up for the temporary withdrawal of eligible liabilities, which may lead to a decline in swap market yields on foreign currency liabilities. When customers temporarily take foreign currency deposits and transfer them to foreign credit institutions, the domestic banking sector will have foreign currency demand. Thanks to sufficient liquidity in the domestic FX swap market, they can obtain foreign currency from non-residents in the FX swap market and offer forints (see *Banai et al.* (*2015*) on the structure of the domestic swap market). The demand for such deals can represent an excess demand on the market segment key for FX price developments and, if FX supply is not increasing, and the swap market is not perfect, it can reduce the implied forint yield on FX swaps.

It may also have a transmission effect if non-residents withdraw forint liabilities rather than foreign currency liabilities. If a non-resident does not wish to undertake on-balance sheet exposure in the Hungarian banking sector, but does not want to change its exchange rate position, it can use the swap market to lend HUF to the

domestic banking system. The emergence of forint supply/FX demand in the swap market may also lead to a decline in FX swap implied yields.

Even before the modifications to the minimum reserve system in autumn 2022 and spring 2023, banks had tended to temporarily reduce some of their eligible liabilities significantly on the last day of the quarter. This was mainly related to the balance sheet adjustment of foreign banks, as foreign banks typically reduce their deposits with domestic banks in the days before the end of the quarter in order to avoid on-balance sheet exposure on key days.

Figure 3
Daily changes in specific eligible liabilities of domestic banks



Source: MNB 4LAN report

Following the reform of the minimum reserve system, banks carried out balance sheet adjustments even in months that were not at the end of a quarter. In January 2023, the MNB announced an increase in the reserve ratio, effective from April 2023, and on the last day of February it announced a restructuring of the interest rate, also effective from April. Thereafter, for the first time from the end of February 2023, banks reduced their eligible liabilities for one day at the end of each month. Adaptation now took place not only at the end of the quarter, but also at the end of other months. In addition to the change in the pattern of foreign bank deposits,

there was also a limited and temporary adjustment in the deposits of domestic institutional investors at the end of the month, the market effect of which was eliminated by the regular FX swap instrument of the MNB (*Figure 3*). We looked at short-term bank deposits from foreign banks and domestic institutional investors, as these were found to be the most volatile items at the end of the month. There was a decline of around 5 per cent in eligible liabilities in February 2023.

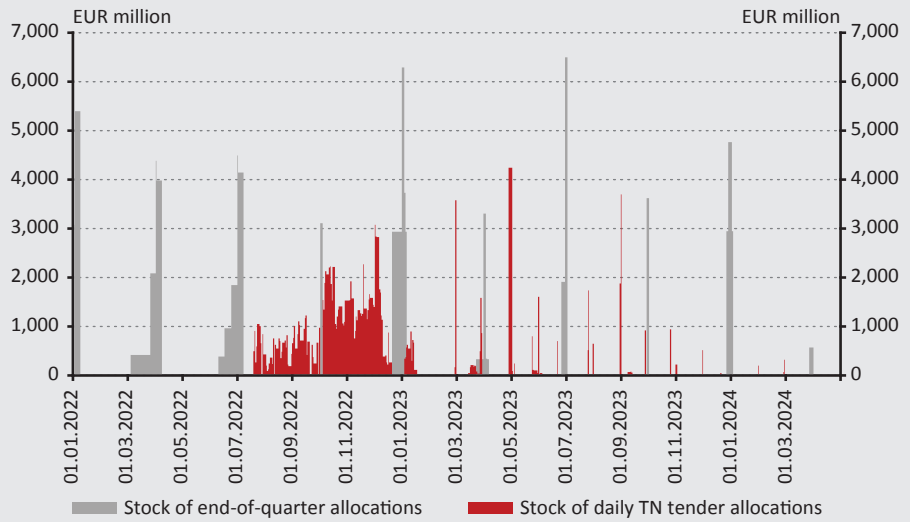
Given the coincidence in timing, it is likely that the reform of the reserve requirement may have partly contributed to the change in the behaviour of domestic banks and their customers, but this cannot be considered as unambiguous. As we will show below, the MNB fixed the reserve base from July 2023; accordingly, it would no longer have been reasonable to reduce the reserve base at the end of the month from May 2023; therefore, strictly speaking, we only have two months of end-month observations (February 2023 and April 2023). Thus, it cannot be ruled out that other factors also played a role in the change in banks' behaviour (e.g. government regulation affecting banks). At the same time, it should be noted that foreign currency liabilities played a key role in the end-of-month adjustment. In addition to the fact that foreign currency liabilities account for a larger share of the liabilities examined, the difference in currency denominations may also explain the more elastic response. Having the same reserve ratio and the same interest on the reserve for deposits denominated in domestic and foreign currency implies a relatively higher burden on foreign currency liabilities due to lower nominal foreign currency interest rates, which gives customers a greater incentive to withdraw their deposits.

The emergence of bank adjustment would not be a problem in itself from the perspective of the central bank's balance sheet: the required reserve is lower and therefore, the liquidity held in other central bank assets is higher; however, this may have a negative impact on monetary transmission as described above, especially on yield developments in the FX swap market, which is sensitive to foreign currency availability. Although the extent of this is not examined in this study due to space limitations, it is worth underlining that the swap market is a key segment of monetary transmission, given that this is the segment where foreign investors first meet the monetary conditions of a small open economy. Thus, conditions in this market can affect prices of other market segments.

Swap market conditions were also influenced by the fact that during the period of the reform, and even before, the MNB regularly announced overnight FX swap tenders to inject foreign currency into the banking system from FX reserves. In the event of a significant fall in swap market yields, banks are able to use this instrument; therefore, the decline in swap yields is only moderate. That is, the potential market effect was eliminated by the used FX swap instrument. Obviously, the FX swap instrument is not unlimited, given that it is provided from FX reserves.

While in the past banks typically took recourse to this instrument at the end of quarters, in 2023 demand was high even at the end of non-quarter-end months. The higher utilisation observed at the end of February, April and August 2023 coincided with the months in which we also observed higher quantitative adjustment in banks' balance sheets (*Figure 4*).

Figure 4
Stock of allocations in the FX liquidity providing FX swap tenders of the MNB



Note: The TN (tom-next) maturity shows transactions with the T+1 spot leg and T+2 futures leg value dates.

Source: MNB

3.3.4. Modifications concerning the calculation of the reserve base

In order to avoid adverse effects on banks' balance sheets, the MNB has adjusted the reserve base, fixing it at an earlier value. The central bank announced at the end of May 2023 that it would begin preparations for determining the reserve base on the basis of monthly average stocks and that, starting with the July 2023 maintenance period, the reserve base would be fixed on the basis of balance sheets as at 31 March 2023. It was also announced that from July 2023, deposits with the MNB with a maturity of at least 14 days would be included in the reserve requirement up to 15 per cent of the minimum reserve (*MNB 2023*). Since this deposit was interest-bearing, banks were able to reduce the unremunerated part of the minimum reserve by setting it off with these deposits. Despite the fixing of the reserve base, some balance sheet adjustment persisted in non-end-of-quarter months, with a visible, temporary decline in bank deposits at the end of August and October 2023. This may reflect, for example, the fact that although the reserve

base was fixed, some banks may have assumed that at a later date the central bank would set a variable reserve base again. In addition, it cannot be ruled out that the reserve base fixing was not noticed by some banks, as the modification of the interest rate on the minimum reserve attracted more attention than the reform of the reserve base.

From the beginning of 2024, the MNB switched to determining the reserve base on the basis of daily average balance sheet data. Following consultations with credit institutions, for the first time, the minimum reserve was calculated based on monthly average bank balance sheet data for the March 2024 maintenance period. The MNB performed the calculation on the basis of average balance sheets as at January 2024. The move to averaging represents a substantial change in the incentive to circumvent the minimum reserve regulation, as banks can indeed shrink their balance sheets with overnight transactions when performing balance sheet adjustments for a single day, which frees them from setting aside reserves for one month, whereas in the case of average balances, they would be forced to shrink their balance sheets for each day. After this change, no significant balance sheet adjustment was observed.

4. Conclusions

In our study, we reviewed the theoretical bases of the reserve requirement, described the changes in international practice and presented in detail the MNB's amendments to the reserve requirements between 2022 and 2024.

Our analysis is consistent with the international literature, complementing the theoretical spectrum from De Grauwe and Ji to Bindseil, with the empirical experiences of a small open economy, stressing that reserve remuneration can be decreased, but this may have strong limits, especially because such a move may lead to capital outflows from the relevant deposit types. The conclusions of this study may also be useful with respect to the hypothesis of Tovar et al., namely, that the effect of interest-free minimum reserves largely depends on the degree of market competition. The empirical evidence presented here confirms Borio's view that there are political economy dimensions to the reform of the reserve system.

As the Hungarian experience covers a relatively short period, the conclusions drawn should be treated with caution and alternative explanations cannot be ruled out; nevertheless, it suggests that although interbank market yields are determined primarily by the yield on the unlimited supply of central bank assets, depending on bank optimisation, the average sterilisation rate and hence the interest paid on the quantitatively limited minimum reserve may also play a role in the evolution of market rates. The burden arising from the minimum reserve system may encourage banks to optimise the reserve base; consequently, the interest rate on the minimum

reserve may have an indirect impact on the market environment. One way to address these effects may involve the modification of the reserve base calculation and transitioning to the consideration of average stocks. This method is rarely used in current central bank practice, even though it is recommended in the literature and was already applied by the Bundesbank before 1999.

Based on the Hungarian experience, in reforming the minimum reserve system and, in particular, upon reducing the interest paid on the minimum reserve, some constraints also need to be considered. The larger the banks' interest income losses (i.e. the under-remunerated part of the minimum reserves) and the stronger their pass-through capacity, the greater the market effects. Outlining and examining these taxonomies may be the subject of further research, along with interpreting and analysing the impact of interest payments on liquidity in nominal and real terms, and possibly, identifying the reasons behind the different responses of individual banks.

Based on domestic experiences, when determining the interest rates paid on the required reserves, special attention should be paid to how such a step affects the foreign exchange inflow from abroad, the country's foreign exchange availability, and what impact this may have on the FX swap market and the general interest rate environment. Examining these is also important because it shows what macro-level costs the interest savings achieved on the required reserves may entail. Therefore, in the case of the decision on the optimal interest rate, this potential trade-off situation must always be considered, ensuring in a kind of iterative process that the expected and realised benefits exceed the unintended costs. The extent of unintended costs may vary over time and space, and is particularly dependent on bank reactions, the vulnerability of the given country and the nominal interest rate level. It is intuitive that in a vulnerable economy, operating with high interest rates and not using reserve currency, characterised by a less competitive banking system, the options are more limited than in an economy that is considered stable, maintaining a relatively low interest rate environment and using money that also fulfils an international function, where banking competition is also more intense. Analytical work on the factors influencing optimal interest rates is an area towards which research can be further developed.

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